

P R O F E S S I O N A L L E A R N I N G

Bridging between Research and Practice

Supporting Professional
Development through Collaborative
Studies of Classroom Teaching
with Technology

Sara Hennessy



SensePublishers

Bridging between Research and Practice

Professional Learning
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Bridging between Research and Practice

*Supporting Professional Development through Collaborative Studies
of Classroom Teaching with Technology*

Sara Hennessy

University of Cambridge, UK



SENSE PUBLISHERS
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TABLE OF CONTENTS

List of Figures	ix
List of Tables	xi
Acknowledgements	xiii
Foreword <i>Barbara Jaworski</i>	xv
Introduction	xxi
Section One	
Developing a Framework for Researcher–Practitioner Partnership: Using Theory to Understand Classroom Practice	1
Chapter 1 Research Focus and Methodology for Collaboratively Analysing Practice	15
Chapter 2 Case Study One: Supporting Knowledge Co-Construction in History <i>Rosemary Deaney, Arthur Chapman and Sara Hennessy with Lloyd Brown</i>	49
Chapter 3 Case Study Two: Supporting Active Learning in Science <i>Sara Hennessy with Chris Tooley</i>	77
Chapter 4 Case Study Three: Fostering Collaborative Interpretation of Poetry in English <i>Sara Hennessy with Jackie Bullock</i>	107
Chapter 5 Looking Across Subjects and Settings	143
Chapter 6 Developing the Methodology: A Study of Dialogue and Interactive Whiteboard Use Across Three Subject Areas	163
Chapter 7 Reflections on the Methodological Approach: Theory Building Through Collaborative Video Analysis	189

TABLE OF CONTENTS

Section Two

Designing a Framework for Teachers' Professional Learning: Using Intermediate Theory to Develop Classroom Practice	215
Chapter 8 The Impact of Research Collaboration on Professional Learning and Practice	225
Chapter 9 Teacher-led Professional Development Using a Multimedia Resource to Stimulate Change in Mathematics Teaching <i>Sara Hennesy, Anne Bowker, Mark Dawes and Rosemary Deaney</i>	245
Chapter 10 Using Theory in Research to Stimulate New Ways of Framing and Supporting Classroom Dialogue <i>Sara Hennesy and Paul Warwick</i>	265
Chapter 11 Conclusions and Future Directions	283
Appendices	321
References	343
Glossary	357
About the Author	361
Other Contributors	363

LIST OF FIGURES

Figure 1.1.	Excerpt from English Lesson 6 combined grid.	21
Figure 1.2.	Title screen of across subjects resource.	28
Figure 1.3.	Sample video screen shot.	29
Figure 1.4.	Multimedia resource: Disc overview map.	29
Figure 1.5.	Interactive map of technology features.	30
Figure 1.6.	Interactive theme map from across subjects resource.	30
Figure 1.7.	Example of nested menus from across subjects resource.	31
Figure 2.1.	History theme map.	59
Figure 2.2.	Lesson 1: Pupils' annotations identifying features showing the 'Golden Age' of Elizabeth.	60
Figure 2.3.	Lesson 1: Pupils' annotations characterising the young Elizabeth.	61
Figure 2.4.	Lesson 2: Dan's annotation suggesting links between unemployment, poverty and crime.	62
Figure 2.5.	Lesson 3: Using the ordinary whiteboard to explore meanings prior to a 'drag and drop' card sort activity on the IWB.	63
Figure 2.6.	Lesson 5: Pupils' annotations while explaining flaws in the plans.	64
Figure 2.7.	Lessons 5 and 6. Pupils' interpretative links concerning defeat of the Armada.	65
Figure 2.8.	Extract from combined grid, history Lesson 3.	72
Figure 3.1.	Paired statements activity.	82
Figure 3.2.	Fate of Glucose matching activity.	83
Figure 3.3.	Interactive Square of Truth activity.	83
Figure 3.4.	Extract from commentary grid, science Lesson 5.	84
Figure 3.5.	Science theme diagram for multimedia resource.	85
Figure 3.6.	Plant cell diagram and Mandy's and Rowena's IWB representations of sugar storage.	86
Figure 3.7.	Lucy's representation of sugar storage in exercise book.	87
Figure 3.8.	Template for constructing photosynthesis equation.	89
Figure 3.9.	Pictorial instructions for experiment.	90
Figure 3.10.	Comparing leaf colours – screenshot showing hidden clue revealed.	91
Figure 3.11.	Chris's learning journey theme diagram.	96
Figure 3.12.	Final science theme diagram.	101
Figure 4.1.	'Flower Power' textual annotation.	115
Figure 4.2.	Graphical annotation of poem 'Hitcher'.	115
Figure 4.3.	Drag-and-drop classification activity.	116
Figure 4.4.	English theme diagram.	117
Figure 4.5.	Excerpt from grid commentary for small group discussion with teacher in English Lesson 5.	123

LIST OF FIGURES

Figure 4.6.	Textual annotation of photograph during discussion of poem ‘Hitcher’.	124
Figure 4.7.	Understanding lifestyles of the hitchhiker and businessman.	126
Figure 4.8.	Collaboratively identifying themes across poems.	127
Figure 4.9.	Revisiting earlier themes.	128
Figure 4.10.	Resource for silent scaffolding.	129
Figure 4.11.	Sample commentary grid: silent scaffolding.	132
Figure 4.12.	Underlining modern and hippy era phrases.	136
Figure 5.1.	Cross-subjects theme map.	146
Figure 6.1.	Scenario screen with annotation.	180
Figure 6.2.	Group representation of scenario discussion.	182
Figure 9.1.	A video clip screen from the T-MEDIA mathematics resource.	248
Figure 9.2.	Proposed process of using the multimedia resources for CPD.	249

LIST OF TABLES

Table 1.1. Phases of collaborative data analysis	20
Table 1.2. Dialogue and IWBs project Phase 1: Activity in Day Workshops 1–3	42
Table 2.1. History lesson sequence: Aims and content	53
Table 3.1. Science lesson sequence: Aims and content	80
Table 3.2. Mortimer and Scott’s (2003) framework of communicative approaches	95
Table 4.1. English lesson sequence: aims and content	110
Table 5.1. Terminology emerging from intermediate theory building process (across subjects)	144
Table 5.2. Themes emerging by subject case	146
Table 6.1. Team representation of “dialogue” in the IWB context	165
Table 6.2. Diane’s reorganisation of the dialogue table	172
Table 6.3. Diane’s rephrased table for colleagues: Using the IWB to support the development of dialogue in the primary classroom	173
Table 7.1. Preconditions and key characteristics of the co-inquiry	212

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FOREWORD

This book *Bridging between research and practice: supporting professional development through collaborative studies of classroom teaching with technology* presents a rich developmental research study in the UK into teaching and teaching development crossing four subject areas: history, science, English and mathematics. Teaching and learning take place in real classrooms in real schools in which there is no attempt to hide the many aspects of school and classroom practice with which a teacher has to contend in offering students the best possible learning experiences in a subject. Classrooms are well equipped with digital technologies and it is taken for granted that the design of teaching will include use of technology (principally the interactive whiteboard, IWB) as a normal aspect of teaching-learning practice. Researchers from the university and teachers from project schools work collegially, recognising that both teachers and researchers bring important knowledge and experience to the teaching-research interface; both are ‘co-learners’ or ‘co-inquirers’.

Central to all consideration and discussion in the book is the notion of *theory*. Theory underpins the design of the projects and activity in schools and informs project findings. Within a sociocultural frame, teaching is seen to mediate learning, a *dialogic approach* to teaching and learning is taken as the norm and constructs such as *scaffolding* and *funnelling* become recognised or instantiated in practice. Teachers and researchers, reflecting on experienced and observed classroom practice, issues in teaching, and students’ learning, relate their insights to theoretical perspectives in order to synthesise from experience.

Associated with the book are two internet sites hosting professional development resources¹, one of which includes digital presentation of all aspects and stages of the T-MEDIA project and a set of video clips for each classroom studied. If we see the book as providing orthogonal axes on teaching development and research inquiry, the digital resource provides a third axis, orthogonal to the first two, enriching the ideas and issues through the digital medium. Thus, as the reader meets ideas and issues through the pages of the book, she can for example, move to a video clip from the classroom, or hear the teacher reflecting on what was learned in the lesson. This dynamic facility parallels fluidity in the classroom between the various media of teaching and learning.

The book reports on two forms of collaboration between the research team and selected teachers. In the first (known as the T-MEDIA project), a major focus is the *partnership between researchers and teachers* in studying and analysing classroom practice (the teaching and learning) from the design phase through analysis of

classroom activity to a theoretical synthesis of the teaching-learning process. The second form of collaboration focuses on teachers' development of classroom practices with the support of their research colleagues. The first leads naturally to the second: the collaborative study of teaching and learning led to new forms of awareness for teachers (as well as the researchers) and suggested new modes for CPD (continuous professional development) for teachers.

In Part 1 of the book, from case studies of classroom teaching and learning, we gain insight into the 'co-construction' of the learning process by teachers and students. This is paralleled by a co-construction of 'intermediate theory' by teachers and researchers through collaborative thematic analysis of digital video recordings and other data. For example, in the study of science teaching (Chapter 3) the teacher Chris conceptualises what he calls a *learning journey* as "a scaffolded pathway towards achievement of new learning" (p. 95). This leads to a discussion with researchers about the zone of proximal development (ZPD) and ways in which the activity of the classroom can be construed in relation to the ZPD. Within a broad sociocultural framework, Chris's *learning journey, scaffolding and use of ZPD* constitute an area of *intermediate theory* and illustrate the teachers' "analytic mindset" (p. 203). Each case draws out important themes and associated intermediate theory which are compared and contrasted in a cross-case analysis (Chapter 5). All teachers use a dialogic approach in the classroom, using technology to support innovative ways of stimulating students' engagement in the subject material and discussion of ideas and issues. The dialogic approach extends further to the use of video recordings of classrooms, not only as a tool for analysis, but to stimulate discussion of learning and teaching between researchers and teachers. As the literature suggests (e.g. Coles, 2012; Jaworski, 1994; Sherin, 2007), the result of such stimulated discussion is a deep learning experience for all participants, and is theory-related. The authors reflect on this methodology and extend the associated theory building in two chapters (Chapters 6 and 7).

As a mathematics educator myself, I was fascinated to read the cases in the other subject areas – religion in Tudor times (history), photosynthesis (science) and anti-social poetry (English). It was a joy to see how these teachers created scenarios for their students in which subject-specific knowledge could be communicated, with the use of technology allowing students to explore ideas, discuss issues and engage in depth with subject concepts. The cases offer clear images of how teachers thought about and designed their teaching as well as the ways in which they interacted with their students and encouraged learning. For example, teacher Jackie selected poems and used the IWB to encourage students to take on the persona of the writer of the poem, feel the emotions, discuss alternative points of view and draw on visual images to support analyses of human behaviour. More than this, however, we see how dialogue with the researchers, stimulated by the video material, led to teachers formulating their craft knowledge in more theoretical terms – contributing to generation of codes in the analytical process and developing towards greater knowledge in teaching. Such dialogue clearly played a formative role for both teachers and researchers: for teachers, stimulating professional development opportunities and, for researchers, enabling

higher level theoretical syntheses. Throughout description and analysis we find technology (especially the IWB) permeating activity in the classroom. Technology afforded dynamic visual presentation, provisionality and technical interactivity (as in the use of multiple resources, textual and graphical annotation – often by hand – and the drag and drop facility). Readers can link to the online T-MEDIA facility to expand the book’s text and access new examples and visual insights.

The second part of the book, *Designing a framework for teachers’ professional learning*, includes the impact of the T-MEDIA study, one year later, on teachers who had participated and their colleagues. The researchers were interested to find out whether new thinking and practices had been sustained and/or taken up by other colleagues. Three aspects stand out as having impact:

- The development of intermediate theory and the concepts to which it related (scaffolding and funnelling were mentioned particularly): teachers felt that the emergence of a terminology helped them to gain deeper insight into the concepts in practice.
- The dialogic approach with use of technology: central to all classrooms, this was highly valued and sustained by the participating teachers who inspired colleagues to try it for themselves
- The importance of video recordings and their use in collaborative analysis of events leading to deeper insights into issues in practice: for example, teachers reported having developed a more *critical* approach to observation of their own and colleagues’ lessons and those of trainee teachers.

It seems clear from what is reported, and especially from the quotations from teachers, that developmental processes from the T-MEDIA project were sustained by the participating teachers and that certain of their colleagues were inspired to take up ideas and practices. Moreover the project was hugely formative for the participating teachers, not only in opening up new visions of practice, but also, through the methodology of dialogic analysis of video recordings linked to theory, in allowing teachers to articulate their knowledge-in-practice in new ways. The book is successful in allowing the teachers’ voice to reveal the developmental process and its outcomes for the teachers. Although the original T-MEDIA project had been designed to study and characterise teaching-learning practice using technology, not to develop teaching, it was clear that important development had taken place.

As Hennessy points out, there is a great deal of wisdom to suggest that CPD consisting of a top-down approach to showing teachers what they should be doing in their classrooms is doomed to failure. The unwitting developmental approach discussed here accords with much that I have experienced in my own professional career. When teachers are inspired to inquire into their own practice, to question what they are doing and why they are doing it and to start to develop ‘intermediate theory’, then they start to change their practice (Jaworski, 1994, 1998, 2008). Moreover they are excited by the levels of engagement that this generates and become ambassadors for change (not least in the three respects listed above).

For the project leaders, such recognition of development in practice led to their conceptualisation of a developmental methodology (for professional learning) related to the methodology of the original project. From the original project, the T-MEDIA and other related resources were now in the public domain. Thus the follow-up projects were designed explicitly to use these resources with new teachers to develop dialogic teaching-learning with technology, and discussion stimulated by use of classroom video recordings. The book reports on one case of this use with mathematics teachers (Chapter 9) conducted by experienced teachers. Three cases in other subjects employed a range of resources alongside the T-MEDIA video examples, during the Dialogue and IWBs project (Chapters 6, 10). Outcomes of both projects suggest that explicit use of these methodologies leads to successful professional development for the teachers concerned, taking place in their own schools. Success is judged through teachers' motivation, engagement and inquiry into new ways of approaching teaching and learning.

Although much of the book focuses on the learning of the teachers, it is clear that the researchers recognise their own deep learning through their engagement with the teachers. Co-learning, through analysis of video records, generated insights which drew on theory, which theory was unable to predict, but which deepened their awareness of theory in relation to practice. For the researchers, this was new knowledge-in-practice. Just as the teachers developed their thinking and practice through co-learning with researchers, so too the researchers developed their practice as leaders of professional development activities for teachers. Their co-learning was deeply intertwined with the methodology of practice and provides a powerful illustration of the learning outcomes this methodology can generate.

I cannot recommend this book too highly. In its necessarily linear presentation of the projects through the chapters of a book, it weaves a complex developmental story with a range of facets. It emphasises clearly the rigour of the research that was conducted, while demonstrating the complexity of the inter-relationships, practices and issues for both teachers and researchers in developing practical and theoretical knowledge. Its graphic insights through text and associated media provide exemplars for teachers and those who work with teachers as a rich resource. It shows us all what can be achieved and the means of achieving it.

There is always a 'but'! Although researchers and teachers worked in real schools with real students and had to contend with all the issues of practice in the sociocultural settings in which the research took place, there is nevertheless a sense of privilege and cocoon. Teachers are able and committed, as are the researchers. There is a wealth of knowledge and resource. How can the approaches developed here meet the needs of educational practice more widely? Hennessy recognises that development at scale is a "thorny" issue (p. 281). She points to the multiple sets of materials that have evolved from the project, drawing on the researchers' deeply experienced insights. Not least, we see the T-MEDIA resource incorporating video material to provide ideas and examples of practice, and as a basis for recognition and critical discussion of teaching-learning issues. However, no materials, however

good, can by themselves generate the developments in practice that we see portrayed in these pages. It is in the *use* of such materials that developmental power is invested. As we read this book and ponder on the messages it brings, we have to consider what is needed to promote effective use on a large scale. While individuals can learn for their own immediate practice, it requires the wider stakeholders of the educational enterprise, including government, to address development at scale. Given a will to do this, what we see here provides important starting points.

NOTE

¹ <http://t-media.educ.cam.ac.uk/>; <http://dialogueiwb.educ.cam.ac.uk/>.

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INTRODUCTION

There is a misconception... that educational theories are established facts or undisputable truths that have direct applicability to the classroom...and can be “plugged” into actual situations and yield direct results...like one applies a proven remedy to a disease. (Gordon, 2007b, p.xi)

There is a long-recognised chasm perceived between two educational cultures. On the one hand there is academic research and the educational theories that it generates; on the other there is everyday classroom practice, the problems arising and pedagogical strategies. Biesta (2007) traces the questioning of a relationship between educational research and practice back to the 18th century. Today the cultures of academia and schooling have different concerns, vocabularies, reward systems and resource levels for research, as well as different views of “knowledge” (de Vries & Pieters, 2007). Various attempts to bridge the chasm and – importantly – to analyse and understand exactly how research-based knowledge and practitioner knowledge differ and complement each other (McIntyre, 2005) have produced valuable insights. The primacy of research-based knowledge has been challenged (e.g. Nuthall, 2004), and a more sophisticated understanding of the possibilities for its relevance and use has emerged.

Research is often construed as producing “technical” or “instrumental” knowledge that points the way to a particular educational outcome: “what works” or the “evidence-based practice” beloved of policymakers in particular. Practitioners may be viewed as autonomous users of fundamental knowledge produced by basic research, or research is the provider of fundamental knowledge for the development of technologies or design knowledge (“engineering model”; these alternatives and others are outlined by Staub, 2004). Underlying these views is an assumption that teaching has a direct, measurable effect on learning. Yet they ignore the need for learners to interpret and make sense of what they are taught, and the factors mediating that process. Prominent factors include the specific characteristics of the particular setting and the various participants in the educational interaction (pupils, teacher, head teacher, parents etc.). The common perception of the technical role of research is questioned by Biesta (2007) who considers that research can inform and improve practice through providing different interpretations and understandings of educational practice (including theories), and that premise underlies this book too. Biesta argues that this often overlooked cultural role is equally – perhaps even more – practical in that it radically shapes the way that we see practice and opportunities for action.

In fact there are multiple gaps perceived between research and practice and hence different aims and strategies for bridging them (Bauer & Fischer, 2007; Biesta, 2007; Gordon & O’Brien, 2007). A review of the different solution models and a survey of

different stakeholders' perspectives of these by Broekkamp and van Hout-Wolters (2007) suggest that the models are ideally complementary rather than conflicting. Many analyses have been simplistically monocausal or exaggerated and few offer ready-for-use solutions (*ibid.*). Nevertheless there is a dawning realisation that bridging is not a simplistic, one-way transmission of knowledge from producers to consumers or a straightforward 'translation' into classroom practice of either research-derived theory or recipes for action. Moreover, it is not the traditional form of 'transfer', which is largely discredited in the literature on pupil learning and vocational learning (Hager & Hodkinson, 2009) across contexts and which seems equally unhelpful in this context of teacher learning. It is nevertheless recognised that a simple demonstration and briefing from a colleague is insufficient, and "the originator needs to engage in joint planning and as a critical friend or coach"; teachers then need to find ways of fine-tuning the new practice to the needs of their classes (Fielding, 2005). However barriers acknowledged include problems being ill-structured, goals being shifting, ill-defined or competing, and information being incomplete, ambiguous, or changing (*ibid.*). A key factor is that teaching is full of unanticipated, diverse and unique situations that require professional judgment (K. Smith, 2007) and ongoing change, and this may obstruct generalisability of research outcomes that are too tightly framed. It also precludes the production or mechanical application of a silver-bullet solution to a practical problem. As Gardner (2011, p. 544) expressed it,

Research ... may prove too subtle and complex to be assimilated with effect. The problem may stem from communication or ... engagement with our audiences but more likely it is the sheer complexity of educational contexts that constrain impact. Ultimately, our research may be transformational but as a rule it simply does not have immediacy or clarity of impact that in other fields a new drug or technological innovation might have.

Consequently it is difficult for policymakers to distil the clear messages they seek and other, competing political imperatives on policy making occlude the messages from empirical inquiry. Alton-Lee (2011, p. 325) optimistically highlights the potential contribution of the growing availability of trustworthy, "best evidence" syntheses (e.g. from the EPPI-Centre¹) in guiding educational policy and practice about the conditions for professional development that have transformational impact at system level...when bodies of evidence are acted on. Gardner concludes, however, that educational research cannot be represented or distilled into simple one-line actions and that it may take many years for its insights to filter through to policy or practice. Likewise, while there may indeed be "nothing so practical as a good theory" (Lewin, 1951, p. 169), an educational theory must be "applied in more nuanced and contextual ways, taking into account the social-historical context in which it was created as well as the various particulars of each classroom situation" (Gordon, 2007b, p.xii). There are multiple ways of applying theory to practice in different disciplines.

It is now acknowledged that practitioners have a wealth of untapped and undervalued expertise at their fingertips that can provide many insights for university

researchers (and for their teacher peers). They can be co-creators of knowledge, given the right opportunities (de Vries & Pieters, 2007). There has been an increasing emphasis on research partnership and collaboration between groups of university researchers and school-based practitioners. There has also been a shift away from an emphasis on critique of existing practice (including comparison with the merits of proposed research-based changes), and towards a critique of proposed changes from the perspective of existing practice and of the local context (McIntyre, 2005). Finally, teachers have rarely contributed to formulating research questions and conducting studies, yet in recent years, increasing numbers have become engaged in school-based action research. A relatively recent approach aiming to develop theory as well as new forms of practice is the ‘design experiment’ (Design-Based Research Collective, 2003). Researchers collaborate closely with practitioners, and they are jointly accountable for the interventions and experiments carried out through repeated cycles of designing, implementation, and analyses. Detailed local knowledge from the field of practice is drawn upon.

Despite these welcome developments, conventional academic research is still perceived by many teachers as too idealistic, general, partial, time-limited, resource-intensive, closeted in scholarly journals, abstract, jargonistic, inaccessible, self-interested and irrelevant to their personal concerns, professional experiences and the complex practical realities of classroom life (Gordon & O’Brien, 2007; D. H. Hargreaves, 1996; Hiebert, Gallimore, & Stigler, 2002; Nuthall, 2004). In one Dutch survey, practitioners, policymakers, academic researchers and teacher educators alike considered that research is inconclusive, theoretical, insufficiently contextualised, fragmented and of low status (Broekkamp & van Hout-Wolters, 2007). Moreover, most practitioners lack an informative, durable professional knowledge base and rarely search spontaneously for research-based knowledge. At best research reports are seen primarily as a source of useful ideas about things they might perhaps try when circumstances permit.

There is an acceptance that teachers are most strongly influenced by evidence drawn from the specific contexts with which they are familiar, case studies of ‘good practice’ produced by other teachers and the often tacit knowledge derived from substantial professional experience, with systematic research only an occasional and rather haphazard factor (James, Pollard, Rees, & Taylor, 2005, p. 112).

In the UK, even in **Teaching Schools** whose formal role in research and development is clearly stated in National College for School Leadership policy and for whom a national research and development network has been set up, there is little evidence of using existing research and some involvement in research is not acknowledged as such. Sebba, Kent and Tregenza (2012) reported on joint practice development projects in five Teaching School alliances (chosen for their strong track record on sharing practice with other schools, practitioner research and inquiry and collaborative innovation in teaching practice) that aimed to develop effective approaches to cross-

school ‘joint practice development’ (Fielding, 2005) and ‘knowledge transfer’. The report observed that “current systems for teachers to access research are limited and those in the joint practice development projects were more likely to get their research information if at all, from Twitter or blogs which are rarely quality assured. (p.1-2).” The report detected very little awareness or use of the National College network and on-line community. It found that schools have relatively few ideas on how to progress ongoing engagement in action research, so that support and better infrastructures for spreading the findings to other colleagues are needed. Sebba *et al.* concluded that a common perception of research seems to be of teachers pursuing Masters degrees, not using research findings to inform their everyday work. They also suggested that an emphasis by senior leaders in schools on very short-term outcomes, fuelled by having to bid (inefficiently) for each small source of funding, may mitigate against the effective use of research. This undermined an expected strategic approach in planning for at least 1-2 years.

Some argue that practitioners may desist from actively using scholarly research findings because they lack the skills, mechanisms and support to do so (Broekkamp & van Hout-Wolters, 2007). Research is a potential source of indirect influence via professional development programmes, textbooks and policies, but potential mediators (teacher educators, publishers, policymakers, professional development organisations) are often ineffective in “implementing” its insights (*ibid.*). Lewis, Perry, & Murata (2006, p. 8) point out that too often, spread of a “proven” innovation is regarded as a separate research phase and a mere technical chore, despite the overwhelming evidence of the difficulty of the dissemination phase and its intimate relationship to the initial characteristics of the innovation as an externally designed entity (Burkhardt & Schoenfeld, 2003). In summary, it should be incumbent on researchers to move beyond the premature stopping point, causal inferences about effectiveness under controlled circumstances at initial sites. They should justify their choice of research methods based on the endpoint— “legs” or instructional improvement at sites of spread and whether it is likely to promote or to undermine effective local adaptation and grassroots spread of innovation (Lewis, *et al.*, 2006, p. 8).

In sum, the tensions persist and the divide remains, perhaps as wide as ever – despite teachers of course being those who could most benefit from educational research.

THE APPROACH AND AUDIENCE OF THIS BOOK

This book presents a fresh approach to the problem. I describe and critique a unique form of research partnership in which university researchers and in-service school teachers were – and are – building and refining theory through collaboratively analysing and critically reflecting on classroom practice. The research itself happens to focus on the use of **interactive whiteboards** to support teaching and learning in a variety of subject areas. The overarching aim of the research programme, however,

is to use classroom research observations and collaborative analysis to bridge the gap between theory and practice. It is asserted that the barriers between them start to be broken down when new understandings of practice that are mutually useful to practitioners and academics begin to arise. This could be said to be a form of professional learning for both partners.

The work contributes a more detailed description of the specific ways that theory was brought to bear and renegotiated than is typically observed in accounts of university–schools partnerships in inquiry, even where the focus is on aligning theory with practice (as Seidl [2008] points out in her review of one such account by Marek & Laubach, 2007). The work additionally offers a general approach to school-based professional development aimed at developing pedagogy – and some specific materials to draw on in the domains of subject teaching and learning supported by ICT (information and communications technology), and classroom dialogue. This is important at a time when responsibility for teacher education and development is being increasingly devolved to schools.

This book seeks to consolidate and disseminate this work, stimulating further thinking about the issues arising. Readers are invited to interact with and critique these ideas. I hope that the discussion will be of particular interest to:

- educational researchers and teacher educators – particularly those involved in research partnerships/mentoring and continuing professional development;
- teacher-researchers (including those undertaking higher education-accredited projects), participants in and coordinators of school-based research and professional development, and teacher mentors;
- practitioners at any level interested in making effective use of whole-class digital technologies, especially interactive whiteboards, and/or in developing a **dialogic teaching** approach.

THE RESEARCH PROGRAMME AND OUTCOMES

The research programme was conducted by the author in collaboration with a number of colleagues at the University of Cambridge. It developed a distinctive line of empirical co-inquiry, which may be characterised as collaborative, systematic investigation aimed at augmenting knowledge; this involved both academic researchers and classroom teachers reflecting on and constructing shared interpretations of classroom practice. The practice we chose to focus on was the critical role of the teacher in purposefully exploiting an exciting new technology– the interactive whiteboard (IWB) – to support subject learning. The IWB is a relatively recent cultural tool that is typically used for whole-class teaching and at the time of writing it is found in 85% of UK classrooms (Futuresource Consulting, 2013). Its use is increasing exponentially in a number of other countries too, notably Denmark, Netherlands, Australia, USA, Canada, Spain and Mexico, with use in both Europe and East Asia projected to surge in the next couple of years. An astounding 1 in 8

classrooms (34 million teaching spaces) across the world already have an IWB and by 2015, 1 in 5 will have one (*ibid.*).

We conducted and analysed classroom observations of teachers exploiting IWBs to support teaching and learning in a variety of subject areas. Seven in-depth case studies of six teachers involving observation of 33 lessons were carried out in primary, middle and (mainly) secondary schools in the East Anglia region of the UK from 2005–2010. Our shared interpretations of the IWB-supported practice drew on teachers' extensive professional knowledge, on their perspectives on how technology supports learning in specific, authentic everyday contexts, and on key constructs emerging in the scholarly literature. Both the methodology of collaboration and the substantive topic area of the case studies are considered widely applicable across settings and school subject areas, largely by virtue of their lack of prescription.

The account in this book focuses largely on the 'T-MEDIA' research project ("Teacher **Mediation** of Subject Learning with ICT: A Multimedia Approach"²), carried out with Rosemary Deaney and centred on case studies of collaborative work with three experienced, **reflective practitioners** in secondary English, science and history and a further study of mathematics teaching.³ It describes and illustrates how multiple perspectives and interpretations were made visible, debated, tested and iteratively refined. A rigorous process of reviewing digital lesson videos, and of identifying **critical episodes** and the underlying rationale proved a powerful catalyst for introspection and reflection.

The process of collaborative thematic data analysis culminated in a collective narrative account that encapsulated both teachers' and researchers' voices. This is framed in a common accessible language and grounded in classroom practice. It was embodied in a series of five professionally produced, interactive multimedia resources. These characterised the key themes and strategies emerging in each case, along with illustrative video sequences and linked professional development activities. Our materials are unconventional in their portrayal of authentic, everyday (rather than supposedly "best") practice, inclusion of pertinent analytic commentary on every episode and built-in points for reflection and discussion.

The impact upon the participating teachers' thinking and subsequent practice of participation in the theory-building process, and sharing of their learning with other colleagues, are the subject of one follow-up study reported (Chapter 8). Another follow-up study focused on using the multimedia resource produced in one subject (mathematics) as a stimulus for reflection within a teacher-led process of collaborative professional development with groups of colleagues in other schools. It again charted changes in thinking and practice (Chapter 9).

A later project, 'Dialogue and IWBs,' is also used to illustrate how some aspects of the work were developed further.⁴ The issues surrounding research partnership were investigated through case studies of using interactive whiteboards to support classroom dialogue (Chapter 6). This choice of topic has an important bearing on the research into co-inquiry. *Dialogic* teaching is an evolving pedagogical approach in which teachers and learners are actively commenting and building on each other's

ideas (Alexander, 2004; Mercer & Littleton, 2007; Mortimer & Scott, 2003). Here we worked with three experienced teachers to collaboratively analyse, document and this time to develop dialogic practice in different subjects: English, history, and personal, social, health and citizenship education (PSHCE). The original methodology was extended in various ways, including through exploiting carefully selected stimulus resources during workshop discussions. Amongst these resources, video exemplars derived from teachers' own classrooms and from our earlier research were particularly helpful. Experiences of and impact upon the participants are also reported (Chapter 10). This work again culminated in concrete theory-informed, co-authored resources for teacher education and professional development.

The role of video throughout the research programme is powerful and multi-faceted, and its value is reflected upon in the book. Lesson video was used in three key ways: first, in extractive mode (Haw & Hadfield, 2011) to support our classroom observations and capture detailed representations of the classroom interactions; second, in reflective mode (*ibid.*), using playback during the analysis process to prompt discussion, reflection and interpretation from multiple perspectives. University researchers and academic subject specialists, teachers who featured in the episodes, and teachers who did not (both subject colleagues and teachers from other schools and disciplines) each viewed the footage with a different professional lens. Third, jointly selected critical episodes were professionally edited and produced as illustrative clips aimed at our target audiences. They were used in a communicative mode through embedding them in professional learning resources and presentations emerging from both projects.

BUILDING 'INTERMEDIATE THEORY'

The starting point of our co-inquiries was making explicit both scholarly and practitioner knowledge in order that both could be reassessed, exploited and integrated – potentially offering both parties a fruitful line of inquiry. This idea is expressed in the key concept of *intermediate theory*: *theory that bridges educational theory and a specific setting* – specifying the conditions in which theory applies (see Section 1, Introduction for elaboration). In the case of the T-MEDIA project, a diverse range of relevant ideas from sociocultural theory was appropriated, integrated, recontextualised and adapted to mesh with teachers' own perspectives. In the subsequent Dialogue and IWBs project we explored, reformulated and extended definitions of **dialogue** through co-inquiry with practitioners who had an established **dialogic pedagogy**. The three participating teachers were offered indirect experience of each other's very different classroom settings as they worked together, and the process culminated in democratically negotiated, enriched understandings of dialogue and dialogic pedagogy, framed in easily accessible language that consciously adapted them for wider use.

The process of integrating our perspectives with insights derived from joint critique of the literature and insights emerging from the data was a reflexive one

in both research projects – and was itself dialogic. In line with a dialogic approach, emerging conditions for success include the essential theorising element (difficult for hard-pressed teachers to engage with under normal circumstances) and a supportive climate of mutual respect for the different but complementary kinds of expertise that university researchers and practitioner participants bring to the collaborative partnership. These include the critical stance and theoretical perspectives of academic discourse, and teachers’ craft knowledge about pedagogical practices, learners and specific classroom contexts (Putnam & Borko, 2000). The account characterises the dynamics – especially facilitation, conduct and outcomes – of this process of reflective dialogue, an element largely missing in the body of literature on professional learning (Nehring, Laboy, & Catarius, 2010). It offers concrete examples via transcribed excerpts of our workshop dialogue with groups of seasoned professionals (the literature focuses on the learning of novices).

A key outcome of the research programme is a proposed flexible framework for equitable research partnership between academics and practitioners that interrogates theory but is ultimately aimed at improving practice – through reflective dialogue. It presents a new opportunity to build a strong professional knowledge base that spans the teaching and research professions, informing both about how we might support effective teaching and learning in our schools.

USING THIS BOOK

Aims and Outline

The substantive findings of the various projects outlined above are used to illustrate the process of sustained collaboration between university researchers, the teachers and their departmental colleagues, with additional input from academic subject specialists. So while use of the technology provided the context for our research collaboration and is alluded to throughout as such, it is the *process of collaborative theory building* that is the *primary* focus of this book; the unique methodology developed and refined through this work is offered as its most significant contribution. In principle the theory-building process could equally have taken place in a non-technology context, with teachers of other subjects, and so on; thus it has wider implications. Likewise, the research studies were carried out in the UK but the implications are not specific to that national context.

A *secondary* purpose of the book is to present, through the case studies, the emerging strategies for mediating classroom use of IWBs – which may be of particular interest to audiences of practitioners and teacher educators. The strategies are not prescriptive but offer alternative approaches and perspectives to consider; these in turn constitute potential stimuli for change. Additional illustrations of the strategies appear in a series of publications,⁵ in a set of multimedia resources developed during T-MEDIA, and in an additional professional development resource that illustrates how the IWB can support classroom dialogue. Note that free access to the four subject-specific T-MEDIA multimedia resources, and the “across-subjects” resource, hyperlinked to

video clips, is available on our website (<http://t-media.educ.cam.ac.uk/>). A further collection of professional development materials on dialogic interaction using the IWB is published by Open University Press (Hennessy, Warwick, Brown, Rawlins, & Neale, 2014); more information, a subset of the resources, links to them and to an open access collection of video exemplars of classroom dialogue supported by IWB use appear at <http://tinyurl.com/OUPIWB>. These materials provide vivid illustration of the outcomes of our research collaboration in a form that is particularly accessible for practitioners, teacher educators and student teachers.

Different audiences may well find certain chapters more interesting than others and the book is designed for dipping into. Section One outlines how academic researchers worked together with teachers in using theory to understand practice and in refining theory. It begins with an introduction to the theoretical underpinning, including the concept of intermediate theory. The rest of the section describes the processes of classroom observation and subsequent collaborative analysis, and the themes emerging. Chapter 1 sets out the evolution of a methodology for developing intermediate theory. This is followed by three case studies (a chapter for each of history, English and science teaching) that illustrate the process in practice and the teaching strategies emerging. These chapters (2–4) were written in conjunction with participating teachers, and they include rich detail and verbatim accounts. Chapter 5 summarises the pedagogical themes emerging across subject areas. Chapter 6 illustrates how the methodological approach to theory building was developed further in three additional case studies of interactive whiteboard use (developing dialogic classroom interaction in English, history and personal, social, health and citizenship education). Chapter 7 synthesises across all of the preceding six chapters. It theorises about bridging between research and practice through reflecting on the methodological approach to theory building via collaborative review of lesson videos. Preconditions, critical features, and scalable benefits of our evolving approach are identified.

Section Two is shorter and examines the relationship of the process with participating teachers' professional development and subsequent practice. Here the notion of the research partnership between classroom and university educators is extended by exploring how outcomes may be used to support other teachers' professional learning. Chapter 8 reports a follow-up study on the impact of involvement in the three T-MEDIA case studies described earlier and Chapter 9 describes a subsequent trial of the emerging approach to school-based professional development with secondary mathematics teachers. Chapter 10 reports on the outcomes of the Dialogue and IWBs project for participants, their schools and for teachers elsewhere through published professional development resources. These chapters report some sustained tangible impacts of engagement with theory, reflection and trialling new approaches and tools on the professional thinking and practice of participating teachers and evidence of their spread and independent adaptation by colleagues in participating schools.

The book concludes in Chapter 11 with some suggestions arising in the light of this and related work: How we might formulate new forms of in-service professional

INTRODUCTION

development that are concerned with purposefully supporting teachers in developing pedagogical insights. Thus, Section One Introduction plus Chapters 1, 7 and 11 chart the developing approach itself, with other chapters interspersed to provide the evidence base and illustrate how it was developed and applied in practice.

A Theory-Informed, Teacher-Led Approach to Professional Learning

Our approach firmly distances itself from traditional one-off, top-down interventions aimed at fidelity to – or improvement in – a particular aspect of practice or policy. In the case of technology use, these typically seek to ‘train’ teachers by developing a discrete set of skills – without follow-up opportunities or continued support (e.g. J. G. Wells, 2007) – often paying little attention to pedagogical aims. Such approaches are frequently unsuccessful in terms of provoking durable change (B. Davis et al., 2009). Even longer courses or workshops where teachers successfully develop awareness and confidence in alternative conceptualisations of teaching can lead to little actual change in practice without ongoing support, because turning new knowledge and ideas into practice is highly challenging (Goldstein, Mnisi, & Rodwell, 1999).

By contrast, our research partnership model is founded on developing new understandings of the principles underlying an innovative approach and thereby constructing new possibilities for teaching. This means recognising challenges, dilemmas and situational constraints, and suggesting practical strategies for addressing those (Marx, Blumenfeld, Krajcik, & Soloway, 1998). It involves supporting teacher communities in pacing and monitoring their own progress. These goals are achieved through a process of sustained, situated, teacher-led development based on: using, discussing and refining intermediate theory already developed (or where time and inclination permit, engaging with scholarly theory afresh), joint reflection and critique of others’ and one’s own practices, and classroom trialling of new ideas, as a springboard for professional learning. The issues around participation of teachers in such a process of professional development are explored in Section Two.

Glossary

Terms in **bold font** (upon first usage) throughout the book are defined in the glossary at the back.

FOUNDATIONS OF THE WORK

Note that Chapters 1 and 7 draw on papers by Hennessy and Deaney (2009b) and Hennessy, Warwick and Mercer (2011); Chapter 2 is based on a paper by Deaney, Chapman and Hennessy (2009), Chapter 4 on Hennessy, Deaney and Tooley (2010), Chapters 6 and 10 on the aforementioned paper by Hennessy, Warwick and Mercer (2011) and on Warwick, Hennessy and Mercer (2011). Chapter 8 is based on

Hennessy and Deaney (2009a). Chapter 9 develops the unpublished work of a project carried out by Hennessy, Deaney, Dawes and Bowker. Introduction chapter and section introductions along with Chapters 3, 5, 9 and 11 largely contain previously unpublished material.

AUTHORS

Three chapters (2, 9, 10) list contributing colleagues as co-authors. Case study chapters (2–4) are authored “with” contributions from each teacher. The remaining seven chapters (Introduction, 1, 5–8, 11) and two section introductions list no authors as they were written by Hennessy.

NOTES

- ¹ <http://eppi.ioe.ac.uk/>.
- ² The 30-month project was funded by the UK Economic and Social Research Council (ESRC) during 2005–2007: ref. RES000230825. Reports and publications are available at <http://www.educ.cam.ac.uk/research/projects/ist/>.
- ³ Although there were originally four subject case studies in the T-MEDIA project, presenting three in detail was considered quite sufficient. Since there was no IWB available in the mathematics classroom (only a data projector), setting that study apart from the others to some extent, it is not included in its own right here, although it is referred to where this is particularly informative, and a follow-up to the mathematics case study is presented in Chapter 9.
- ⁴ The “IWBs and Dialogic Teaching” project was undertaken in collaboration with Neil Mercer and Paul Warwick as part of a personal ESRC-funded Research Fellowship programme of work carried out in 2007–2010 by the author (ref. RES063270081). Reports and publications are available at <http://dialogueiwb.educ.cam.ac.uk/>.
- ⁵ See reports and publications at <http://www.educ.cam.ac.uk/research/projects/ist/> and <http://dialogueiwb.educ.cam.ac.uk/>.

SECTION ONE

DEVELOPING A FRAMEWORK FOR RESEARCHER–PRACTITIONER PARTNERSHIP: USING THEORY TO UNDERSTAND CLASSROOM PRACTICE

The theoretical framework provides the language, the constructs, the models and criteria through which educational contexts can be examined in a rigorous and systematic manner (Venville, 2006, p. 822).

INTRODUCTION

This section contains seven chapters describing how academic researchers worked together with classroom teachers in using theory to understand practice, and in refining theory. This section introduction examines previous approaches to research partnership as a form of continuing professional development and highlights those that focus on peer learning and reflective practice. It introduces the notion of intermediate theory and our approach to developing it through collaborative review of lesson videos. The rest of the section describes the processes of classroom observation and subsequent collaborative analysis, and the themes emerging.

BACKGROUND

What do we already know about effecting change in classroom practice? It has been shown that:

- imposed change has little chance of success (Cordingley, 2004);
- likewise, teachers do not tend automatically to alter their practice in light of research findings encountered (Cordingley, 2004);
- change is gradual and extends only as far as participants feel comfortable: “Change is usually not a radical and revolutionary process, but a (slow) historical evolution of the possibility spaces experienced by practitioners” (Roth & Tobin, 2004, p. 174);
- change is sometimes impeded by day-to-day functioning, which needs to be paramount.

In a more positive vein, we know that the most promising approaches to professional development:

- are collaborative, drawing on teachers' local networks and encouraging peer learning through dialogue, especially in face-to-face settings (OECD, 2009; Wishart & Eagle, 2011);
- are sustained and intensive, supporting teachers' ongoing reflection and rethinking of their own classroom practice (J. G. Wells, 2007; Zwart, Wubbels, Bergen, & Bolhuis, 2007);
- consider teaching as inquiry (Alton-Lee, 2011) and engage teachers in concrete, experiential tasks that are rooted in ongoing inquiry (Marek & Laubach, 2007; OECD, 1998, 2009; J. G. Wells, 2007);
- attend to the social context of the school and the messy, practical realities of classroom life;
- build on teachers' knowledge bases; critique new proposals from the perspective of existing practice (McIntyre, 2005);
- allow teachers to identify their own starting points and choose their own aspects of practice to research, improve or adapt (Lampert & Loewenberg Ball, 1998; William, 2009);
- involve regular meetings of a "teacher learning community" focused on a shared goal (as with the popular "Assessment for Learning" approach) - where teachers jointly plan teaching improvements and report on progress to colleagues (William, 2009);
- include voluntary lesson observation by pairs or triads of teachers or by pupils, and giving structured, constructive feedback; observation can offer new strategies, challenge set routines, and suggest new ways to analyse and evaluate student learning (Sebba, et al., 2012).

A one-size-fits-all approach has never proved successful in education. James and McCormick (2009) found that much of the roll out of the immensely popular Assessment for Learning approach in England has focused on giving teachers procedures to try out in the classroom without considering what they already believe about learning in the first place. Evidence from their data suggests that teachers who feel more committed and able to promote learner autonomy (20% of the sample) are more likely to realise it in their classrooms than others. They also have a greater sense of their own agency, and they test and develop innovative ideas in their own classrooms in creative ways.

A few years ago, a national in-service initiative to train all school teachers in England to use new technologies in their teaching came to be widely regarded as a failure, albeit with some pockets of success. An evaluation of the initiative (N. Davis, Preston, & Sahin, 2009) yielded some important messages: whereas centralised skills-focused approaches in this area were found to be inadequate, the most successful model proved to be an "organic" approach designed to support

evolution of each teacher's classroom, school and region. Face-to-face training, workbooks and group assignments were supported by case studies of good practice. Successful characteristics of this approach included:

- school-based training using the school's own ICT equipment and resources;
- a direct relationship with each teacher's beliefs, subject discipline and pedagogy;
- embedded tasks that made specific links to participants' professional practice;
- personal objective setting and a collective needs analysis for each group;
- active learning opportunities by teachers developing their own professionalism over an extended period of time with teachers in the same community of practice.

These indicators for successful professional development and, in particular, the time required for reflection, sharing and debating with colleagues, collectively offer the basis of a framework for professional learning in which the focus is on reflexively and collaboratively developing new insights into pedagogy. These kinds of sustained collaboration over time are clearly a far cry from the isolated, short-term professional development events that teachers are expected to attend; without ongoing support, feedback or sharing of experiences, systemic change is unlikely and teachers naturally revert to prior practices that have become automatic (William, 2009, p. 22). In this book, the term "continuing professional development" or CPD is used only to refer to opportunities for teacher learning that are genuinely *continuing* over time rather than one-off.

The focus in these contemporary approaches is conspicuously on "peer learning" and "reflective practice". Peers can play a critical role. Glazer and Hannafin (2006) describe reciprocal interactions between teachers sharing and evaluating teaching strategies and ideas they develop together in the pursuit of shared curricular and pedagogical goals. These terms represent laudable practice with potential power. But they require scrutiny, since both can mean many different things, and the quality of change is subject to the motivations of those involved.

Manouchehri (2001) points out the need to distinguish between affective engagement and cognitive involvement. Observing two teachers who were engaged in what is often called "peer coaching", and who held that teaching was largely a matter for individual teachers to define, she noted that their peer observations were unfocused and comments to each other were limited to briefly noting differences in practices. The other's pedagogy was not challenged or even discussed (despite recognition of critical weaknesses), although it was a stimulus for private reflection upon their own practice. This contrasted with another pair who were keen to debate, to learn and to improve practice. However, one of the team members proactively created a productive professional discourse structure for interactions with her peer, who initially held similar beliefs about individual responsibility to the first pair and merely acted as listener. She questioned her colleague in depth and made connections to theories about why events in both his class and her own had occurred or what other outcomes could have been expected, thus drawing him into engagement with

explanatory theories. The author concluded that collegiality per se – albeit linked with emotional support and sharing of daily experiences – may not provoke change in practices, since a critical stance also appears to be needed. To initiate and sustain a culture of peer support for improving practice, roles and responsibilities of colleagues may need to be redefined: “Teachers need first to believe that they have the right, and the potential, to influence the profession. . . . [and to] learn how to engage in collaborative reflection on both self and peer practice in ways to improve teaching and to facilitate teacher growth” (*ibid.*, p. 96). These assertions raise the status of the teacher’s role in the direction of professional development and they highlight the central role that peers can learn to play as critical friends.

By contrast, ‘coach’ implies that one is more expert or knowledgeable. Hargreaves’ (2012) vision of joint practice development dismisses the notion of unilateral practice transfer and instead frames it as a co-construction of practice that entails incremental innovation, of fundamental importance for sustainability. However the terms coach, donor and recipient – rejected by participating teachers themselves (Sebba, et al., 2012) – are used by Hargreaves in describing how through mutual observation and coaching the donor reflects further on the practice that is being shared and explores ways in which it can be improved. The recipient can also contribute as an act of reciprocity.

Reflective practice takes a range of forms too. In Schön’s (1991) “reflection-in-action” the practitioner engages in dialogue with someone whose different perspective could help to reframe an underlying problem. Handscomb and MacBeath (2004) consider that reflective practice is a public, evidence-based activity demanding the systematic collection and analysis of data. Pollard (2005) claims that it leads to a “higher standard” of teaching and stipulates that it includes engaging with the relevant academic literature. This most rigorous form of reflective practice is also more time consuming, requiring resources that many practitioners on their own may find difficult to access. This is one area in which a research partnership between classroom and university educators may prove fruitful.

Some support for this assertion comes from the model of ‘knowledge communities’ which assumes that links between research and practice are established in professional networks that have the aims of making the participants – a group of people sharing an interest or passion – profit from each other’s expertise, and of generating new knowledge (Wenger, 1998).

Collaboration may be carried out via the Internet or face-to-face, on a small scale or on a large scale, intensively or less intensively, in a formal or in an informal way, directed locally or centrally, and so forth. Diverse professional groups may participate, including researchers, teachers, policy-makers, mediators and/or funders of research. Basically, mutual influence of research and practice will be the most effective when the collaboration is intensive, the professional background of participants is heterogeneous, and the activities concern not only the exchange of knowledge but also activities in boundary-crossing practices. (Broekkamp & van Hout-Wolters, 2007, p. 210)

APPROACHES TO TEACHER–RESEARCHER COLLABORATION

A growing body of work focuses on collaboration between classroom practitioners and university researchers as a powerful vehicle for pedagogical change – in ways that more closely integrate theory and rethinking of practice (Baumfield & Butterworth, 2007; Darling-Hammond, 1994). For example, in interactive “co-learning” agreements between university researchers and practitioners, both parties work towards improving practice. Both act as agents of (reflexive) inquiry, actively participating in rigorous analysis, contributing interpretative insights and re-negotiating their perspectives – within a carefully constructed framework of trust (Edwards & Jones, 2003, p. 431; Wagner, 1997). Similarly, partnership with university colleagues with a “traditional commitment to knowledge production and criticality” helps to “engage practitioners in the sorts of thinking they value and need . . . [especially in] “bouncing ideas off others” (Triggs & John, 2004, p. 436) and deliberating on their practice. But to be effective, university–school research partnerships require mutual benefits and a genuine coalition of interest (C. McLaughlin, Black-Hawkins, Brindley, McIntyre, & Taber, 2006). They necessitate the critique of subconscious discourses operating in practice, and a deep involvement in exploring how practice influences pupils’ learning (Cordingley, 2004; Dawes, 2001; Rathgen, 2006).

In one unusually long and fruitful partnership (spanning over 40 years) between university science educators, their student teachers and a local school district, its extraordinary success is attributed largely to the creation of a culture of ongoing co-inquiry (Marek & Laubach, 2007). In this partnership prospective teachers are apprenticed within a theoretical orientation to inquiry-based science teaching. The school teachers practice in their classrooms constructivist learning theories and learning cycle methodologies (exploration, concept development, content expansion and reading about it) that pre-service teachers study at the university; thus the science classrooms are “living laboratories” for teacher preparation at the university, supported by a common theory base.

Another attempt to infuse theory into practice was a professional development model tested by Butler, Lauscher, Jarvis-Selinger and Beckingham (2004). This exposed teachers to principles concerning self-regulated student learning, through modelling, workshops, intensive classroom support, feedback and reflection. They consequently shifted their questioning techniques and interaction patterns with students. They considered the new theoretical concepts and language they adopted and personalised to be crucial in effecting change. The researchers described the framework as a “guiding light” (ibid, p. 451) but stressed the danger of dependence on “outsiders” for sustaining an innovation. They also linked teacher learning with emerging “reconstructed conceptual frameworks” but no details of reconstruction or adaptation were presented. The findings have some implications for our own studies, although we did not provide classroom support; instead we examined whether the scholarly theory introduced had any subsequent use as a tool for characterising teacher thinking about pedagogy. This process is elaborated as follows.

In our research partnerships, we set out to understand, question, deconstruct, and later to develop, classroom practice through university researchers and teachers acting as co-inquirers and engaging in collaborative theory building. Our aim was to co-construct or jointly build accounts of practice and underlying pedagogical strategies that could be shared with both teacher and academic colleagues. This approach, like the ones noted above, is a kind of “reciprocal partnership” that respects the teacher’s “voice” and often untapped and undervalued expertise (Elden, 1981; Fisler & Firestone, 2006; C. McLaughlin, et al., 2006; Rathgen, 2006). Likewise, “co-teaching” and its underpinning, “co-generative dialogue”, aim to collectively generate a discourse for explaining classroom events and designing changes (Tobin & Roth, 2007). This is effected through sharing responsibility for extending explicit and implicit learning opportunities for pupils and co-teachers. Our approach differs somewhat from ‘coaching’ models, for example Content-Focused Coaching (Staub, 2004). Both approaches include

- pre-lesson planning conferences;
- the enactment of lessons or invisible translation of pedagogical beliefs into action (Zwart, et al., 2007);
- post-lesson reflection conferences;
- theory-guided conversations focused on student learning and core pedagogical issues.

However, a coach is considered to be co-accountable for the design and enactment of lessons; in our studies that remained the teacher’s responsibility.

I am mindful of Triggs and John’s (2004) assertion that educational research often reflects asymmetrical power relations whereby academics use practitioners as the objects of research. However, I believe that our own collegial research partnership models a very different power structure. It also represents a significant departure from conventional action research that is carried out by practitioners, and from the traditional “gather data” and “deliver knowledge” approach that characterises most academic research.

Our approach to collaborative theory building was also derived from our previous experience of working with teacher–researchers. During the TIPS (“Technology-Integrated Pedagogical Strategies”)¹ project, 15 teacher–researchers tried out new pedagogical approaches to using technology in a range of subject areas over the course of a year. First they were encouraged to make explicit their **practical theories** for how a technology supported learning and guided the development of a pedagogical strategy incorporating its classroom use, then they evaluated their theories in practice (Deaney, Ruthven, & Hennessy, 2006). The study showed that teachers’ initial ideas were often modified when operating within the constraints of the setting. Their speculative theories about idealised use of technology were tempered through practice by their own beliefs about how pupils learn and about “what works” (pedagogically and technically) in the specific setting. This craft knowledge (Cooper & McIntyre, 1996) is concrete, detailed knowledge developed

and stored in relation to specific learner, classroom and activity contexts, and accessed for use in similar situations. In this study, craft knowledge was shaped by the perceived constraints and **affordances** of the setting, by resources at hand, and by trial and adaptation of practice. Developing practical theory could thus be viewed as a complex and evolving process of reciprocal interaction with the setting and with associated craft knowledge (Hiebert, et al., 2002).

During each TIPS project, two lesson observations and post-lesson interviews were carried out. The interview discussions were designed to help teacher-researchers articulate some of the thinking behind their developing practice. They found it difficult, however, to move beyond a general and superficial account of practical theory, both initially and in their written reports – despite the support and models provided. Hence the researchers’ analyses of classroom action in relation to practical theory remained interpretative.

The design of the subsequent ‘T-MEDIA’ research project was therefore guided by the lessons emerging from TIPS and other models of teacher development (Clarke & Hollingsworth, 2002). Collegial interactions and external input from the university team were central. While these focused on research mentoring in the case of TIPS, T-MEDIA involved introducing and discussing theory quite explicitly, as elaborated in the next section. Recognising that synthesising research-based knowledge with teachers’ craft knowledge demands “time, energy and helpful procedures” (McIntyre, 2005, p. 362), we sought to find ways to structure and promote “quality conversations” focused on the specifics of teaching and to set up contexts in which “rigorous and critical debate” can happen (Wallace, 2003, pp. 11–12). We therefore planned a series of intensive workshops and meetings conducted away from school sites (at the university): an approach that “affords [teachers] the luxury of exploring ideas without worrying about what they are going to do tomorrow” (Putnam & Borko, 2000, p. 6). Through the in-depth examination of digital video data, workshops were focused on the minutiae of ordinary classroom lessons, thus combining the advantages of working in both settings.

DEVELOPING INTERMEDIATE THEORY

Theory provides teachers with a frame of reference and a language for naming and critically analysing many of the problems they encounter daily. In our case, a sociocultural framework provided the initial theoretical language, constructs and lens through which to begin our analysis, and ultimately proved to be a powerful “guide to thought and instrument of interpretation” (Gordon, 2007b, p.xi). Whereas our approach to analysing classroom interactions was explicitly informed by various (subject-specific and sociocultural) literature, the aim was to engage in “problematizing” (Freire, 1976) – to engage, in other words, in dialogue centred around explaining the data. This brought together the academics’ scholarly knowledge, derived from existing theory, research findings and experience, with expert teachers’ practical theories (Deaney, et al., 2006) and their extensive,

professional craft knowledge. The main goal of the research collaboration was the joint construction of an analytic framework that elicited and codified the explicit, implicit, initial and evolving theories and expectations of the different individuals involved. Through joint reflection on specific classroom experiences, we aimed to represent and understand them in new, grounded, and detailed ways that were helpful for all team members and for other practitioners and researchers.

We understand that although sociocultural learning theory may broadly frame an educational practice, it does not bridge directly to it; grand theory lacks orientation to particular contingencies and tends to pass over important details. Indeed, learning theories – and intervention programs aligned with them – require significant adaptation to local resources and constraints if they are to inform practice; they cannot simply be exported or disseminated to new settings. In looking at teacher learning, we extrapolate from the use of a much more flexible form of “transfer” from the extensive review by Bransford and Schwartz (1999) of empirical work in the field of student learning. This is based on “preparing for future learning” through analysing contrasting cases, building on learners’ own ideas, helping teachers to critically scrutinise and clarify their own thinking, and to actively change the given situation according to their current state and goals. Important prerequisites include support for innovative risk taking in an authentic inquiry environment and opportunities to receive feedback and to improve practice. This is linked in turn with a supportive disposition characterised by willingness to question and relinquish one’s own assumptions and to seek others’ ideas and perspectives (Bransford & Schwartz, 1999). All of the participants in the studies reported here were willing to do this and to take what Stenhouse (1975, p. 156) called a “research stance”: namely, “a disposition to examine one’s own practice critically and systematically” in the interests of personal development. Bransford and Schwartz point out that usefulness of this approach shows up only when people are given the opportunity to learn new information. They argue the case for investing time and energy in developing adaptive rather than substantive expertise (for example, helping people learn a particular software package is contrasted with taking the extra time to prepare them to continually learn new packages).

The notion of “travel” proposed by the US National Academy of Education in their specification of research priorities (NAE (National Academy of Education), 1999) likewise suggests that

Broad use is more likely to be achieved if we learn how to develop resources that are intended for other people’s use of innovative programs as models that they can adapt to their own circumstances, rather than striving for universally true, abstract propositions. (Greeno, 2004, p. 8)

The shift away from the ambiguous term “transfer” is welcome, and the stance taken in the work reported here is related. I prefer, however, to speak of “pedagogical principles” (any or all of which may be appropriated and trialled in new settings, where their manifestations will look rather different) rather than “programmes”

or “models” (albeit adaptable ones). The latter terms hold less situated and more prescriptive connotations, including an assumption of adoption or adaptation of the whole. My stance is consistent with the assertion of Randi and Corno (2007, pp. 336–337): that any number of interventions might be designed to embody a particular theory and thus using multiple examples may ultimately help teachers to abstract the general principles underlying the theory.

The process of intermediate theory building could indeed be viewed as a form of Randi and Corno’s (2007) “conceptual theory mapping”. This is an inductive process of theory validation in which teachers adopt and adapt applications of theory-based principles that fit their learners’ needs as they arise. This might take the form, for example, of developing self-regulated learning experiences that guide pupils to model their work habits on lessons learned from the literature. It is a kind of “forward reasoning” (Perkins & Salomon, 1989), and it stands in contrast to the faithful application of a theory-based intervention to practice.

Instead, teachers appropriate scholarly ideas into their practical reasoning in a manner that provides a new context for research. The research examines how the theory maps broadly to content across existing curricula, domains, disciplines or teaching situations. This gives the theory credence by demonstrating its external validity. Our approach likewise offers practitioners professional autonomy and the opportunity to be adaptive and inventive, aligning their practices and approaches with aspects of theory they themselves deem relevant and refining them accordingly, purposefully and iteratively (Bransford & Schwartz, 1999). The ultimate goals of our intermediate theory-building process were to exploit insights from research (a) to help describe, understand, critique and learn from observed classroom practice; (b) to guide principled development of new practices and pedagogies; and (c) to refine both practical and grand theory. I describe below how we tested the boundaries of both *a priori* practical theory and grand theory through micro-analysis of their applicability and manifestation in different practical settings and across domains, within and between taught subject areas.

Randi and Corno (2007) concluded that collaborative research by academics and practitioners is the implicit mechanism in the interplay between practice and theory, serving to collect and generate examples of theory as it plays out in practice across a variety of domains. The nature of teachers’ contribution to theory mapping demands more attention, however. Nuthall and Alton-Lee (1990) suggested that university researchers could “hand over” their theoretical and interpretive work to teachers to find applications for theory in practice. In this way, teachers’ findings would become part of the research process and be used first in the development of grounded theory before it is tested empirically. Examples generated in practice might subsequently be used to develop, refine, and elaborate theory, precisely as they were in our studies.

This evolving, cross-validated theory becomes the substance of what is reported to teachers, with specific findings being embedded in the theory only as illustrative and practical examples of the theory in action in specific

contexts. Teachers can then take the theory, grounded as it must be in classroom activities, and try it out in their own classrooms, knowing that they are also engaging in further research (*ibid.*, p. 565). In this iterative fashion, the findings of classroom research become “embedded in an evolving explanatory theory of classroom learning that is of practical value to teachers” (*ibid.*, p. 547), giving the research “pragmatic validity” Nuthall (2004, p. 273).

Hiebert et al. (2002), discussing “A knowledge base for the teaching profession: what would it look like and how can we get one?”, propose creating space for a new set of professional development opportunities for teachers and a new means of producing and verifying professional knowledge.

Teachers would be able to employ the methods of replication and observation across multiple trials to produce rigorous tests of quality and effects. Sometimes they would test practices developed by other teachers, and sometimes they would test ideas generated in the research community. Over time, the observations and replications of teachers in the schools would become a common pathway through which promising ideas were tested and refined before they found their way into the nation’s classrooms. And, as intentions became reality in classrooms, a new kind of knowledge about improving classroom practice would emerge, a knowledge that would accumulate into a professional knowledge base for teaching and continuing improvement in teaching. (*ibid.*, p. 12)

However, others have highlighted the limitations of practitioner knowledge derived in this way. For example, Nuthall (2004) argues that it is difficult for teachers to access evidence about the learning of their pupils and to gain insights into how (often invisible and complex) learning processes occur through interaction with their teaching. Simplistic assumptions that teaching leads to learning need to be superseded by an explanatory theory of underlying mechanisms – how different ways of managing the classroom and creating, supporting and assessing activities are related to learning outcomes; what are the influences of learners’ prior experiences, beliefs, motivations and peer interactions; and so on. Teasing apart the myriad of (often interdependent) contextual influences and attributing causality offers a major challenge.

Likewise, intervention programmes (including some design-based research) are often evaluated as a whole so that precisely what aspects of the intervention were directly related to learning, and how individuals responded, remain unidentified. As Nuthall (2004) points out, these are just what a teacher needs to know in order to use the programme subsequently in an intelligent and context-sensitive way. Yet the kinds of detailed and ongoing observation and recording of individual pupil experience are unrealistic for teachers to carry out alone. Objectivity can be elusive too; for instance, teachers can only see the classroom through their own eyes and are often unaware of a mismatch between their stated beliefs and their practice, or of the enormous influence that their own expectations can have upon learners.

In sum, Nuthall (2004) argues that individual case studies of teaching, whether carried out in action by teachers or by outsiders, are incomplete until they are replicated in a variety of different contexts, with different curriculum content, different kinds of learners, and so on. Only then can they lead to the kind of generalisable explanatory theory that teachers need to guide their own practice. Such studies allow us to distinguish both what is unique to a specific context and what is generalisable across many contexts.

While individual case studies and narrative accounts are a rich source of new ideas and potentially valuable insights, scholars must move on to studies that can produce knowledge which is both more practical and theoretical, more profound and generalizable (Nuthall, 2004, p. 300).

Accordingly, we draw on the idea of an intermediate theoretical scope (diSessa, 1991) that is located – and serves as a bridge – between specific setting and grand theory, specifying the conditions in which theory applies. This is a characteristic of design-based research methodology (not employed here, although there are some commonalities, including a form of mindful transfer: Randi & Corno, 2007) where reflection and theory building may occur at an intermediate level of analysis, namely one focusing attention on the pathways connecting learning theory and practice (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003). Grounding theory in practice in this way helps to articulate the design and its instantiation, and informs its modification, though the research cycle is probably less likely in turn to directly inform or to challenge grand theory. The notion of intermediate theory in this project was developed through coordinating and accommodating to the different purposes and perspectives of university researchers and teachers, and engaging with each other's practices.

In this approach, ideas embedded in theory are introduced to the teachers provisionally rather than prescriptively (Alexander, 1984; McIntyre, 2005; Stenhouse, 1975). The intention is for them then to be recontextualised, verified or iteratively refined. Rather than embracing theory wholesale and attempting to use it directly to inform practice, we seek to adapt elements of the theory to fit the diverse classroom contexts selected as its testbed. To conclude, intermediate theory building is not an abstract consensus-building exercise; rather, it necessitates setting up a practical arena for testing out a synthesis of *a priori* practical theory and selected elements of grand theory in relation to technology-supported activity. It includes recognising challenges, dilemmas, and situational constraints, and then developing practical strategies for addressing them (Marx, et al., 1998).

Using Collaborative Review of Lesson Videos

Opportunities for teachers to observe each other's practices at first hand are still comparatively rare (Day & Sachs, 2004; Pedder, James, & MacBeath, 2005) but digital video offers a means of both capturing and revisiting authentic classroom

activity. This technology has recently become established as a powerful tool for critical reflection and knowledge construction. A body of literature describes the transformation of meaning making into a public and shared experience through a process of cultural change in which participants exchange their viewpoints and interpretations (Goldman, 2004; Powell, Francisco, & Maher, 2003; Sheard & Harrison, 2005; Sorensen, Newton, & Harrison, 2006). Armstrong and Curran (2006, p. 11) concluded, further, that through jointly analysing video data, “teachers are able to develop new ways of thinking ... which can immediately feed back into actual teaching situations”. Similarly, cogenerative dialoguing – collective generation of local theory about classroom events – “produces recommendations for [imminent] concrete actions and change that teachers experience as an opening of their possibilities” (Roth & Tobin, 2004, p. 175).

Digital video recording and review was therefore selected (as part of a range of mixed methods) as the tool most suited to supporting our process of co-inquiry. The issues related to this tool are explored throughout the book, beginning in the methods Chapter 1 where the discussion includes the added complexity of using video, the pros and cons of using records of teachers’ own lessons versus those of strangers, and the use of video clips to support professional development.

In our research, the video review meetings were employed as – and proved to be – a powerful catalyst for teacher introspection. The extensive scheduled discussions of both lesson plans and the various forms of data (see details in Chapter 1) were intended to create the critical space whereby “craft knowledge can legitimately come under respectful forms of examination comparable to those applied to scholarly knowledge” (Ruthven, 2002, p. 589). We use the term ‘applied practical theory’ to describe this synergy. This conceptualisation assumes that practical theory is situated in local, authentic pedagogical practices, perhaps related to specific learner groups, too, and that it evolves through adaptation to particular settings of use. An article by Ruthven, Hennessy and Deaney (2008) on the interpretative flexibility of (dynamic geometry) software elaborates the process by which conceptions of a technology develop during both the evolution of its design and its appropriation as a functional tool, to become aligned with user concerns. Other recent work by de Freitas *et al.* (2008) devised workshops for practitioners to critically evaluate given pedagogical models for technology use, and illustrates their adeptness at adapting the models to suit their own contexts. The conclusion from that study that “teachers learn to talk the talk of educationalists by making sense of the artefacts that educationalists provide” (*ibid.*, p. 12) indicates that our related goal of collaboratively crafting intermediate theory with practitioners was not overambitious. Of course, the experienced, hand-picked teacher participants already possessed well-developed pedagogical thinking and clear rationale for using the familiar technologies chosen. It was therefore perhaps less of a leap for them than for the typical teacher to articulate the associated practical theory that had become integrated with their craft knowledge through experience of trying out approaches over time.

Two kinds of beliefs emerged during our data collection:

- continually evolving perspectives upon how interactive whiteboard (IWB) technology supported learning within specific contexts;
- more generalised, common beliefs: for example, concerning the generic IWB tool supporting visualisation of complex concepts and fostering learner participation. These were inextricably linked to the first kind.

Along with the interviews, participant observation by the teachers through video review was essential in eliciting an accurate, in-depth account of the rationale implicit in their actions. It was additionally important in providing richer contextual information because university researchers did not know the pupils, the constraints operating or the subject matter in the way that the teachers did. The teachers possessed varied levels of experience with the hardware, software and lesson materials employed, so that some scope for testing activities and theory remained; applied practical theory thus provided a helpful starting point but was inevitably shaped and elaborated through experience of teaching the lesson sequence and of the review process.

Developing an Intermediate Theory Framework Through the Dialogic Cycle

Ruthven (2002) has articulated in some detail how craft knowledge may ultimately be brought to contribute to further development (reframing and recontextualisation) of scholarly knowledge and vice versa, with knowledge being filtered and reformulated. In our study, applied practical theory interacted with grand theory (perceived as elastic rather than deterministic) through such a dialogic cycle as university researchers and teachers built a shared understanding of the evolving theory. Multiple perspectives and interpretations were made visible, debated, systematically tested, refined and extended through an iterative process that helped establish a framework for the ongoing analysis, as documented in Lesh and Lehrer's (2000) model of iterative video-tape analysis. The process culminated in a coding scheme and a narrative account that are framed in a common accessible language.

Triggs and John (2004) – and likewise teachers within our own schools–university research partnership (C. McLaughlin, et al., 2006) – have highlighted the importance of overcoming the language barrier if teachers are to engage with research. To address this issue, categories and overarching pedagogical themes were described using participants' own language or in vivo codes (Strauss, 1987) for key constructs wherever possible, and definitions were elaborated using concrete examples from observed lessons. However, the more abstract, specialised terminology of social science provided a useful framework with which to structure some of our collective interpretations. Its introduction extended the teachers' own "language of practice" (Sugrue, 2004) and offered the teacher participants an alternative language to describe their actions, which they could adopt or adapt to whatever extent they chose. Note that this was not merely a process of finding a common language to

describe mutually recognised phenomena, but one of reshaping perspectives; both university researchers and teachers saw activity in new ways and modified and refined their initial, more generalised theories. Specifically, *a priori* sociocultural theory was appropriated, extended and jointly elaborated (albeit not radically) over time – through critical reflection on its application to the context of technology use and to the specific case being studied. It was consequently integrated with practical theory and grounded in the diverse contexts in which technology is used. Our characterisation of this process acknowledges that coding is never “theoretically innocent” but is shaped by – and constantly interacts with – our prior and developing perspectives: “a theoretical frame is embedded in any research design ... the main function of data collection and analysis is to make one’s underlying premises as visible as possible and to challenge and develop the initial framework” (Alasuutari, 1996, p. 372–3). The theory encapsulated within the final narrative needed to rise above highly domain-specific and pragmatic concerns to some extent if it was to be usefully applied in a range of other settings, as intended. Expression of the individual teacher’s rationale served as a set of terms of reference for co-construction of an account that transcended it.

In sum, the main objective was to couple the practices of researching and teaching in a way that would ultimately contribute to the negotiated, systematic formulation of grounded intermediate theory. The first chapter in this section outlines the methodology we developed to tackle this. The following three chapters present T-MEDIA case studies that illustrate the theory-building process and its outcomes in different subject areas, followed by a summary in Chapter 5 of the pedagogical themes emerging across subjects. Chapter 6 develops the methodological approach to theory building further through a study focusing on classroom dialogue. Chapter 7 synthesises across all of the first six chapters. It reflects further on the methodological approach to theory building via collaborative review of lesson videos, identifying preconditions, key characteristics and scalable benefits of our evolving approach.

NOTE

- ¹ The TIPS programme comprised a series of small-scale, school-based projects in which teachers investigated a range of self-devised, Technology-Integrated Pedagogical Strategies in their own classrooms Hennessy, S., Deaney, R., & Ruthven, K. (2005). Emerging teacher strategies for mediating ‘Technology-integrated Instructional Conversations’: a socio-cultural perspective. *Curriculum Journal*, 16(3), 265–292. Retrieved from <http://dx.doi.org/10.1080/09585170500256487>. The projects were supported by Best Practice Research Scholarships awarded by the national Department for Education, UK.

RESEARCH FOCUS AND METHODOLOGY FOR COLLABORATIVELY ANALYSING PRACTICE

INTRODUCTION

Developing intermediate theory together was the primary goal of the research collaboration, as described in the Section One Introduction. The process by which we achieved that goal is outlined in this chapter and then illustrated in greater detail in each of the following case studies (Chapters 2–4) and in Chapter 6. Here I describe the methodology iteratively developed for recording and analysing our observations of 33 lessons during two separate research projects. Each of these (approximately 1-hour) lesson videos was subject to several hours of individual and collective analytic scrutiny. The initial development took place during the T-MEDIA (“Teacher Mediation of Subject Learning with ICT: A Multimedia Approach”) project carried out with colleague Rosemary Deaney, and this is described first. An account of how the methodology was refined and extended during the Dialogue and IWBs project follows.

Note that in keeping with my portrayal of the teachers as research collaborators, no attempt is made to conceal their identities – indeed three of them are co-authors of case study chapters – and they have given permission for themselves and their schools to be named. Note also that while most of the content of the accounts in the case study chapters is unsurprisingly written largely from the university researcher’s viewpoint, all participating teachers have read them and endorsed their validity, and they have contributed in various ways to the writings as well as to the research.

T-MEDIA PROJECT: RESEARCH FOCUS

The substantive focus of the T-MEDIA research was on analysing and documenting successful pedagogic strategies for exploiting use of digital technology resources: data projectors and interactive whiteboards (IWBs) in particular. Although these tools are increasingly prevalent in UK classrooms and some other countries, the underlying pedagogy is comparatively under-developed. Our primary focus was assisting teachers to make explicit the rationale behind their actions, and thereby illuminate what they construed as effective practice. The research also sought to identify relevant contextual factors and the contribution of other resources and activities, and to produce stimuli for adapting practices to new settings. Thus we did not set out to create recipes or identify models of “best practice” for replication. Rather we wanted to generate an accessible theoretical framework that might, in turn, provide teachers with a lens for reflection – active, persistent and careful consideration (Zwart, et al., 2007) – about their strategic use of such technology.

The research focused on developing understanding and articulating strategies and mechanisms (with the goal of dissemination) rather than improving the practice of case study teachers *per se*, as distinct from other research studies such as the InterActive Education Project's collaborative development and evaluation of "subject design initiatives," namely those "that focus on particular areas of the curriculum that students might normally find difficult and where a particular use of [technology] could enhance learning" (Sutherland et al., 2004, p. 413). (Our second research project, reported below, did seek to improve practice, however.)

We were also concerned with theory building, specifically focusing on teacher mediation. The research objectives centred on developing a shared analytical framework and language, identifying pedagogical strategies for making use of IWB technology effective in the specific educational context, and characterising more generalisable strategies. In summary, our aims were:

- to record, analyse and document exemplary cases of established teaching practices that integrate use of ICT in supporting subject teaching and learning at secondary level;
- to elicit, identify and represent the craft knowledge that guides teaching and learning in these cases;
- using a peer-interview technique, to stimulate pupils involved in these cases to articulate, and reflect on, their ideas about how teachers successfully mediate use of ICT and how this supports their learning; to feed these back to teachers;
- in collaboration with practitioners, to draw on and extend sociocultural learning theory so as to develop a theoretically guided model of teacher mediation of activity to support learning with technology;
- to compile and disseminate annotated audiovisual accounts providing replicable exemplars of practice.

These aims were achieved through a phased process of video review using a clearly formulated set of criteria for identifying key episodes and eliciting the rationale underlying the practice depicted. Additionally, feedback was sought from the teacher and pupils during a series of interviews and meetings. Lesh and Lehrer (2008) warn that many projects ultimately collect far too much video footage and spend far too little time interpreting the data. We addressed this by engaging in in-depth critical scrutiny and discussion of each lesson video and related data, in conjunction with participating practitioners. While we, the academic researchers, initially formulated the project proposal, the teachers and a departmental colleague in each case collaborated with us throughout the stages of data collection, analysis and validation and development of multimedia outcomes. Thus the eight teachers made a significant and sustained commitment to act as our co-investigators in this "participatory" research (Elden, 1981) over its 30-month timespan. Crucially, all of their time was funded by the project. One or two volunteer academic subject specialists per case also viewed the videos and offered independent input.

The video review process involved: exposure of teachers to key constructs from sociocultural theory, allowing them to select, appropriate and apply relevant notions using their own language where desired; supporting initial alignment of all participants in terms of key ideas and subsequent negotiation of an analytic account; collaborative development of graphical representations of the central themes in each case and connections between them.

The key research questions relating to developing grounded intermediate theory were:

- To what extent would the teachers filmed and their participating colleagues be willing and able to engage with the theory-building process?
- How might we build a partnership where university researchers were “neither the legislators of practice nor the dispensers of wisdom” (Boostrom, Hansen, & Jackson, 1993, p. 43) and what are its defining features?

T-MEDIA PROJECT: METHOD

Participants and Roles

Four UK teachers, one in each of four secondary subject areas – English, mathematics, science and history – took part in the research. The teachers were all experienced, reflective practitioners who had previously been involved in our research.¹ Lloyd Brown was a history teacher of some 25 years standing and was Head of Humanities at the time. Jackie Bullock had taught English and Drama for 10 years at the time of the study; she was Head of Year and responsible for developing technology within English. Chris Tooley worked as an Advanced Skills Teacher² and was designated by the county as a leading science teacher in relation to his extensive expertise with the IWB; he had taught for 15 years at the same school. These teachers’ professional profiles are described in much more detail in Chapters 2–4 where individual case studies of their practice are presented. A fourth teacher, Sarah Hampton, had taught for 8 years and was head of her mathematics department. She was committed to working with mixed groups of students across the attainment range.

All of the teachers had participated in previous research with us. Earlier interviews had yielded evidence of well-articulated pedagogy for “integral use” of technology (Dawes, 2001), and of expenditure of time and energy in developing new approaches promoting active learning and in sustaining them over time. Thus the teachers had developed the confidence, technical and pedagogical skills for using technology systematically, appropriately and effectively in their everyday practice. One teacher (mathematics) used a data projector, whereas the other three had permanent access to an IWB in their classrooms. Moreover the teachers were willing to take a critical “research stance” (Stenhouse, 1975, p. 156).

Each teacher worked with a colleague they had selected from their subject department – a like-minded teacher who was both interested in the research and

an enthusiastic user of technology in their own classroom (again detailed profiles are available in Chapters 2–4). The colleagues were not filmed but took part in the planning process to some extent and then played a full role in the analysis process. Thus all eight teachers acted as classroom educators, subject specialists, and teacher–researchers in this study. The four main teachers’ classes of pupils (aged 12–15) were participants as well, being filmed and interviewed about their learning experiences. The classes were designated heterogenous (mixed levels of attainment) or homogenous (low to middle attaining) groupings within each subject.

The three schools to which the teachers and pupils belonged encompassed a range of typical settings and social backgrounds. All were state-funded, mixed 11–16 colleges within a 25-mile radius of the city of Cambridge (UK) and had some nationally recognised form of specialist subject status.³ Two of the three schools involved were members of our local schools–university research partnership, whose established tradition of academics supporting teacher research channel for schools–university partnership previous over the previous decade was detailed by McLaughlin, Black-Hawkins, Brindley, McIntyre and Taber (2006).

Other participants in the research collaboration were the two university researchers who initially conceived the focus, design and methodology of the project when securing its funding. The subsequent process of collaborative decision making – involving the university researchers and two teachers in each case – began with lesson planning (negotiating only aspects such as selection of pupil group, topic, technology). It continued throughout the stages of data collection, thematic analysis and validation, and development of multimedia outcomes and culminated in some joint reports and conference presentations

In each case we also involved at least one volunteer academic subject specialist (two each in history and mathematics). Five came from our university faculty and one from another institution; all had extensive teacher education experience. Their role was primarily to view and comment on the observational data from a subject perspective and in light of wider practice with which they were familiar. The details of each of these participant roles in the collaborative analysis and development work are elaborated below.

Data Collection

The investigation took an in-depth case study approach; we observed and video-recorded each class over six lessons (plus one pilot/acclimatisation session), recording 24 lessons in total.⁴ The main (mobile) video camera was positioned on a tripod, usually at the back of the classroom to minimise intrusion, and followed the teacher. It was operated by a professional cameraman, directed by the researcher. A (fixed) second camera at the front captured children’s faces when answering questions etc.

A total of four (semi-structured) teacher interviews (one during planning, two post-lesson, one follow-up) were carried out using printed prompt cards (see

Appendices 1–4). These were audio recorded, and transcribed. Learner perceptions were solicited using focus-group interviews (see Appendix 5); two pupils were trained to interview mixed-sex groups of six of their classmates (randomly chosen by the teacher) after the third and final lessons in each study, again using prompt cards. Copies of pupil work and all lesson materials and outlines were collected, screen displays and annotations were captured and digital photographs were taken. Additionally, each teacher kept an unstructured diary recording their planning and decision-making processes and, in most cases, post-lesson reflections. The two university researchers each took responsibility for two case studies, conducting all of the observations, interviews and meetings, and preparing the data. British Educational Research Association ethical guidelines⁵ were followed throughout the study, particularly with respect to responsibility to participants and obtaining informed consent. All pupil names have been changed.

The specific practices we investigated included use of the IWB in science for learning about the photosynthesis process in Year 10 (age 14–15); constructing collective interpretations of poetry with an ‘anti-social’ theme in English with Year 10, using the IWB; use of multiple technological resources including the IWB in history to support analysis of evidence concerning the “golden age of Elizabeth I” in Year 8 (age 12–13); using dynamic graphing software with a data projector and laptops to teach the concepts of intercept and gradient in linear functions in Year 8.

Collaborative Video Review and Professional Development Material Production

The use of classroom video built upon the growing consensus in the literature that professional development activities need to be located in the familiar, everyday practice of teaching. Outside the classroom this can mean drawing on tangible artefacts such as lesson plans, curriculum documents, schemes of work, pupil work and purposefully selected clips from lesson video recordings to focus attention on specific aspects of classroom practice and interaction (Borko, Jacobs, Eiteljorg, & Pittman, 2008), as in the research reported here. Video records are particularly valuable in highlighting aspects of classroom life that a teacher might not notice while carrying out a lesson, and can capture the ethos of a classroom (Clarke & Hollingsworth, 2002). Using external microphones moreover makes it possible to record small-group interactions and teachers’ conversations with individual learners that are not typically available to an observer, and of course to replay and pause the tapes at critical points for discussion, permitting reflection at a “leisurely and thoughtful pace” (Borko, et al., 2008, p. 420). Video also captures the important elements of an approach for the benefit of practitioners in other settings; it enables a new approach to be studied and adapted more easily at new sites.

Repeated viewings of video...offer the “opportunity to analyse teaching in ways that are very different from the types of practices and responsibilities that are usually a part of teachers’ daily work. In particular, video allows one

to enter the world of the classroom without having to be in the position of teaching in-the-moment and to manipulate that world in ways not possible without the video record. (Sherin, 2007, p. 13)

In order to achieve joint, negotiated understanding of the classroom activity being reviewed, the whole team was actively involved in an iterative cycle of analysis through discussion that included scrutiny and categorisation of strategies and interactions within and across lessons. This entailed extracting and cross-checking analytic categories, posing conjectures and testing interpretations across episodes, theory building, identifying and formatting exemplars for dissemination, and generating tools for reflection for others within the subject area. It comprised a phased process of individual review and joint meetings after completion of the lesson series (see Table 1.1).

Phase 1: Individual video review. A time-coded descriptive summary of the videoed lesson activities and interactions (with significant utterances transcribed verbatim) was produced by the university research team and incorporated in a grid for each lesson, containing one column per team member (see Figure 1.2). All members of the team used this, alongside the video, to familiarise themselves with the lessons, to reflect, and to comment independently. As in the study described by Armstrong and Curran (2006), providing unedited video footage on CDs⁶ allowed repeated playback in the viewer’s own time.

Table 1.1. Phases of collaborative data analysis

<i>Phase</i>	<i>Activities</i>	<i>Outcomes</i>
1	Preparation of review materials, independent video review using timeline grids, selection and provisional categorisation of critical episodes	Video summaries, analytic commentary & questions regarding pedagogic rationale, thematic codes
2	Collation of combined grids, systematic integration with other data, independent review	Instances of converging & diverging perspectives, points for discussion
3	Video review meetings, scrutiny of critical episodes, negotiation of emerging themes	Identification of main strategies and themes, linked to theory and practice; concrete exemplars of these; revised coding scheme
4	Systematic computer coding of all qualitative data, further analytical review and follow-up teacher interview	Illustrated thematic storyline for each case, an overarching account
5	Final selection and trialling of lesson video clips and associated analytic commentary, identification of issues for viewer reflection	Five CD-ROMs illustrating themes and strategies emerging within and across cases, and offering tools for professional development

<i>Start End</i>	<i>Video Summary</i>	<i>Teacher</i>	<i>Colleague</i>	<i>Researcher 1</i>	<i>Researcher 2</i>
0:13:59	<i>T projects a possible technique and a question (with examples from poems). T: Here are some suggestions to start you off. Pick up your pens and in your mind think, 'I know who I'm writing from the point of view of. I'm not me any more'. T continues making suggestions for the persona and reasoning behind their thoughts/actions. Maybe they are trying to prove something to the world... have been let down... Ps should think about where persona is and what has happened in his life. T talks through slide and examples to illustrate techniques.</i>	T anticipates difficulty starting poem. Speaks in 1 st person as if they are the persona – transferring thinking in this way to class. T prompting Ps to write specific type of poem. Very real examples given orally with support provided visually.	This slide provides further ideas and T constantly challenges Ps to think by giving examples for them to work with. This helps those who will be struggling without singling them out. All Ps seem engaged. T circulates constantly giving ideas and feedback. <i>Dialogic synthesis</i>	T continues to structure activity for Ps, using (<i>scaffolding</i>) <i>personalising</i> mechanisms (thinking themselves into role) and illustration to give them a handle on the writing task; also allows option of using own way of starting off (giving responsibility for exploration where they can take it: <i>differentiation?</i>)	<i>Scaffolding</i> continues. T guides Ps towards starting point. T models two alternative approaches but leaves open for further ideas. <i>Fading; handing over responsibility</i> Ps to focus only on launch at this stage. Having provided an earlier overview of the task, T structures / paces / activity sensitively so as to render it manageable

T = Teacher, P = Pupil.

Figure 1.1. Excerpt from English Lesson 6 combined grid.

The teacher interview and diary excerpts below elaborate the teacher's rationale.

Diary: It was important to establish a comfortable and relaxed environment for the writing process to begin so I didn't want to 'intrude' into the lesson too much but still wanted to scaffold the writing process for those students who would undoubtedly need help. The SmartFiles I produced contained sufficient structure for the majority of the class to start writing immediately – the examples of how the poems studied had begun, were presented visually and orally as I know that some students would pick up on what I was saying rather than looking at the board. The SmartFiles were not intrusive as they were always there in the background.

Interview: Really what I did was just look back at those three poems and picked out the ways that some of them started or the ways that they were developed, the types of mood. . . and the way that they've resolved their discussion of a topic. So. . . those slides were. . . prompting them: you know imagine you're the speaker, you're really irritated, what is it that's irritated you? [. . .] I used it as a scaffold, as a structure for them so they could use as much or as little of it as they wanted to. . . it was really just about giving them ideas. . . 'we've done this already, remember? You commented upon the effects of the alliteration and the metaphors, now's the time to have a go at just using them.'

Impressions were recorded through written commentary and preliminary selection of **critical episodes** (see Powell, et al., 2003, p. 416, on "critical events" or "connected sequences of utterances and actions that, within the context of a priori or a posteriori research questions, require explanation"). Critical episodes were defined as actions, teacher interventions, or pupil-initiated interactions that were key in using technology effectively and/or promoting learning of the topic. These episodes were identified by all team members independently at this stage. Analytic commentary described what key part the technology and the teacher played; the effectiveness of the supporting teaching approach or strategy in terms of pupil response, learning or motivation; the level of learner participation (cognitive or physical – e.g. expressing ideas, articulating and representing developing knowledge, receiving feedback); whether and how peer interactions appeared to be supporting learning; key contributory contextual and other factors that seemed to have a positive or negative impact on successful use of the technology; and how lesson activities or teaching and learning interactions related to prior or subsequent use of technology within the lesson series.⁷

The university researchers and the teacher-colleague noted on the grid questions for further discussion with the teacher during the subsequent review meetings. Questions posed were carefully formulated to avoid bias or value judgment, stimulating rather than presenting insights (Lyle, 2003). For example, one question read: "Why did you give out paper copies of the diary text when it was also displayed on the IWB?" The questions were intended to clarify the teacher's rationale for a particular action or interaction, the underlying curriculum objectives, or views about the unique contribution of the technology, or to elicit further contextual information.

Likewise the subject specialist(s) viewed the videos and made independent input at this stage on their own grid copies. Critical commentary from these academic colleagues with specialist subject knowledge and extensive experience of teacher development offered additional detailed insights. It served to relate the observations pertaining to use of a relatively new technology to a wider context of subject teaching using technology, and to suggest alternative potential approaches. Significantly, this colleague was an impartial observer and thus able to pose probing questions indirectly (usually in writing) to the teachers for their subsequent response and clarification (the form and degree of specialist input was flexible and varied).

Phase 2: Collation of individual video reviews. In preparation for whole-team discussions, four individual review grids were collated and combined in a single document for each of the lessons. These were then integrated with relevant excerpts from the other observational data collected. Review of the combined grids, selected clips and other data, and of the inherent degree of consensus, took place independently by teacher, colleague and university researchers.

Phase 3: Collaborative analysis. A series of four 3-hour meetings was held at the university over about 2 months, where perspectives were compared and integrated. The first three meetings treated individual lessons systematically in turn whereas the final meeting identified themes prominent across the whole lesson module (emerging patterns, generalisations, comparisons). Discussions were audio-recorded and transcribed so as to document the evolving shared interpretations. Lesson videos were available throughout for joint viewing on a laptop computer for reference to additional corroborative and contrasting examples. One subject specialist joined a review meeting (having observed in person one of the lessons discussed). Specialists' written commentary was circulated beforehand. A key aim of these meetings was to discuss what made the tentatively identified critical episodes more or less significant (attending to commonalities and differences of choice or view between reviewers). Initial impressions were verified by subsequent scrutiny, or abandoned through consensus in favour of alternative explanations. Ultimately we agreed on a shared set of episodes.

After the team had commented on the first two lessons but before the first meeting, the university researchers circulated a glossary document (see Appendix 6) summarising and contrasting theories of learning, and elaborating some of the central constructs embodied in one framework, that of sociocultural theory. These related to teacher mediation and included terms not typically familiar to teachers because they derive from theoretical research, including for example *scaffolding*, *fading*, *zone of proximal development*, *assistive questioning*, *affordances*, and *focusing*. For example, definitions of two terms were:

Funnelling / authoritative interaction – interaction (pupils giving responses or making contributions) but teacher leading pupils towards target response

or particular interpretation / understanding / solution, by controlling decision making (Bauersfeld, 1988) or guiding via question-and-answer (Mortimer & Scott, 2003).

Dialogic interaction – discussion-based discourse in which teacher recognises and clarifies pupils’ existing understandings and builds upon these to formulate joint understanding (Mortimer & Scott, 2003); intentional sharing / exploration of ideas, collaborative meaning making (learners contributing ideas, teachers helping take ideas forward); may involve open-ended questioning, talking through answers, reflecting, interpreting, evaluating.

These theoretical concepts and ideas were additionally encapsulated within a set of preliminary deductive codes generated by the university researchers during analysis of the preceding T-MEDIA case study, and initially derived from our previous analysis of teacher mediation during the TIPS project (Hennessy, et al., 2005). They were illustrated with examples of strategies from the teacher’s own (first two) lessons. Teachers found this helpful, because, as one described,

It’s very difficult to suddenly think of a word for a concept or an idea that you are putting into practice. The scaffolding was easy because we are used to that and we do that all time, but some of the other terms would have been quite difficult for us to think of.

However, their own ideas resonated closely with some of the terms. For instance another teacher described *funnelling* as “a fantastic word for a very complex, long-winded, rambling description of something that happened”. She explained how

the way we were describing things was in sort of teacher speak, and in ways that were familiar to us, and then [you two] were using academic research terms that were very, very similar. ... looking at the same thing from two different angles I found interesting. And it kind of gives what you do in the classroom a bit more *status*.

The provisional coding scheme was discussed and revised at the first meeting, then used as a foundation for collaborative construction and refinement of the analytic framework. The university researchers stressed that coding is not a blueprint but something to be tinkered with endlessly until we have a framework that everyone is happy to work with, depicting our collective understanding of what was happening on the film. It was continually refined as new, inductive codes were generated and integrated, the meanings of both kinds of codes were negotiated, and their degree of fit with the data assessed. Thematic organisation therefore involved a complex, recursive process of constant comparison (Glaser & Strauss, 1967). Revision of the coding scheme took place at each meeting, with close reference to examples in the grids, until a final draft was agreed. The categorisation ultimately described processes of advance planning and classroom interaction that were linked with carefully specified conditions and consequences, as illustrated below.

Finally, the team identified overarching themes and potential exemplars of these for dissemination, making clear the selection criteria and negotiating the content and structure of the final CD-ROM for each subject. This process included generating questions for other teachers to consider (concerning ways of making use of the technology more effective) and discussion of applicability to other contexts, topics and pupil groups.

It is important to note that a very labour-intensive component of Phases 1–3 was the preparation and timely distribution of materials to all team members, which proved critically important in supporting the process of joint data review. This involved the project secretary and the lead researcher for the particular case study in summarising or transcribing meeting notes, interviews and videos; continually liaising with the teachers to obtain materials such as IWB slides, lesson plans and handouts; formulating, piloting and revising the instruments, observation records, commentary grids, glossary, video review guidelines; collating, checking and integrating the various data sources (e.g. observation notes, video summary and IWB slides / nondigital whiteboard representations were systematically combined for every lesson); and cataloguing and tracking distribution of the materials comprising a multimedia database for each case (an extended version of the “video portfolios” employed by Maher & Martino, 1996). Phased distribution of materials and review of data from 1–3 lessons between meetings helped to avoid overwhelming team members unduly with a large volume of data. Timing was also engineered so that interview data, diary excerpts, and specialist comments for a specific lesson were circulated by the lead researcher only after all team members had commented on the grid (so as to maintain rigour and avoid influencing perceptions), but before the relevant review meeting so that there was time for perusal. Finally, having enough uninterrupted (i.e. project-funded) time for the informal meeting discussions proved critical, as elaborated in Chapter 7.

Phase 4: Integration and coding of all data sources. This was carried out by the university research team using HyperResearch™ 2.6 qualitative analysis software⁸ simply in order to systematically apply the final coding scheme. Further analytical review – by university researchers in collaboration with teacher, colleague and subject specialist – included a final teacher interview to further clarify issues emerging from the analysis or raised by specialists. The process culminated in the development of a simple but comprehensive narrative account, contextualised for each of the four subject areas. Each narrative was represented by a map with links to selected video sequences and slides (reproducing whiteboard displays) illustrating the main themes identified, plus the informative interview, diary and meeting excerpts (“nuggets”), and review grid commentary from all three groups. A fifth account examined similarities and contrasts of pedagogical approaches within and across cases, reviewing these in light of the negotiated theoretical framework.

Phase 5: Presentation of findings. The research findings were ultimately exploited through collaborative development (and professional authoring) of five presentation

CD-ROMs characterising the key generic and situationally specific mediation strategies emerging from microanalysis across multiple data sources both within each case and across subject cases (drawing on the analytic tradition in the case study literature: Yin, 1998).⁹ The design and content of the multimedia resources are detailed immediately below. In this final production phase, the ultimate selections of lesson video clips and associated segments of analytic commentary were made, further alternative strategies were generated, and issues for viewer discussion and reflection were identified and incorporated in the resources.

T-MEDIA PROJECT: MULTIMEDIA TOOLS FOR PROFESSIONAL DEVELOPMENT

Aims

The five interactive resources have a user-controlled hypermedia format. They are intended for use by practitioners, student teachers, mentors, heads of department, teaching and learning coordinators, advisors, teacher educators and researchers. Their aims are to:

- highlight key issues emerging from our joint analyses and exemplify strategies and contextual conditions for success, including integration with non-digital resources and activities;
- use video clips and narrative to illustrate how projection technology can potentially be exploited to enhance collaborative construction of subject knowledge – in ordinary classrooms with learners across the attainment range;
- share a theoretical lens through which the rationale underlying this practice can be rendered more visible and meaningful to other practitioners;
- allow viewers to engage with the material at a deeper level and to build bridges with their own experience and practical theories of how they can promote learning using technology;
- stimulate teachers to question their own practices and assumptions and to debate with departmental colleagues about effective or innovative pedagogical approaches, “added value” and possible alternatives;
- develop user confidence to try out new approaches and provide examples of teaching resources.

These aims are consonant with our clear statement from the outset to participants and audiences of the research that our video-based materials are *not* intended to provide idealised or prescriptive models of “best practice”. Those are often considered “staged” by teachers:

- novice teachers may feel disempowered by portrayal of supposedly expert practice that may appear hard to emulate;
- in-service teachers are likely to dismiss the ideas and exemplars as irrelevant to their own school contexts or to be overtly critical, especially of the unrealistic conditions often portrayed (e.g. small classes of well-behaved children);

- teachers may, understandably, ‘cherry pick’ the materials perceived as most relevant and dismiss the rest; we know that effective teachers do not simply adopt curriculum materials (or their embedded reform messages) wholesale but they decide for themselves how to enact lessons.

Moreover, international comparative research using video (NRC, 2001) confirms our belief that it is unrealistic to assume we can identify “best” or even “effective” practice and the precise elements to be imitated (which necessitates establishing an empirical link with learning gains). The substantial NRC review concludes that “using international videotapes to present exemplary practice and train teachers to adopt it is a particularly problematic enterprise that deserves more careful scrutiny than it has received thus far” (p. 23). It suggests that other contextual factors, including pupil group attributes, should be taken into account. So instead we provided video exemplars of authentic situations for discussion. In selecting a sequence of clips for presentation, we went beyond the original selection of critical episodes in some cases, for example including a further clip portraying the teacher introducing an activity that was the subject of a later episode, or a clip showing how an activity was followed up or responded to by pupils. The context, including interactions both before and after a specific interaction, informs the viewer better about the sequence of and connections between activities over time. It gives the clips meaning for the researcher and the viewer (Haw & Hadfield, 2011).

We recognised that video vignettes cannot “speak for themselves;” video alone can lead to unfocused sampling and it is insufficient in supporting reflective dialogue. Lesh and Lehrer’s (2000) assertion that “video draws its power from the interpretive framework established by researchers” (p. 673) was borne out. In this case the framework was co-constructed with practitioners and then drawn upon in devising the built-in guiding activities. Suggested issues for user discussion reflect some external constraints and tensions arising – for example the balance between pupil and teacher manipulation at the board, and advance versus real time construction of resources with learners. Moreover, analytic commentary from different interpretive perspectives was included with each clip; apart from the option to consider these different perspectives on the same practice, the commentary offers the viewer further information about the teacher’s thinking and the context, if desired.

These multimedia tools can be used by groups of colleagues or educators debating approaches and issues with groups of practitioners (or pupils), or by individuals, reflecting on the materials, and optionally recording thoughts to share. The tools also offer guiding principles for designers of further video-based activities that move away from “best practice” models towards one of stimulation and inspiration.

Content and Uses

The resources were originally produced on CD-ROM and made freely available at cost price. They now appear online as well at <http://t-media.educ.cam.ac.uk/>. There

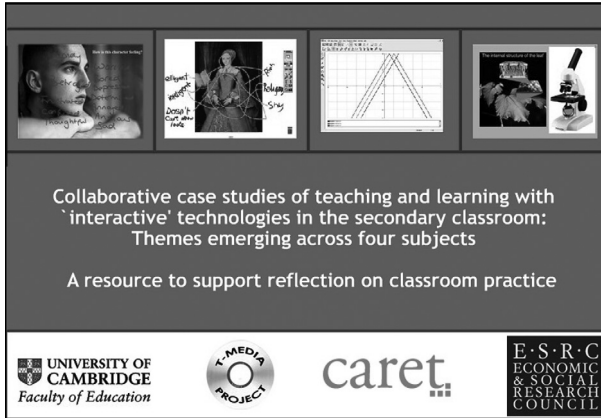


Figure 1.2. Title screen of *Across Subjects* resource.

are four individual subject CD-ROMs / online resources and a fifth overarching one (“Across Subjects”: see Figure 1.2) that presents excerpts and themes emerging across cases. (A two-disk compilation pack contains all five resources.) The maps of emerging themes and narrative accounts contain hyperlinks to related video clips and analytic commentary, with each clip in turn linked with professional development activities. These were designed to permit the results of the detailed case analyses to be discussed within a broader framework.

Each resource includes (12–21) video clips, each 2–9 minutes long and with an introduction plus related commentary and materials (see screen shot in Figure 1.3):

- a summary of the whole lesson for contextualisation;
- scaleable images of the screens displayed in the clip;
- overview of IWB features and other resources used;
- teacher commentary on the episode (from teacher’s and colleague’s grids, relevant diary and interview material);
- university researcher commentary (from grids);
- further commentary from subject specialist/s, team discussions, pupil perspectives occasionally;
- suggested alternative teaching approaches, not necessarily using technology;
- issues for discussion;
- prompts for reflection intended to focus on individuals’ own practice; this facility enables text input for saving or sharing with others.

Each resource also includes:

- an interactive Disc Overview map (Figure 1.4);
- a Tour of the Disk demonstration video with voiceover;
- an audio introduction to the resource spoken by the teacher;



Figure 1.3. Sample video screen shot.

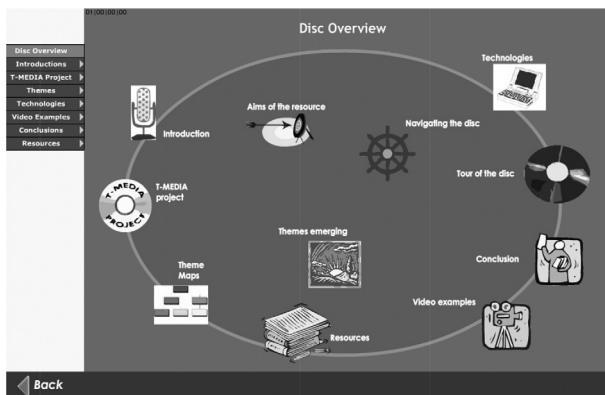


Figure 1.4. Multimedia resource: Disc overview map.

- background information about the teacher, pupil group, school, aims of each lesson sequence, research team and research methods;
- details of the perceived “added value” of the technologies used and qualitative evidence (teacher/pupil accounts) for learning in each lesson;
- downloadable lesson resources, pupil work, whole-lesson video summaries plus screen displays;
- a glossary of terms used;
- references to literature and other resources.

In designing the resource, we drew on our collective intuition – supported by research (Sheard & Harrison, 2005; Sorenson, Newton, & Harrison, 2006) – that presenting multiple hyperlinked resources and allowing flexible access according to users’ own motivations and interests, is most successful for professional development. Users can

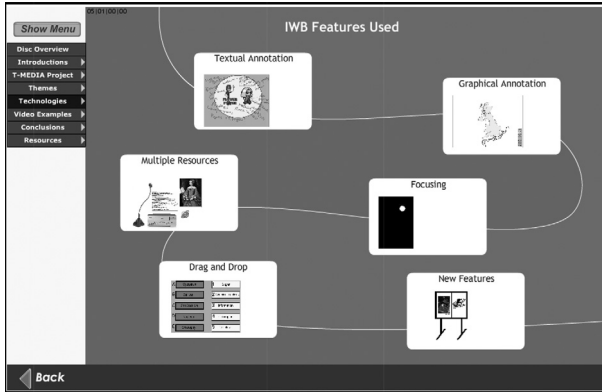


Figure 1.5. Interactive map of technology features.

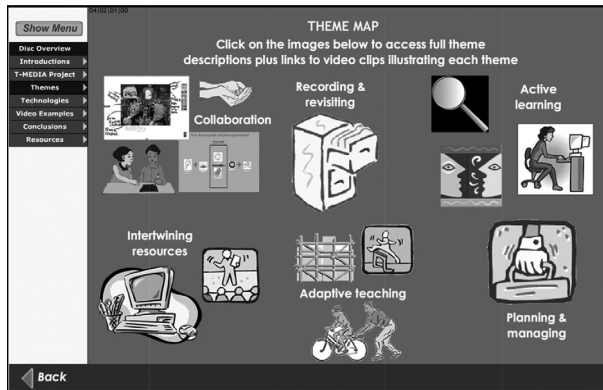


Figure 1.6. Interactive theme map from Across Subjects resource.

therefore obtain a lesson sequence overview and information about participants or methodology before viewing videos either chronologically or navigating selectively via an interactive map of technology features (hyperlinked to exemplifying clips: Figure 1.5), or via a clickable map representing pedagogic themes and links (Figure 1.6). Options are also available via nested menus (Figure 1.7). The resource can thus be used to explore either issues around the use and choice of different hardware and software (e.g. interactive whiteboards versus data projector only), or more general pedagogical issues (e.g. the role of teacher questioning in encouraging pupils to build on each other’s ideas).

Resource design and content were heavily influenced by teacher suggestions that included the use of “pop-up” still images/slides accessible alongside clips, some clips showing no technology use, and occasional footage from the second camera integrated to reduce teacher focus. Several technical issues arose in representing

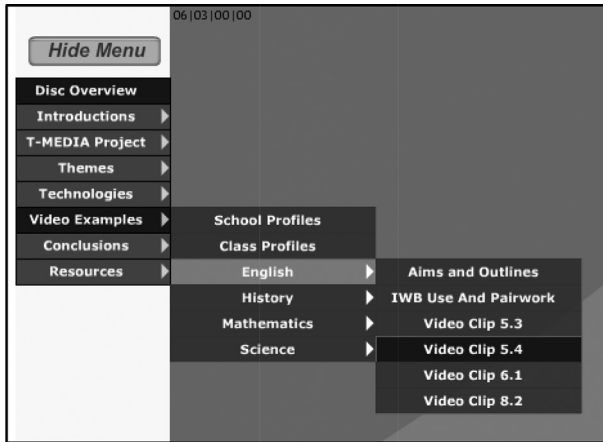


Figure 1.7. Example of nested menus from Across Subjects resource.

complementary interpretations of a single video record using hypermedia. Based on related theory, the issues we considered included simultaneous use and proximity of multiple representations, cognitive load, and degree of user control over navigation (Clark & Mayer, 2003; Zahn, Barquero, & Schwan, 2004). Also of concern were contextual factors that may limit generalisability (National Research Council, 2001), and the merits of the “guided noticing” paradigm developed by Pea, Mills, Rosen, Dauber, Effelsberg and Hoffert (2004) for expressing multiple perspectives on significant interactions. Professional, broadcast quality video recording proved important in this context of technology use for providing rich data that clearly capture the dynamic processes of annotation and interaction with projected images.

The lengthy narrative accounts weaving together the themes emerging from our analyses are located within five files accessible on the Across Subjects CD-ROM¹⁰ / online resource and also segmented within the Themes area of each resource. We recognise that the narratives encompass causally linked assertions about how the themes are interrelated (Juzwik, 2006). These proposed interrelationships, along with the hyperlinks to video clips of critical episodes illustrating each theme, inevitably introduce a viewpoint on observed events and strategies. Generation of themes and selection of episodes were negotiated by consensus (transcribed meeting notes are available to other researchers for inspection so that our conclusions are traceable to the data: *ibid.*). They were shaped by our research focus; other “takes” on the data undoubtedly exist and we recognise that viewers may bring new levels of meaning and different interests, as discussed further in the Conclusions chapter (11).

The materials have been distributed widely, for example via subject associations, teacher education networks, publications for the teaching profession and our publications website. A significant degree of interest has been expressed in the

research outcomes by academics, practitioners, trainees and teacher educators, and the CD-ROMs have been requested by individuals and organisations all over the world.

Prototypes were piloted with academic and practitioner subject colleagues and commentary upon the resulting resources from different audiences continues to be welcomed. They have been trialled with student teachers and the final versions have been embedded in a Masters degree course in Science Education at Cambridge University, with the aim of supporting teachers in developing effective ways to exploit the IWB to enhance learning within their own classrooms. The multimedia resources have also been used in outreach workshops nationally with leading teachers, and to support other Masters courses. At the time of writing these include an MEd course at Edge Hill University and an online MA Teaching and Learning course for primary teachers (i-Learning Technologies module) at Hibernia College, Dublin, where the case studies are “used as a stimulus to engage teachers in reflective discussion during online tutorials” (tutor).

Although a formal evaluation has not been conducted in these higher education and outreach settings (owing to lack of funding), feedback has been very positive. For example a report from one workshop stated:

Teachers were very keen to start using the materials in their schools and for outreach. Teacher-educators quickly saw potential for trainees. Delegates [appreciated holding] a constructive, non-threatening discussion of an unknown teacher; they suggested using a clip at every department meeting for a year.

Presenting footage of lessons filmed in a real classroom with pupils at the lower end of the attainment range, and offering a wide choice of flexible or structured routes through the multimedia resource, have particularly been found to appeal to teachers and mentors of student teachers. The mathematics resource has been trialled more extensively, as reported in Chapter 9.

DIALOGUE AND IWBS PROJECT: DEVELOPING THE METHODOLOGY

Research Focus

The methodology developed in the T-MEDIA project was refined and extended in another project, “Dialogue and IWBS”, in conjunction with collaborators Paul Warwick and Neil Mercer. Our aim was to work together with the three participating teachers to analyse and develop theory and practice concerning classroom dialogue in the context of using the IWB.

Our substantive focus in this project was on pedagogic strategies for orchestrating dialogue in the context of IWB use (Mercer, Hennessy, & Warwick, 2010), recognising that the technology offers new opportunities for dialogue in which pupils physically contribute their own ideas and a class can construct new knowledge together (Hennessy, 2011). In order that readers can make sense of the study (elaborated in

Chapter 6), the substantive focus is elaborated briefly here before describing how the methodology of co-inquiry was developed.

Dialogic interaction and interactive whiteboard technology Dialogic interaction is an evolving pedagogical approach in which teachers and learners share ideas and reason collaboratively (Alexander, 2004; Mercer & Littleton, 2007; Mortimer & Scott, 2003). Teachers support such reasoning through open-ended higher-order questioning, reformulating, reflecting and interpreting. However, a dialogic approach is not common practice, in UK classrooms at least. A significant strength of the IWB technology lies in its potential to support the collective and visible expression and evaluation of learners' ideas, and thus the co-construction of new knowledge during interactive whole-class teaching (Mercer, et al., 2010). It lends itself to supporting dialogic classroom interaction in which teachers and learners construct digitally represented knowledge artefacts together (Hennessy, 2011). These visible, dynamic and constantly evolving resources constitute interim records of activity and act as supportive devices for learners' emerging thinking, rather than finished products of dialogue.

Our project built on our previous observations of how some reflective practitioners harness the **affordances** of IWB technology more than others (Gillen, Kleine Staarman, Littleton, Mercer, & Twiner, 2007; Hennessy, Deane, Ruthven, & Winterbottom, 2007; P Warwick & Kershner, 2008). The term affordances (Gibson, 1979) refers to perceived advantages, neatly described by Conole and Dyke (2004, p. 204) as "what uses ICT invites and facilitates, what it lends itself to and what it can do well"; thus moving beyond the intended, prescribed or designed function of technology towards creative and innovative responses to technologies and adaptation for use in unforeseen circumstances. IWB affordances include *provisionality* (objects on the whiteboard are easily modified so that ideas can be tried out before being finalised), *interactivity* (direct manipulation of objects), and *multimodality* (multiple communicative modes). Together they increase the opportunity for teachers to create space, time and status for learner contributions, and to challenge thinking by exploring different perspectives. The teacher's role is critical in sustaining dialogue around these multimodal representations and in making explicit the importance of explanation and justification of ideas. Examining and developing this role was the substantive focus of our wider project, with its central question: *How can practitioners with an established dialogic approach to teaching exploit the IWB technology to support pupil learning?*

The co-inquiry process underlying the dialogue and IWBS project The goal of the research was to engage teacher participants in reflecting on, making explicit and developing their own dialogic practice. This was to involve (a) deliberating on the underlying issues and principles, (b) debating the merits and limitations of both conventional representations of dialogue and others' documented classroom practices, and discussing their adaptability to participants' unique contexts, and

(c) designing, implementing and critically evaluating creative pedagogical strategies that support teacher–pupil and pupil–pupil dialogue using the IWB.

The process of co-inquiry involved jointly assessing the utility of theory and practical guidelines derived from research in the area of dialogue and using relevant aspects of these to inform thinking and, as in T-MEDIA, to recontextualise and refine the theory itself. We set out to extend the T-MEDIA methodology in several significant ways. The primary goal this time was on *developing* as well as scrutinising and documenting classroom practice. A central feature was that *before* lesson filming, teachers and university researchers participated in workshops in which resources, especially video, were used to stimulate the reflective dialogue that formed the basis of our research partnership. The workshops served the dual purpose of professional development (for both the teachers and university researchers) and data collection, helping us to make explicit and capture our collective thinking as it developed. The theory-building process in this project benefited greatly from: critique of carefully selected stimuli; deep reflection within teacher diaries; iterative representation of our thinking about developing strategies already embedded in practice. It also included fruitful interchange between teachers of different subjects and primary/secondary phases of schooling. Our aims can be summarised as follows:

- to develop the evolving methodology for equitable research collaboration with teachers by incorporating some new stimuli;
- to undertake a workshop-based process of intermediate-theory building and video analysis aimed at co-constructing and documenting a research-informed perspective on dialogue and dialogic pedagogy in the context of IWB use;
- to solicit teacher perspectives on the theory building and on other aspects of the co-inquiry process and its outcomes for them;
- to reflect from a university researcher perspective on the dynamics, methods and scalability of the collaborative theory building process, and on how its outcomes might be shared more widely.

Intermediate Theory-Building Workshops and the Role of Video Records of Others' Practices

An intermediate theory of dialogic teaching involving IWB for whole-class settings was developed through workshops that included sharing, questioning and recontextualising established notions of dialogue and dialogic pedagogy. Beginning in the first workshop, the team co-constructed a descriptive framework with the aim of reconciling some of the variation in use of these terms in the literature, and translating this into language that other teachers could access. This crucial modification to our previous methodology continued throughout the project as a dialogic cycle of exchange in which the scholarly knowledge being examined was not only synthesised and reformulated but also “activated within teaching” (Ruthven, 2002, p. 596).

The workshops were again conducted away from school sites, at the university. Gearing the workshop activities towards incorporating and testing new ideas in their classrooms and then discussing the experiences in subsequent workshop sessions combined the advantages of working in both settings. Because our three case study teachers were reasonably confident using a dialogic approach, they were able to engage with the literature and other stimuli and bring their own professional knowledge to bear.

Our procedure for introducing theory in the workshops combined:

- (a) distribution of occasional short readings (detailed in Table 1.2), mainly for reference rather than as “assignments”;
- (b) some short presentations synthesising key research in the field;
- (c) informal introduction of theoretical constructs into our ongoing discussions (referring to printed resources where appropriate) at points where they seemed relevant. This was mainly during joint viewing of videos or when teachers interpreted an example of practice in a way that stimulated a link being made by a university researcher to familiar work.

The small number of teachers permitted plenty of opportunities to discuss specific resources, ideas and exemplars of practice, and enabled the team to establish our degree of alignment with the constructs encountered. This process supported the progressive development of theoretical awareness and the co-construction of our own account of dialogue (rooted in practice).

We did not want to overwhelm the teachers with theory, so were selective in what we included in discussion. So, for example, we did not mention the theoretical framework of Bakhtin (1981) and Wegerif (2007),¹¹ but nevertheless brought some of their ideas (e.g. “orienting oneself to others’ perspectives”) into our presentations and discussions, and they are evident in the final account. Other ideas (e.g. “willingness to change one’s mind”) remained explicit throughout, and further initially explicit ideas (“consensus”, “dialogue” itself) became reformulated (“synthesis”, “nonverbal dialogue”) or had “faded” (Ruthven, 2002), as elaborated in Chapter 6. Thus, the salience of original theories within the intermediate framework varied, as in examples by Ruthven, Laborde, Leach and Tiberghien (2009), both at the point of exposure and in their use.

This grounding in educational theory and exploitation of some new stimuli in workshops *before* lesson observations were undertaken was a crucial feature of this study. We devised resources to use as springboards for discussion and subsequent lesson planning, and to try out a dialogic approach supported by technology use. (Specific resources used are listed later on in Table 1.2). The design built upon an NCETM (National Centre for Excellence in Teaching Mathematics)-commissioned T-MEDIA follow-up study employing the mathematics resource, as described in Chapter 9. In that study the resource acted as an external catalyst for discussion within a cycle of teacher-led collaborative professional development – through video-stimulated dialogue and critique, joint lesson planning with a common

teacher-selected focus, peer observation, feedback and joint reflection. The Dialogue and IWBs study used similar resources except that the teachers did not observe each other in person but had their own lessons videoed.

The main resource was a set of digital video exemplars of teachers integrating IWB technology into their practice. These were recordings both (1) from participants' own lessons and (2) from those of other, unknown teachers in prior projects (in Phases 1b, 1c and 3 below). Use of (1) has proved effective in professional development work carried out independently by Jones et al. (2009) using "video-stimulated reflective dialogue" to improve pedagogy in using technology to support dialogic teaching in mathematics and science. Other research (reviewed by Borko, et al., 2008) shows that teachers observing their own teaching are able to activate contextualised knowledge about the classroom observed and their own teaching practices, and to identify areas for improvement. Viewing clips of their own footage with others in an ongoing "video club" helped mathematics teachers in one study to develop the skill of "noticing" (van Es & Sherin, 2008). Noticing is a key dimension of reflection and involves "(a) identifying what is important in a teaching situation; (b) using what one knows about the context to reason about a situation; and (c) making connections between specific events and broader principles of teaching and learning" (ibid., p. 245). Through this process teachers are found to develop important insights into their students' thinking and to come to talk about classroom interactions in new ways. They use their interpretations to inform pedagogical decisions.

Note that (a) assumes that something identifiable and singular is significant; van Es and Sherin (2008) indicate that their facilitation methods influenced teachers coming to focus their comments on interpreting students' mathematical thinking. This may be considered highly desirable but it must be acknowledged that teachers were guided in this way in their study; "What did you notice?" yields very different outcomes to "Did you notice X?" Some professional development programmes have instead defined criteria for choosing a video clip but have not otherwise constrained what was noticed (Coles, 2012; Jaworski, 1990).

Use of (2) relates to work using the Interactive Classroom Explorer interface with teachers who learn through critiquing digital video extracts of exemplary practice (Sorensen, et al., 2006). Both forms of video can engage teachers in fine-grained analyses of classroom practice (Sherin, 2007) and **both can** be useful for professional learning. In a comparative short-term study embedded in the extensive 6-year IPN Video Study in which 250 science lessons were recorded in German and Swiss classrooms, use of video from teachers' own classrooms proved more motivating than watching videos of an unknown teacher (Seidel, Stürmer, Blomberg, Kobarg, & Schwindt, 2011). It was more stimulating of professional development in terms of both deeper immersion in the topic or lesson and resonance – "activating teaching experience," i.e. participants had their own teaching in mind. However, teachers were less self-reflective and articulated fewer critical incidents and alternatives after watching their own lessons, implying that self-defence mechanisms operate.

Where teachers are (3) observing their known colleagues in action rather than their own footage, they learn new pedagogical strategies, better appreciate their students' capabilities, and realise that they all struggle with similar issues (Borko, et al., 2008). However, if the colleagues are present during the discussions, it is likely that participants will feel inhibited from articulating criticisms and prefer to focus on ideas and practices that stimulate their own thinking.

While Coles (2012) suggests that the choice of video (teacher-created or not, familiar or unfamiliar setting) is not as important as the use made of it, the three kinds of videos are considered here to serve complementary purposes.

- Use of (1) makes teaching and learning in one's own classroom more accessible as a lesson can be viewed from the perspective of an observer (Sherin, 2007). It supports critical noticing of selected, relevant and important events as long as teachers feel safe and risk taking is supported (Borko, et al., 2008). It also helps teachers focus on pupil understanding and participation (van Es & Sherin, 2008).
- Use of (2) allows teachers to experience and more freely critique a wider range of practices (as illustrated in Chapter 9), raising the possibility of comparing and contrasting alternate pedagogical strategies (Sherin, 2007).
- Use of (3) offers new insights that can be contextualised through face-to-face discussion with the videoed teacher, and practices can be immediately compared with one's own. It is also interesting to compare events and issues highlighted by the subject of the video and by the colleagues watching.

All kinds of videos were used as stimuli for debate in a series of in-depth workshop (team) discussions – although videos of type (3) involved colleagues from other schools of course, not from the same school community, as was the situation in T-MEDIA. In each case, short clips were selected; teachers consider these to be more useful than a whole lesson (Coles, 2012). The discussions focused on the key construct of “dialogic interaction” that had emerged as centrally important in our previous collaborative data analyses and in the literature, and on extending it to new contexts.

Research Partnership through Dialogic Inquiry

We sought to achieve a truly equitable approach to co-constructing new practices, whereby (as before) the insights and reflections of all were equally important in formulating and refining theory. Our workshop procedures built on a growing body of research on successful approaches to professional development for classroom technology use: primarily those based on modelling, observing, reflecting, mentoring and peer discussion (e.g. de Freitas, et al., 2008; Miller & Glover, 2007). As mentioned in the Section One Introduction, this work illustrates teachers' adeptness at adapting given models to suit their own contexts. Our approach drew additionally on prominent work that creates partnerships between university researchers and teachers engaged in transforming professional knowledge together, including the

InterActive Education Project (Sutherland, et al., 2004; Sutherland, Robertson, & John, 2008; Triggs & John, 2004) and its follow-up (Armstrong & Curran, 2006). InterActive instigated “subject-design initiatives” (SDIs) – sequences of work focused on embedding technology into a small curriculum area to support learning. These were collaboratively designed by teacher–researcher pairs, informed by research evidence and theory, then implemented and evaluated in the classroom. Our study extended this approach in the various ways described above. The outcomes of the InterActive SDIs were found to vary according to the strength of the individual teachers’ pedagogy; our highly targeted sampling strategy was devised to maximise this strength.

We brought together teachers of very different subjects and across phases of schooling into a single team (another departure from both InterActive and T-MEDIA methodologies). This strategy was probably successful because it varied both subjects and phases whereas Jaworski (2007) found that some primary (mathematics) teachers felt uncomfortable working in a group with secondary colleagues with more experience of teaching the same subject. One might imagine that differences between the concerns of such a varied group of teachers would be too great, but we have previously observed that there are both common and distinguishing features of the pedagogic strategies that teachers draw on when using technology in different curriculum areas (e.g. Ruthven, Hennessy, & Brindley, 2004) and in different schooling phases. Our focus on dialogic teaching, an approach that we firmly believe to be generically applicable, prompted us to seek (and find) some commonalities across subject areas. The situated perspective indicates that the dialogic approach will of course manifest itself in different ways according to context (Putnam & Borko, 2000); the three teachers benefited here from vicarious encounters with each other’s different classroom settings and comparisons between them, affording reflection and critical analysis that would not have been possible when acting in the setting (*ibid.*).

The teachers shared a common pedagogical approach in which they held a personal investment, and had individual autonomy to plan new lessons based on that approach as it evolved through our co-inquiry. We recognised them overtly as experts in their subject domains and therefore as best equipped to assess what might work in their own classrooms. The university researchers were not experts “directing teacher learning” or offering simplistic recipes for success, but were merely familiar with literature that might be relevant to our co-inquirers’ classroom practices.

Similarly, we did not model dialogic teaching; we exposed all workshop participants to video exemplars of classroom practice, and decided together how dialogic the depictions were (or were not), and why. A notable departure from prior work in this field, then, is that we did not present “research-based proposals” for practice (McIntyre, 2005) other than the general remit of developing some form of dialogic approach. Teachers generated and tested proposals themselves from critique of the theory, exemplars of classroom teaching, and, importantly, from their personal perspectives of fit with (or adaptation to) their existing concerns, contexts

and practices. Analysing video footage from their own classrooms and sharing it with the team were vital to this process.

The iterative process of co-constructing a notion of dialogic pedagogy was in itself dialogic. It involved teachers and university researchers in cumulatively building on each other's ideas and experiences as we reconciled theoretical concepts and ideas with evolving classroom practice and collective thinking and purposefully developed them further. A critical characteristic of our co-inquiry approach, then, was dialogic inquiry (G. Wells, 1999), in that dialogue is perceived as the central means through which knowledge building takes place in an authentic inquiry environment. The latter environment supports question posing, conjecture and innovative risk taking (Bransford & Schwartz, 1999), going well beyond mere exchange of ideas. Thus we construe dialogue and inquiry as co-determined. (The relationship between dialogue and inquiry is further explored to some extent in the theoretical synthesis by Hennessy, 2011).

DIALOGUE AND IWBS PROJECT: METHOD

Participants and Roles

Three UK teachers working in natural settings across various school phase, subject, and pupil-group contexts took part in the case studies. All three were experienced, reflective and articulate practitioners who were each known to one of the university researchers, and teaching at Faculty partnership (initial teacher education rather than research partnership) schools. I had not collaborated with my two colleagues previously, so this was essentially a new research partnership between the six of us, and we evolved a new way of working for this project.

The teachers were selected on the basis of having an observable, dialogic pedagogical approach, using an IWB confidently (though not necessarily expertly) as an integral part of their everyday practice, and as before, being willing to take a critical research stance (Stenhouse, 1975, p. 156). An orientation towards research participation has also been linked with “willingness to engage in a meaningful way with [prior] research” (Simons, Kushner, Jones, & James, 2003), another important selection criterion this time. The three were:

Diane (Deputy Head Teacher and Curriculum Leader with 10 years' teaching experience) worked with primary children aged 10. She chose to focus on personal, social, health and citizenship education (specifically, the topic of personal safety and assertiveness) for the study. Diane is a senior mentor who teaches on the Faculty's mentoring course, where she explains how a dialogic pedagogy informs her work in developing reflective practice with student teachers. As an exemplar teacher for postgraduate observation visits, she has been seen teaching by many of our Faculty colleagues, who recommended her when we sought dialogic teachers for the project.

Caroline (Head of English with 5 years' experience) worked with middle-school pupils aged 12–13, and introduced crime-story writing in her lessons. Caroline

undertook her postgraduate teacher training and the “Fast Track” leadership programme at Cambridge, and was therefore subject to additional scrutiny with respect to classroom pedagogy. She has often talked in the Faculty about her pedagogical approach with student teachers and is seen by her school’s senior managers as having exemplary classroom practice. Since this study she followed up the work by enrolling in our MEd programme (2008–10) and used her dialogic teaching as a springboard for evaluation and development of teaching in her school.

Lloyd (Head of Humanities with 18 years’ teaching experience) worked with secondary pupils aged 13–14, and focused on trench warfare during World War I in his history lessons. Lloyd had participated in a previous research project (Technology-Integrated Pedagogic Strategies, 2000–02) and as already described, in T-MEDIA, where his dialogic approach was directly observed and scrutinised in depth during our thematic analysis.

The three teachers all worked in mixed-sex schools within a 25-mile radius of Cambridge. Our interactions over time with the schools indicated that they all had a research culture and leadership supportive of our co-inquiry, an important precondition for its success (Baumfield & Butterworth, 2007). The primary school class was a heterogenous grouping (mixed attainment levels) comprising the younger half of the year cohort. The school was in an ethnically diverse inner-city location and had levels of socioeconomic disadvantage (as indicated by entitlement to free school meals) significantly greater than the national average. The suburban middle school had a level of disadvantage lower than the national average, and the class contained the upper half of a year-group cohort grouped primarily in terms of attainment on a standardised writing test. The secondary school was in the same location as the primary school and had average levels of disadvantage, and specialist Technology College status. The class was an (experimental) all-boys grouping within history, designated as homogenous (highest attaining of four classes). This class was deemed valuable for case study because it contained two pupils in the “Pupils as Learning Partners” scheme. This involved the pupils (incognito to peers) commenting on lessons using a diary and a lesson observation sheet that Lloyd had devised to categorise classroom interaction, focusing on dialogue. They discussed their responses with the teacher and even helped with subsequent lesson planning. The scheme was a remarkable outcome of Lloyd’s earlier discussions with colleagues about the T-MEDIA research, and its development had subsequently received external funding.

To compare across the schools, the secondary and middle school classes had no pupils with severe special educational needs, whereas a very high proportion – half – of the primary class (13/25) had Individual Educational Plans. This meant that they had special educational needs of some kind. They constituted the most challenging group that Diane had ever taught. “Value-added” standardised test data showed that pupils in all of the schools made good progress relative to their intake performance levels.

We supported (and funded) the teachers in achieving accredited recognition from our Faculty via the Certificate of Educational Enquiry programme. This required

them to write a 4,000-word report that included reflection on inquiry processes and findings. Encouraging them to carve out and investigate an aspect of the research that they found of particular interest recognised teachers' prioritisation of practicality in applying ideas from research (McIntyre, 2005) and increased the degree of personal ownership.

In addition to the three teachers, other participants in the research collaboration were: the pupils filmed (the two Learning Partners also participated in a video analysis session), three university researchers (the authors) and an expert IWB user, Chris (T-MEDIA science teacher), who provided some workshop input. A research assistant recorded and processed the audio and video recordings.

Data Collection

The programme comprised a phased, workshop-based process, in which we progressively deconstructed existing ideas about dialogue and exemplars of existing practice. All workshops were attended by all three teachers plus at least two university researchers.

Phase 1: Initial workshops. The programme began with three full-day workshops, all scheduled within a two-week period. The workshop activities and use of stimuli are summarised in Table 1.2.

Phase 2: Classroom lessons. Three consecutive lessons were videoed in each classroom; one researcher and our research assistant were present at each. Piloting during two familiarisation lessons before each study began assisted resolution of technical issues.¹² The teachers kept unstructured diaries recording their pre- and post-lesson reflections, observations and strategic planning. They were interviewed once about their plans (using a semi-structured schedule) and twice again after lessons (using printed prompt cards) for about an hour. IWB resource files and captured annotations, lesson plans, worksheets, digital photographs and copies of pupil work provided valuable additional contextualising data. Copies of all data were circulated to the researchers and the teacher they concerned, including copies of the videos on CD.

Phase 3: Video review. Two months after the end of Phase 1, the whole team reconvened for a fourth half-day workshop to review our experiences and evolving construction of dialogue. Teacher-selected video clips (and transcripts) were shared and used in generating criteria for identifying critical episodes. This technique had been used by Sheard and Harrison (2005) and Armstrong and Curran (2006) because it offered greater teacher ownership over the data than is customary. As in Phase 1 with pilot videos, then, teachers reviewed their own and each other's lesson videos together. Our negotiation of the definition is elaborated in Chapter 6. Ultimately we defined critical episodes of IWB-supported dialogue as

Table 1.2. Dialogue and IWBs project Phase 1: Activity in Day Workshops 1–3

Phase Activities	Purposes
1a Pilot filming of 2 lessons with each target class.	Community building (Jaworski, 2007); familiarisation of whole team with all teachers' existing classroom practices and pupils; construction of shared understanding of their approaches to supporting dialogue and discussion of what seemed effective.
1b Workshops begin, employing range of resources as stimuli for reflection upon practice: <i>commenting & reflecting on teacher-selected extracts from pilot video footage</i> . Participants commented on their own and colleagues' practices.	Formulation of thinking about issues such as pupils' use of the IWB versus spectatorship, use of nondigital mini-whiteboards to engage all pupils, added value of the IWB and status as a tool, role of talk in a multimodal context, importance of creating a supportive environment for dialogue, need for explicitly developing reasoning skills.
1c <i>Researcher presentations</i> : managing dialogic teaching and learning (Warwick); strategies for engaging pupils in using the IWB (Hennessy); "exploratory talk" and "talk rules" (Mercer); illustrations from professional development activities generated by 'Thinking Together' research on development of classroom language and reasoning (Dawes, Mercer, & Wegerif, 2004; Mercer & Littleton, 2007).	Evaluation of illustrated approaches (of unknown teachers) and applicability to teachers' own contexts; discussion of ways of further exploiting IWB technology to enhance their own approaches.
<i>Viewing video clips and transcripts from our previous research</i> , including 3 T-MEDIA CD-ROMs; footage from 'Dialogic Teaching in Science Classrooms' (Mercer & Scott, 2007) and 'IWBs as Pedagogic Tools in Primary Schools' (Gillen, et al., 2007)	Distribution of literature: short article on questioning strategies (Cardellicchio & Field, 1997); Futurelab report on IWBs (Rudd, 2007); Alexander's (2004) treatise on dialogic teaching; Mortimer and Scott (2003) chapter; Lloyd's own lesson observation coding scheme based on the latter framework (see Hennessy & Deaney, 2009a).

- 1d Exploration and iterative *refinement of notions of dialogue* and pedagogical strategies for using IWB to facilitate it, developed during each workshop and then through interaction with data (ongoing negotiation of phrasing). Capture of our collective ideas as they were generated, refined and integrated, within two constantly evolving tables in brainstorm format (see Tables 6.1–6.3 in Chapter 6, and Appendix 7).
Unstructured diaries kept of teacher reflections on each workshop experience. Audio-recording, partial transcription or summarising of workshop discussions. Documentation of evolving shared interpretations of both dialogue and process of our collaboration.
- 1e *Technical input* from an IWB-experienced expert (science) teacher (Chris) – extensive dialogically-oriented demonstration of using sophisticated IWB features in the classroom; subsequent availability for one-to-one technical assistance. (To tailor the input, participants’ existing and desired IWB skills and access to equipment were surveyed beforehand.) Development of teachers’ technical expertise and increased range of features available for exploitation; continuing support during subsequent lesson planning where desired.
- 1f *Design of mini-modules of IWB-supported work* (during and after Workshop 3) that encompassed the dialogic principles embodied in our tables, fit within the curriculum and teachers’ current teaching schemes, and were adaptable to other contexts. Activation of evolving dialogic theory within teaching practice; exploration of flexible, learner-responsive approaches.

Note. Activities are not all sequential as some phases overlap, for example 1d was ongoing throughout the project.

- collectively illustrating a range of IWB uses;
- including dialogue that is: stimulated by well-selected resources that are engaging and/or meaningful to learners; linked with any level of IWB use but including some pupil ownership of the board; arising from opportunities for focused, cumulative, open-ended discussion in whole class, pairs, or groups; moving forward pupils' learning.

Importantly, after initially reviewing the videos we revised our notion of critical episode to include both discrete episodes of IWB use (as planned) and larger cycles of activity sustained or phased over time. We agreed that critical episodes only make sense in light of the “bigger picture” and that “some lessons may be a continuous story characterised by dialogic interaction”.

Subsequent analysis and discussion of episodes (9–10 episodes per subject) was carried out by one university researcher (normally the one present during filming) in collaboration with the teacher (whose “insider memory of the lesson” was of major importance: Groundwater-Smith & Dadds, 2004, p. 255). Each member of the pair independently reviewed, critically reflected and commented on the three lesson videos along with diaries, interview transcripts and other data. They recorded and exchanged their thoughts and selections with precise timings, then met for 3–5 hours to compare them. Lesson videos were available on a laptop computer throughout the meetings, and transcripts of provisionally identified critical episodes were prepared beforehand. Initial impressions about episodes were (mainly) verified or aligned and elaborated through subsequent joint scrutiny, or (rarely) abandoned through consensus.

Analytic commentary took the form of a set of review notes for each case. These were created by the university researcher, who first documented the teacher's prior pedagogical aims for promoting dialogue using the IWB (data from the planning stage Interview 1), then briefly summarised each selected episode. Both reviewers independently described the part played by the technology and the teacher in each chosen episode, the underlying rationale and effectiveness of the pedagogical approach in terms of quality of dialogue, and the level of learner participation (cognitive or physical). These procedures were loosely based on sociocultural discourse analysis, an approach developed by Mercer (2004) and colleagues to understand participants' own meanings within small segments of conversation through identifying key phrases signifying reasoning. This methodology was adapted to our context of technology use, where the archiving and revisiting features of the IWB technology serve to support cumulative knowledge building across – as well as within – critical episodes and lessons. Our analysis therefore examined connections made during extended sequences and cycles of dialogic interaction. We identified some short clips providing essential contextual information for critical episodes (e.g. a task introduction) and investigated links between dialogic activities away from the board and activities involving it, in the present, past, or future. Transcripts and video recordings were reviewed in conjunction with interim screen shots of digital artifacts on the IWB; this helped us understand how artifacts are actively created and

dynamically manipulated in conjunction with talk and written texts, extending the notion of dialogue to multimodal interaction.

The university researcher's comments were interspersed with direct quotes about the episode or lesson from the post-lesson Interviews 2 and 3. They included questions for discussion with the teacher, intended to clarify the rationale for a particular action or interaction or views about the unique contribution of the technology. For instance, "Why were pupils not initially informed that they would need to reconcile their ideas by working with a partner after planning their storyboards individually?" The document was refined after the review meeting to incorporate both reviewers' written reflections and the outcome of their verbal negotiations, drawing on a transcript of the meeting.

This review process enabled us to identify what the data in each case revealed about the integration of IWB use to support dialogue. The newly developed pedagogical approaches were thereby scrutinised, debated and subsequently refined by the teachers. This phase culminated in a final agreed set of critical episodes from each classroom, a rationale for their selection, and some initial messages for our understanding of dialogic pedagogy in the context of IWB use.

Phase 4: Final workshop. Five months after Phase 3, the whole team reconvened during a fifth half-day workshop (not originally planned). This session allowed us to consolidate our thoughts about dialogue and the role of the IWB across the three classrooms, and to provide feedback to the teachers on their findings and reflections on their own data before writing the certification reports. We discussed the expected impact within the three schools and the practical and attitudinal obstacles to adoption of a dialogic approach and IWB use by novices. We revised our drafts of the dialogue tables initiated in Phase 1 to serve as resources that might spark inquiry by other teachers (see Table 6.3 and Appendix 7). We also sent teachers a short follow-up, open-ended questionnaire to solicit individual feedback on the process of collaboration and its impact on their thinking or practice.

Phase 5: Cross-case analysis. Finally, the university research team conducted a cross-case analysis, comparing and contrasting approaches used in the three different settings. We aimed to make conditions for dialogue in an IWB context explicit so that they might resonate with other teachers' experiences. This was achieved through revisiting videos of critical episodes plus systematic thematic coding of all (27) teacher diaries, (5) workshop transcripts, (3) review meeting transcripts, (9) interviews, (3) follow-up questionnaires and (3) certification reports using HyperResearch™ 2.6. In addition to identifying strategies for using the IWB and teacher/pupil responses (one coding category), this cross-case analysis served to solicit teachers' perspectives on the collaborative research and analysis process itself. Our analysis resulted in six further, broad (non-exclusive) categories linked to the four methodological aims:

- articulation or development of teacher/team thinking and subsequent classroom practice;

- development of tables characterising dialogue and dialogic pedagogy (see Chapter 6) / process of collaboration;
- development or dissemination of new ideas or practices within school or department;
- impact of workshop input (videos, dialogue literature etc.);
- pupil perspectives and responses to orchestration of dialogue (and impact on teacher practice);
- development of criteria for critical episodes.

As elaborated in Chapter 6, the process yielded a series of illustrative episodes in each case plus negotiated, recontextualised understandings of dialogue and strategies for fostering dialogic pedagogy. These were adapted for wider use, thus forming a springboard for further critique and modification in new settings.

DIALOGUE AND IWBs PROJECT: A PROFESSIONAL DEVELOPMENT RESOURCE

A professional development resource was commissioned by Open University Press and co-authored by the participating practitioners and university researchers (Hennessy, et al., 2013). Note that the decision to go with a commercial publisher this time reflected the volume of text to be presented and the desire to make a professionally printed product widely available at reasonable cost. All of the digital video clips remain openly accessible via the university's streaming media service and the main resource bank and some of the materials produced are freely available online via a dedicated website at <http://tinyurl.com/OUPIWB>.

The materials are useable at primary or secondary levels, and across subject areas. They encourage teachers to create a supportive ethos for dialogue and engage students in a variety of forms of dialogic interaction and activity, both away from and at the IWB. The approach for providing stimuli for discussion, reflection and trialling of new ideas, the target audiences and suggested modes of use are all very similar to those for the T-MEDIA multimedia resources. The resource includes (see Appendix 10 for more detail):

- texts introducing the notions of dialogue and dialogic teaching and considering the role of the IWB;
- 'dialogue tables' – concisely summarising what happens in a dialogic classroom, what dialogic activity could lead to, and teacher strategies for supporting dialogue;
- a large Resource Bank of video clips (stored at <http://sms.cam.ac.uk/collection/1085164>) and screenshots illustrating whole class dialogue and dialogue in small groups in action plus brief descriptions of the classroom activities;
- an action plan document for a whole school approach to setting up and reviewing practice via staff meetings; this resource for senior managers of schools can be adapted for use by smaller groups or with other schools;
- sample and template IWB activities;
- six Reader chapters containing concise background readings, that report in an accessible way on the research underpinning this resource and offering some more

in-depth illustrations from authentic classroom practice, along with reflections upon them (three chapters are case stories authored by the three participating teachers);

- ‘snippets’, or excerpts, from the research literature and from the Reader chapters;
- references for further reading.

CHAPTER SUMMARY

This chapter has described the process by which we developed grounded ‘intermediate theory’ through an intensive and equitable collaboration with practitioners during two main research projects. The first project (T-MEDIA) involved in-depth case studies of secondary classroom teaching and learning in English, mathematics, science and history with projection technologies including the IWB. Digital video records and other data were collaboratively analysed by the university research team and two teachers in each case. The resulting intermediate theory derived from recontextualising and refining constructs from sociocultural theory by applying them to specific classroom practices involving technology, and reframing them using accessible language. It was embodied within detailed narrative accounts linked to video clips of classroom practice. The outcomes were presented as five multimedia tools for professional development (one per subject, one overarching).

This methodology then evolved further during the Dialogue and IWBs project, in which a team of researchers and practitioners worked to *develop* as well as to analyse and document practice – in this case new uses of the interactive whiteboard to develop dialogic classroom interaction in English, history and personal, social, health and citizenship education. Joint review of literature and digital video exemplars, teachers’ own lesson videos and post-lesson interviews subsequently served to identify effective pedagogical strategies for supporting dialogue in this new context. The process of continually integrating researcher and practitioner perspectives along with insights from the data ultimately culminated in co-construction of an enriched understanding of “dialogue” and “dialogic pedagogy”, again framed in accessible language. A commercially published professional development resource was also produced by the team.

NOTES

- ¹ Two of the teachers were Heads of Department, one was a Head of Year, the fourth was Assistant Principal, Advanced Skills Teacher and lead science teacher for Cambridgeshire, specialising in IWBs. Two had participated in the TIPS (Technology-Integrated Pedagogic Strategies) project (2000–02) with us, and two in the SET-IT (Situated Expertise in Technology-integrated Teaching: Mathematics and Science) project (2002–04).
- ² Advanced Skills status is awarded to recognise expert UK teachers and partly release them from teaching in order to share their practice with others.
- ³ The Specialist Schools Programme (<http://www.standards.dfes.gov.uk/specialistschools/>) helps schools, in partnership with private sector sponsors and supported by additional Government funding, to establish distinctive identities through their chosen subject specialisms.

- ⁴ Not all lessons were consecutive; in a couple of cases, interim lessons were observed but not videoed. Note that ethical issues raised by Powell et al. (2003) pertaining to video in classrooms were addressed. In particular, informed consent was obtained from students and parents or carers.
- ⁵ <http://www.bera.ac.uk/publications/guidelines/>
- ⁶ Video recordings (camera 1) were provided in compressed, easily viewable .mpeg1 format.; footage from the second camera was incorporated in the final CDs where appropriate. Note that induction of the cameraman and piloting of the filming procedure were necessary for smooth operation and a high quality outcome. Briefing covered (a) the broad focus of research, (b) the specific focus of filming and criteria for removing the main camera from its tripod in order to follow the action, (c) set-up procedures and timetable/physical constraints operating, (d) criteria for intervention and (e) the need for a neutral personal demeanor. Piloting during a familiarisation lesson before each study began assisted determination of camera location and resolution of technical issues such as IWB glare and poor contrast.
- ⁷ These guidelines were deliberately framed to provide sufficient information for reviewers to act upon, but to be open-ended enough to reveal the features of interest to each individual without overly constraining the process. (They were less prescriptive than those employed in studies such as Moyles, J., Hargreaves, L., Merry, R., Paterson, F., & Esarte-Sarries, V. (2003). *Interactive Teaching in the Primary School: Digging Deeper into Meanings*. Maidenhead: Open University Press.: see their Appendix E for the 40 reflective questions posed). Commentary was applied only to viewer-selected salient portions of video – but coverage proved extensive in all cases.
- ⁸ www.researchware.com
- ⁹ Our previous work on technology use related to subject culture indicates that while practitioner knowledge and thinking is largely contextually bound, tied to specific pedagogies, activities, student groups and subject cultures, more generic patterns can be identified.
- ¹⁰ Filenames contain “Themes_Emerging.pdf” and are stored in the Downloadable Resources folders.
- ¹¹ More details about the substantive focus and the theoretical framework are provided in: Hennessy, S. (2011). The role of digital artefacts on the interactive whiteboard in mediating dialogic teaching and learning. *Journal of Computer Assisted Learning*, 27(6), 463–586.
- ¹² There was a single (mobile) video camera on a tripod, usually positioned facing away from the windows at the side of the classroom to minimise intrusion and to avoid backlighting. (One teacher commented that this camera angle made it easier to see and evaluate the activity from a pupil’s perspective, as he was keen to do, when reviewing the videos, whereas placing the camera right at the back as we had done in T-MEDIA yielded “a slight feeling of detachment”.) The teacher wore a radio microphone and a second radio microphone was positioned near students on the other side of the classroom.

This chapter was based on two co-authored articles, posted by permission of the publisher:

Hennessy, S., & Deaney, R. (2009). Integrating multiple teacher and researcher perspectives through video analysis of pedagogic approaches to using projection technologies. Teachers College Record, 111(7), 1753–1795. Available online at <http://www.tcrecord.org/Content.asp?ContentId=15305>.

Hennessy, S., Warwick, P., & Mercer, N. (2011). A dialogic inquiry approach to working with teachers in developing classroom dialogue. Teachers College Record, 113(9), 1906–1959. Available online at <http://www.tcrecord.org/content.asp?contentid=16178>

CASE STUDY ONE: SUPPORTING KNOWLEDGE CO-CONSTRUCTION IN HISTORY

Rosemary Deaney, Arthur Chapman and Sara Hennessy with Lloyd Brown

INTRODUCTION

In this chapter we describe how the T-MEDIA research process enabled us to explore how the participating history teacher used the interactive whiteboard (IWB) along with other resources to mediate learning in his classroom – and how development of the team’s shared understandings contributed to the formulation of intermediate theory (as outlined in Chapter 1). Beginning with brief introductions to the team members involved in this case study (co-authors on this chapter), we review some key aspects of teaching and learning history as a curricular subject, and present an outline of the lesson sequence which provided our focal data. Tracing key threads through the process of video review, we present the three themes that we identified together, and draw on examples from our discussions to illustrate how the theoretical framework developed.

Further details about the participants and the lessons observed in this case study, plus video clips and other material illustrating the themes emerging and uses of technology, are available in the history multimedia resource freely accessible at <http://t-media.educ.cam.ac.uk/>.

PARTICIPANTS

Lloyd, History Teacher

Joining the project as a history teacher of some 25 years standing, Lloyd Brown had seen the widespread introduction of computers in schools over the past two decades. At the same time he had become increasingly aware of the potential of new technologies to enhance teaching and learning of his subject. In 2001, at Chesterton Community College, both he and his departmental colleague Rolf Purvis took part in a schools–university research partnership project with Cambridge University,¹ which focused on developing pedagogical strategies incorporating use of Information and Communications Technology (ICT). They worked together to explore the notion of “multisource” learning, in which a range of online resources was brought into play to enhance teaching and learning of particular topics. After the project ended Lloyd continued to build up an archive of online links and used a digital projector to share

these materials with his pupils. Since then the school had purchased an IWB for the whole department, but as it was located away from Lloyd's regular classroom, access had to be negotiated on an ad hoc basis. By the time he joined the T-MEDIA project, Lloyd finally had an IWB installed in his own classroom and had been using it for around 6 months. He saw involvement with the project as an opportunity to develop his approach to teaching a topic which, at that point, occupied a substantial part of the department's scheme of work on the Tudors: the "Golden age" of Queen Elizabeth.

At the time of the T-MEDIA filming, Lloyd was Head of the Humanities Department. Subsequently he took on a more managerial role as Assistant Head. While his primary subject was history, which he had taught across his teaching career, he had also taught other humanities subjects such as geography and religious education, and, in more vocational areas, leisure and tourism and business studies. In the current post, he mentored trainee teachers on postgraduate programmes and led in-service development work in the school. He had developed an active interest in research and had held three UK government-funded Best Practice Research Scholarships, variously supporting investigations of: "multisource learning" (as mentioned above), development of oracy, and intra- and interpersonal multiple intelligences.

Rolf, Teacher Colleague

Rolf Purvis had taught at Chesterton Community College for more than 20 years, specialising in history and personal and social education. He was also Deputy Head. For several years he had coordinated research activities within the school. His particular responsibilities were curriculum, pastoral matters and research; in addition he was involved in the training and mentoring of newly qualified teachers, teacher researchers and school faculty leaders. He had also held two Best Practice Research Scholarships, focusing on "researching researchers" and, with Lloyd, "multisource learning".

Arthur, History Subject Specialist

Arthur Chapman was an external academic colleague invited to join the team as subject specialist in history. He was well known in his field and also an experienced teacher and postgraduate teacher-educator. He contributed written commentary on the footage, which was added to the combined grids (as described in methods Chapter 1) and circulated prior to our meetings. Although Lloyd and Rolf did not meet him personally until later in the project, they valued highly his involvement from the outset, and appreciated the professional insights he conveyed. After the study, Lloyd reflected:

It was very, very interesting to have [Arthur's] input and again I felt, even though I'd not met him before, that he was a very supportive colleague of things that he saw. And I think that was very important.

The mutual level of regard among the team was helpful in quickly establishing a forum of trust in which comments could be made and received as being exploratory and constructive rather than personally critical. Arthur's written observations often provided stimuli for discussion during our review meetings. Some of the terms he used quickly became incorporated into our descriptive framework: for example the notion of *avoiding alienation* (of individual learners) by pitching tasks at an appropriate level of challenge.

Pupil Group

The class who worked with us in the project comprised 28 pupils aged 12–13, of both sexes. Attainment within this mixed group was spread across a wide range: for example, three children were described as “very able” while four received help for specific educational difficulties. The group also included some children from very challenging home circumstances. Lloyd considered the class as “mutually supportive” of each other and took this into consideration in designing activities to engage and challenge across the range.

SETTING

The school was a mixed, inner-city comprehensive of around 1,000 pupils, and served a socially and ethnically diverse community. Achievement standards were generally above the national average and the levels of educational disadvantage a little lower than national average. Over 90 languages were spoken by pupils in the school and over 25% came from homes where English is not the first language. It had specialist status as a Technology College and was also a Training School, whose role was to support the professional developing student, novice and established teachers within its local networks and through its links with the university. There was a strong research ethos in the school, supported by a flourishing research partnership with the university and connections across other networks in the area. Housed in buildings that had been extended and refurbished over its 75-year history, the site was also widely used for community activities. The lessons being described here took place in a classroom typical of others in the school – and indeed of many other UK classrooms built in a similar era, in which 30 or so desks were tightly packed and arranged in rows facing the front, where the teacher's desk, IWB and projector were placed.

At the time of filming, the history department had only the one IWB and projector for use with teachers' laptops, and no dedicated computer suite. When required, the department used a set of computers in the library for teaching. There was no formal whole-school ICT policy apart from one that covered internet use, but a 4-year programme had been initiated to increase the skill levels and sophistication of staff in using the technology.

LESSON TOPICS AND OBJECTIVES FOR TEACHING AND LEARNING

During the weeks immediately prior to filming, pupils had been studying a unit entitled “Could your religion get you into trouble during Tudor times?” Topics covered in earlier lessons had included an introduction to the Tudor dynasty and a comparison of Henry VII and Henry VIII. After this, the class had looked at changes in the church under Henry VIII, followed by the reigns of Edward and Mary, and leading up to the problems faced by Elizabeth I. Lloyd wanted to “get the kids to see that by the time we come to Elizabeth’s reign, some kind of consensus in religion is probably the best way forward for the country”.

The series of six filmed lessons spanned a 3-week period and was designed to address the question “How ‘golden’ was the age of Elizabeth I?” Much of the module had been written collaboratively with other members of staff within the department, and Lloyd aimed to incorporate a range of activities that would help pupils to characterise aspects of the Elizabethan age by exploring some of the problems Elizabeth faced and how she and her government dealt with them. An outline of the lessons is given in Table 2.1.

In the following sections we characterise Lloyd’s approach through outlining the pedagogical themes arising in this case study. Note that in this chapter and subsequent ones, themes defined on our coding scheme are in *italic font*.

LLOYD’S APPROACH

Lloyd’s own aspirations regarding history teaching and learning were grounded in a deeply held belief about the wider importance of encouraging children to express their ideas and to engage critically with those of others:

Teaching kids to think and be able to articulate and debate their views has always been sacrosanct to me. History provides a vehicle for this, but these skills are generic across many – if not all – disciplines. If people can engage with each other, that is a good thing. Is there a more important skill to survive in life than the ability to work with others?! (Interview)

Moreover, he took a highly collaborative approach to teaching his subject, and also regarded this democratising aim as a motivator for pupils’ engagement with learning:

Fundamentally, trying to get pupils to contribute as much as possible to collaborating with me on developing knowledge and understanding – the collaborative learning community, if you like. I also have a belief that kids can contribute ideas that make that knowledge and understanding richer and think it is important to help them understand that they can do that!

In this way, Lloyd saw the interactive possibilities afforded by IWB technology as serving to enhance the pedagogy that he already espoused. Alongside an introduction to the historical events to be studied in this lesson sequence, he planned to encourage development of pupils’ analytical and interpretative thinking through his strategic

Table 2.1. *History lesson sequence: Aims and content*

<i>Lesson aims</i>	<i>Lesson content</i>
<p><i>Lesson 1</i></p> <p>Aims</p> <ul style="list-style-type: none"> – To establish idea of possible meaning of a ‘golden age’ – To use portraits to show change – To consider the value of paintings as historical evidence 	<p>Recap on Tudor succession; Machyn’s diary entries re accession and death of Mary I on IWB. Pairwork with paper copies to identify difficult terms; Ps highlight text on IWB.</p> <p>T reads with class, interprets and discusses highlighted words.</p> <p>Ps list ‘possible problems Elizabeth faced on coming to the throne’ in exercise books then feed into whole class discussion.</p> <p>T displays [well-known] Armada portrait on IWB: How does the picture suggest a ‘golden’ age? Ps label features; Ps to find out (using the internet in their own time) why, and where, is Elizabeth’s hand resting on the globe?</p> <p>Whole class discussion of earlier Elizabeth picture (1547). Ps identify and annotate features on IWB. How does Elizabeth seem to have changed over this period of time?</p> <p>Brief plenary on how understanding of pictures has been developed through discussion.</p>
<p><i>Lesson 2</i></p> <p>Aims</p> <ul style="list-style-type: none"> – To understand the problems faced by Elizabeth and consider how she might tackle them. 	<p>Recap on religious problems during reign of Elizabeth.</p> <p>T introduces Spanish problem; Ps discuss and vote on which options should Elizabeth take, recording ideas on IWB. Ps note arguments for and against marriage to Philip, using handout to find out more information. T circulates.</p> <p>Discussion of conflict at sea. Ps write sample arguments for and against on IWB. Ps record own ideas.</p> <p>T introduces question on IWB of what Elizabeth should do about poverty, crime and unemployment. P annotates to suggest how these are linked.</p>
<p><i>Lesson 3</i></p> <p>Aims</p> <ul style="list-style-type: none"> – To examine the reasons for poverty in C16th – To look at how effectively Elizabeth dealt with poverty 	<p>T recaps on link between poverty, crime and unemployment – revisits saved P annotations.</p> <p>T introduces ‘classification of causes of poverty’ activity (Heinemann IWB resource); asks Ps to identify items they don’t understand; discusses / explains.</p> <p>T constructs definitions for four headings (social, economic, political, religious) drawing on P ideas.</p> <p>Ps work in pairs to sort causes under these headings; individuals come forward to drag items on screen; Ps record in books.</p> <p>T introduces Poor Laws. Ps consult handout; T questions to check understanding.</p> <p>Whole class discussion around Heinemann ‘idle or deserving’ simulation on IWB.</p> <p>T recaps: causes of poverty, Elizabeth’s government’s ‘solution’ – and issues that arose.</p>
<p><i>Lesson 4</i></p> <p>Aims</p> <ul style="list-style-type: none"> – To consider how Elizabeth might tackle the problem of Mary 	<p>T recaps Poor Laws (Heinemann software); Ps discuss further examples. (Homework: to discuss with parent/s on effects of Poor Laws.)</p> <p>T introduces ‘Elizabeth’s problem: Mary, Queen of Scots’ on IWB and explains how problem developed (handout).</p> <p>Ps add thought bubble to picture of Mary on IWB.</p> <p>T shows example produced by colleague Ts. Ps compare.</p>

(continued)

Table 2.1. History lesson sequence: Aims and content (continued)

<i>Lesson aims</i>	<i>Lesson content</i>
– To understand the decision to execute	Whole class discussion re options for Elizabeth. Ps annotate picture with thought bubble on IWB.
– To work out what were the reactions to the execution	Mary’s execution: source text displayed on IWB. Ps highlight key words showing (positive & negative) reactions to Mary’s execution. Ps record. T circulates and discusses with class. Picture of Mary’s execution (Heinemann) displayed on IWB. Ps annotate key elements. T summarises; debate continues regarding how successfully Elizabeth had solved the problems of poverty and Mary.
<i>Lesson 5</i>	Recap on execution of Mary Queen of Scots using picture and narrative sources. T uses statements on OWB as framework for discussing importance of multiple sources in gaining understanding of the event.
<i>Aims</i>	
– To understand why the conflict between England and Spain reached a head in 1588	T questions pupil in role as Philip II of Spain. Answers reveal why he is angry with Elizabeth and about to launch an invasion of England.
– To examine the Spanish plans for attack and the English plans for defence	Ps note down reasons for Spanish plan to invade.
– To examine the reasons for the defeat of the Armada	T introduces Spanish Plan using IWB. P invited to plot route of Armada on map.
– To use sources on the execution to raise issues about historical evidence	Ps note strengths and weaknesses of the plan. Feedback on IWB; discussion. Repeated with English defence plan. Ps use textbook to discover sequence and outcome of events then identify key events. Examination of evidence on the reasons for the defeat of the Armada; Ps annotate text on IWB. T discusses. T summarises: What contributed to the Armada’s defeat? Can all evidence be trusted? Did the defeat of the Armada solve the problem of conflict with Spain?
<i>Lesson 6</i>	Recap on Armada route and attack and defence plans using slides from yesterday.
<i>Aims</i>	
– To finish work on, and review, the Spanish problem	Review of text sources on IWB; Ps draw links between them – and explain reasoning.
– To set up the assignment by developing a writing frame	Ps note key points re defeat of Armada. T summarises on OWB. T introduces assignment question: ‘ How successfully did Elizabeth and her Government tackle the problems they faced?’ Armada portrait is revisited. Recap/discussion on problem of poverty drawing on homework about Poor Laws; Ps annotate writing frame on IWB. Ps produce and share lead sentences for opening sections of assignment. T highlights chronology of events. Ps complete plan for homework.

T = teacher, P = pupil

use of both digital and non-digital tools and resources, centring on developing whole-class use of the IWB.

From the outset of the study, Lloyd kept a project diary, intended to capture brief reflections about aspects of planning and teaching the lessons that seemed noteworthy at the time. These documents became part of the shared data set which revealed insights into the personal philosophy underlying and permeating Lloyd's approach to teaching, which itself ultimately shaped the development of our analytic framework.

Overarching Aims and Objectives: First Order and Second Order Historical Knowledge

Before examining the themes that emerged through our analysis, we look briefly at what teaching and learning history means in broad conceptual and curricular terms, to show how Lloyd's aims and objectives for the sequence were contextualised within this subject focus.

History learning has been analysed into two distinct domains: *first order*, or substantive, knowledge and understanding, and *second order*, or disciplinary, knowledge and understanding (Howson, 2007; Lee, 2005). Learning history is thus not only about developing understanding of past actors, events and states of affairs and of substantive historical concepts necessary to this task (such as the concept "feudalism", for example). It is also about mastering the concepts that historians use to construct claims about the past, such as "evidence" and "significance" (Lee, 2005; Wineburg, 2007).

A focus on key concepts and processes as much as on substantive historical knowledge – as associated with the philosophy of the Schools History Project tradition (Shemilt, 1980) – had become integral to the National Curriculum for history in secondary schools in England (QCA, 2007):

As they develop their understanding of the nature of historical study, pupils ask and answer important questions, evaluate evidence, detect bias, identify and analyse different interpretations of the past, and learn how to substantiate any arguments and judgements they make. (QCA, 2007)

Lloyd's scheme of work had been devised with these dual objectives in mind. However, a number of considerations underpin the focus on second-order knowledge in contemporary history education. They range, on the one hand, from the view that learners need to understand the basis of the claims that substantive historical knowledge comprises, to the argument that a focus on knowledge construction is essential to the education of informed and empowered citizens in a democratic society. As Barton and Levstik have argued:

Preparing students to make reasoned judgements cannot be accomplished by telling them what to think; preparing them to move beyond their own perspective

cannot be accomplished by demanding reproduction of a consensual narrative of the national past; and preparing them to take part in collaborative discourse about the common good cannot be accomplished by tightly controlled, teacher-centered instruction. These goals can only be achieved when students take part in meaningful and relevant historical inquiries, examine a variety of evidence, consider multiple viewpoints and develop conclusions that are defended and negotiated with others. (Barton & Levstik, 2004, p. 260).

Aligning with this view, Lloyd saw the classroom processes of “generating ideas and thinking about different problems” as working towards “a deeper understanding of some of the complexities and issues”. Within the videoed sequence, this work was supported by use of technology and involved use of causal reasoning: classifying, prioritising and then interlinking reasons and distinguishing cause from association and cause from effect. (See for example, Episode 3.2 in relation to poverty, and Lesson 5 concerning the defeat of the Armada).

Skills of historical inquiry are promoted by drawing inferences and producing warranted claims about the past (including recognising relevant elements of source material, evaluating its reliability and plausibility, recognising a need to incorporate multiple sources, devising, debating, justifying and validating claims, developing generalisations through extracting and linking corroborating evidence). Lloyd taught these *second-order* concepts through subtly *modelling* what “doing history” involves, in terms of historical analysis and inquiry, and building up these understandings over time in different contexts.

Analytical thinking was fostered through careful task structuring, for example in Lesson 1 (see Episodes 1.1 and 1.2 below), firstly identifying salient features of portraits of Elizabeth and drawing inferences about a “golden age” from those features, then taking the opposite approach of looking for conclusions and trying to relate them back to images and other sources. In Lesson 3, generalised statements about events and factors influencing outcomes were also linked together – highlighting both similarities and causal sequences.

However, Lloyd’s aims concerning the evaluation of claims and evidence went beyond application of analytic skills in the historical domain to modelling these approaches as transferable or “life” skills:

10 or 15 years ago, we were very much teaching children about “This is what an historian does”, and we were practising skills of the historian ... and we were talking to Year 7 [age 11–12] kids about “These are all his/her primary sources, secondary sources ... Now you’re thinking about transferable skills, important life skills: how to read the newspaper, how to analyse the news, how to analyse things that you use at work, how to judge events and people ... where to go to find out information. (Meeting)

I think education is about creating rounded citizens ... and there are a number of ways in which you do that, skills that you need, and qualities that you need

to develop ... and one of them is the weighing of evidence. But it's also being confident enough to be able to present your views on that. (Interview)

Fostering a collaborative environment in which pupils could gain confidence in formulating, articulating and sharing their views was Lloyd's overriding pedagogical concern.

Use of Technology Resources

Lloyd's classroom was equipped with a network computer linked to the internet, a static interactive whiteboard, with an ordinary whiteboard (OWB) alongside, and data projector. He planned to use a variety of digital resources in the filmed lessons, some of which were materials sourced from the internet such as images of Elizabeth I (Figures 2.2 and 2.3) and others that he devised himself such as the summary of the Spanish plan of attack (Figure 2.6), and collections of statements drawn from historical sources (Figure 2.7). While much of the module had been designed collaboratively within the department for previous groups, Lloyd was keen to develop further IWB activities by "adapting strategies already used, and creating new ones". (Diary)

In addition, two of the six lessons drew on an educational CD-ROM (Heinemann, 2004b: Think History) that included audiovisual dramatisations of historical events such as the execution of Mary, Queen of Scots, and an interactive simulation of trials conducted under the Poor Laws.

A systematic categorisation (using the video data) of teaching modes across the six 1-hour lessons we filmed showed that the IWB was used for direct whole-class teaching for 63% of the total lesson time. Additionally, 10% was individual/pair work directly referring to the IWB. For 22% of lesson time there was no IWB use, with a further 5% mixed mode activity. Note that these figures (presented in each case study chapter) are merely intended to help describe the context; no judgment was made by the research team about how often the IWB was used, although alternative potential strategies were of course discussed on occasion.

Although Lloyd himself was still getting to grips with the technology and only beginning to understand the potential of its functionality at this time, already he had started to exploit many of the tools and features available. The strategies he used and his rationale for employing them already lent impetus to his lessons, but he was keen to keep on extending practice, as our conversations revealed.

Within the series, we explored and identified how Lloyd used IWB tools and resources in communicating and developing complex ideas and modelling historical thinking processes through:

- capitalising on *increased availability of multiple sources*: drawing on a wide range of high quality images, texts, audio clips and simulations offering historical source materials for interaction and manipulation;

- using *textual annotation* extensively (including labels, links, thought bubbles, *agree-disagree* via marking with tick or cross) to facilitate public sharing, generation and recording of ideas, to make inferences and crystallise causal reasoning, to assess historical decision making, to encourage pupils to respond to peer contributions, and to engage pupils and “give proposers a stake” in the discussion;
- using *graphical annotation* features (including underlining, circling, coloured highlighters, shading and box outlining) as *analytic tools*, for example to render complex ideas and historical language more concrete and salient, to reduce “cognitive load” and to build up a vivid picture;
- *focusing* using *spotlighting*, *magnification*, and *hide and reveal* to zoom in and investigate detail, to maintain attention on key concepts and relationships, or to conceal and reveal “correct” answers;
- using *drag and drop* functionality to facilitate discussion and practice of classification.

In these ways, we saw technological resources being used as visible, manipulable, dynamic *objects of joint reference* within the classroom and as *scaffolds* and stimuli for analytical thinking.

Lloyd’s purposeful use of digital resources alongside non-digital materials, in support of both his curricular teaching aims and general pedagogical approach, is illustrated in later examples and elaborated in the next section.

THEMES IDENTIFIED

The pattern of individual and joint video review common to all of the case studies was outlined in Chapter 1. Lloyd’s commentary here reflected his position as teacher of the class while Rolf acted as designated colleague practitioner. Video files were also sent to Arthur, who returned comments that were circulated to the rest of the team alongside the combined grids, prior to our review meetings. Arthur also joined us for the fourth team meeting, held at school, when we looked back together over the sequence of lessons as a whole, identified emerging, overarching themes and considered how we could portray those on the planned CD-ROM resource.

The key themes (highlighted throughout the text using italics) are summarised in the following diagram (Figure 2.1), which also represents the highly interrelated way in which we saw them as being linked with each other. In particular, although not all elements in the diagram are directly connected within the graphic, their inclusion within the shaded background ellipse is intended to denote the close interplay between them. (An interactive version of the diagram with hyperlinks to video clips and other material illustrating the themes appears in the multimedia resource at <http://t-media.educ.cam.ac.uk/>).

Lloyd’s design of the lesson series promoted two important curricular aspects of historical learning: *historical knowledge* and *skills* associated with the discipline. Lesson tasks and activities were thoughtfully devised in ways that exploited

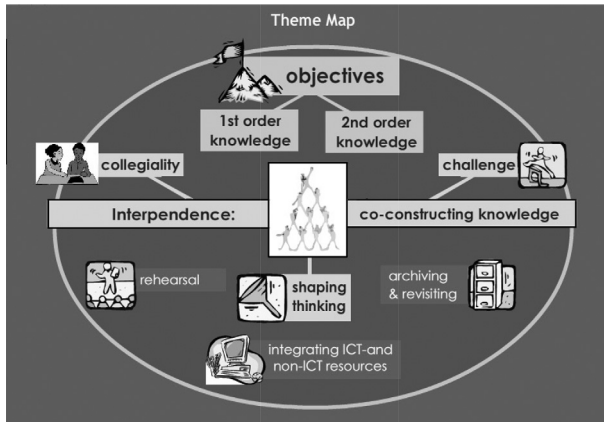


Figure 2.1. History theme map.

technology to support these dual objectives. In addition, the classroom ethos that Lloyd fostered was one of *collaboration and inter-dependence*. Our analysis distinguished contributory elements as a blend of *collegiality*, *challenge* and subtle teacher intervention to *shape thinking*. These aspects, alongside other strategies such as *rehearsal*, *archiving and revisiting* digital material and *integrating ICT and non-ICT resources* are discussed below.

We now present four examples of critical lesson episodes, collectively identified, to illustrate the major themes that emerged from our analysis. We then trace how our own process of collaborative review played out through further examples of how we as a research team came to deepen our understandings and develop a shared language for analytic description.

Episodes 1.1 and 1.2: Collaborative Interpretation of Images to Introduce Elizabeth I and the ‘Golden Age’

In Lesson 1 Lloyd introduced the key idea for the whole sequence: “The ‘golden age’ of Elizabeth I” through discussion of the Armada portrait displayed on the IWB (Episode 1.1). His aim here was to “engage the kids, to hook them straight away by looking at the picture” (Interview 2).

Pupils came forward to annotate features they perceived as indicative of a ‘golden age’ and explain why they had selected these (see Figure 2.2). They labelled ‘jewellery’ and noted the lavish clothing as ‘posh’ and ‘expensive’. Seeing the Armada in the background, Michael labelled ‘winning battles’. Lloyd then used the IWB spotlight tool to focus on particular parts of the image, firstly one that pupils had already noted: Elizabeth’s face and hair (Ellie suggested that the queen’s pale face shows that “she is rich and she doesn’t go out”).

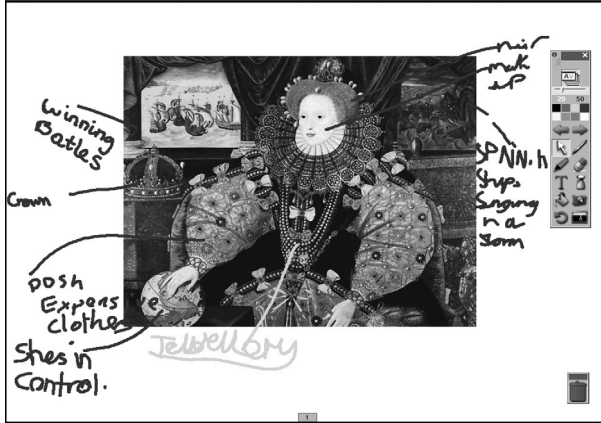


Figure 2.2. Lesson 1: Pupils’ annotations identifying features showing the ‘Golden Age’ of Elizabeth.

He then moved the spotlight onto the globe and asked, “What does this mean?” Lizzie said, “She’s in control”, while Josh volunteered, “Does this mean she rules the world?” Lloyd suggested that there was a “very specific meaning”, and challenged pupils to find out the answer (using the internet) within the next few days. (The class returned to this slide in Lesson 6 and Lloyd used the zoom tool to show that Elizabeth’s hand was resting on the North American colonies – and briefly discussed the historical implications of this.)

After showing the Armada Portrait, Lloyd projected an earlier portrait of Elizabeth (Episode 1.2; Figure 2.3). When volunteers had added descriptive labels around the picture, he invited others to connect these labels with features of the image. In doing so, Lloyd wanted them to “guess the thinking of others and extend their own knowledge”.

Collaboration will allow some pupils to see things they hadn’t spotted or had thought about in a different way. (Grid comment)

For example, after Lizzie had written, “Doesn’t care about looks”, Jane was asked to come forward and show why. Jane circled the face and explained “it’s because she’s not wearing make-up”.

Here, use of the IWB’s annotation, spotlight and zoom features supported building up a vivid picture of this key historical character, helping pupils in turn to understand her motives and subsequent events. Lloyd deliberately *exploited the IWB functionality* to develop both *first- and second-order historical thinking*. Further, he used technology to *co-construct historical knowledge* and understanding so as to empower pupils as learners.

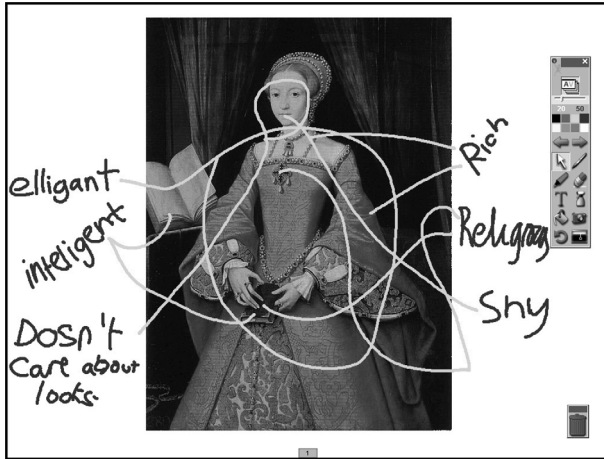


Figure 2.3. Lesson 1: Pupils' annotations characterising the young Elizabeth.

Episodes 3.1 and 3.2: Co-constructing Knowledge about Poverty in Elizabethan Times

At the end of Lesson 2, Lloyd introduced some of the many problems that beset the Elizabethan era; Lesson 3 then focused on two main questions concerning Elizabethan social policy: what were the causes of poverty, and what did the government do to respond? Answering these questions entailed developing substantive *first-order* knowledge. At the same time, pupils needed to know and understand specific features of the Elizabethan context: for example, why there were so many landless labourers. In his commentary, Arthur pointed out that these topics can pose particular difficulties when learners draw on preconceptions based on their contemporary experience and their assumptions about how the world works. Appreciating this situation also required development of substantive conceptual understandings about, for example, the distinction between social and political problems and processes. It was here that *second-order* knowledge was brought into play, since answering questions about causes involves developing the ability to link factors together and identify hierarchies of importance amongst causes (Chapman, 2003; Chapman & Woodcock, 2006).

Episode 3.1: Archiving and Revisiting Learning

In this sequence, Lloyd used the IWB's *archiving and revisiting* facilities to help his class explore the relationships between factors of poverty. In his introduction to the topic at the end of Lesson 2 he had invited pupils to suggest sequential and hierarchical relationships between factors by annotating a whiteboard slide (see Figure 2.4); Dan came forward to order three perceived problems for Elizabeth.

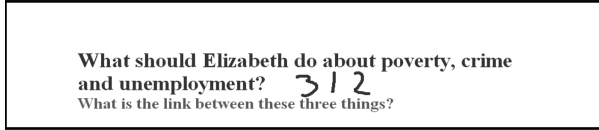


Figure 2.4. Lesson 2: Dan’s annotation suggesting links between unemployment, poverty and crime.

This slide was *archived* and then revisited at the start of the next lesson as follows:

Can I take you back to where we were when Dan came up from his seat and he linked together poverty, crime and unemployment in the last lesson? ... Dan can you just remind us why you said number 3 comes first, then number two, then number 1? (Lloyd, Lesson 3)

Revisiting annotated IWB slides and other stored materials can serve to draw on shared experience and previously co-constructed knowledge (*reigniting*, see Chapter 3), and to consolidate and synthesise these in the process of building up understanding of the events, thus “adding value” beyond that available with other forms of ICT. In this instance, we noted how Lloyd deliberately built on a learner’s contribution rather than simply recalling teacher-generated materials to develop the lesson theme, as might conventionally happen in the classroom. The novelty of this episode prompted a fruitful discussion among the review team, as described later in this chapter.

Episode 3.2: Using the IWB and non-IWB Resources to Support Collaborative Development of Understanding

The following example illustrates how Lloyd *integrated ICT and non-ICT resources* in a *co-constructive* pedagogic strategy to build substantive pupil knowledge and understanding of the past in a way that simultaneously developed, applied and consolidated emerging knowledge.

Following the opening episode described above, Lloyd went on to project an interactive slide from Heinemann’s *Think History* series that listed factors of poverty (such as “less help from monks”). The slide was designed to promote categorisation of these factors through *dragging and dropping* them under broader conceptual headings (e.g. “social”). Prior to focusing on categorisation, Lloyd discussed the meaning of the individual factors with the class. Lloyd did not tell the pupils what the situation was directly, but asked them to make suggestions about the factors that may have caused poverty at the time and also to make suggestions about the meanings of the factors identified on the slide.

The emphasis was on interaction with the text on the board – pupils were asked to come to the front and point to items on the slide that they “were unsure about”; the rest of the class were then invited to volunteer explanations, and these were recorded

<i>Social</i>	<i>Economic</i>	<i>Political</i>	<i>Religious</i>
To do with people	How money is created Economy not helping	Government not helping	People looked down on

Figure 2.5. Lesson 3: Using the ordinary whiteboard to explore meanings prior to a 'drag and drop' card sort activity on the IWB.

on the ordinary whiteboard (OWB) (see Figure 2.5). The lesson then moved to a broader level of analysis, focused on categories under which the factors could be grouped. Again, the emphasis was on the joint clarification of the meaning of these categories.

Once all the broad terms had been defined, pupils worked in pairs to decide in which category they would place each factor, whilst Lloyd circulated and supported individuals, praising and clarifying. Finally, in a plenary, pupils came to the front of the class to *drag and drop* factors under relevant headings. The class was asked to vote on whether or not they agreed with the decisions that their peers had made and individuals who had voted were asked to justify their choices in a way that called on them to explain and *share their understanding*. Lloyd's reflection on the lesson confirmed his commitment to promoting active engagement in learning:

The concepts were hard. In the end it doesn't bother me too much if they haven't understood all those classifications. I think what it's about is actively trying to get them to work out what the causes of poverty were. (Interview 2)

Lesson 5: Reasons for Defeat of the Spanish Armada

The episodes outlined above also exemplify what we jointly termed *rehearsal*: supportive strategies that gave learners opportunities to express and develop their thinking prior to bringing ideas to the whole class or recording them on the IWB. These strategies included *paired discussion* as a *priming* mechanism that allowed pupils to formulate and trial their ideas. Lloyd's interaction with individuals or pairs during these discussions was a means of *focusing and checking understanding* while backs of exercise books were used as a notepad tool.

At the start of the sequence on the defeat of the Spanish Armada in Lesson 5, Lloyd displayed an IWB text identifying the "Spanish plan" (Episode 5.1; see Figure 2.6) and briefly talked through it to ensure comprehension. Pupils were then tasked to discuss the plan in pairs.

"What do you think of this plan? Just have a think about this with your partner for a minute. Just think: is there any part of the plan that you think could go wrong?" (Lloyd, Lesson 5)

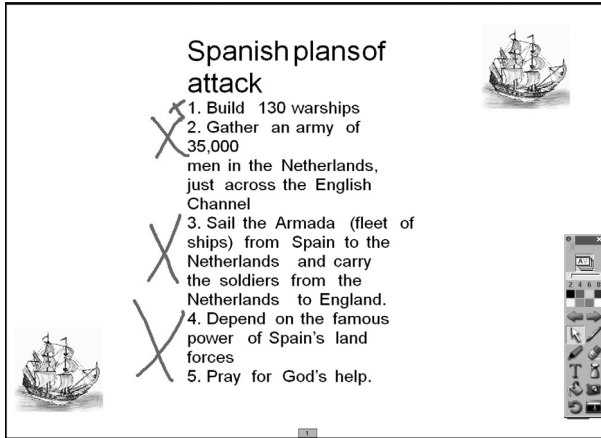


Figure 2.6. Lesson 5: Pupils' annotations while explaining flaws in the plans.

After this opportunity to consolidate understanding, assisted by teacher circulation and support, individual pupils came to the front of the class to annotate the plan on the IWB. They were encouraged to develop and justify their choice of possible problem. (The annotated slide was revisited in the following lesson.)

Later in the lesson, the key task was to infer reasons for the Armada's defeat from texts displayed on the IWB. Here, the OWB was used first as a notepad for members of the class to sketch out ideas about the location of the Netherlands on a map of Europe that Lloyd had drafted. Whole-class understandings of the narrative events were built and supported through teacher–pupil interaction, integrated into the broader task of inferring reasons for defeat. We noted how this approach contrasted with the typical front of class exposition of events associated with a more conventional “transmission”-oriented classroom. The OWB diagram was then used by Lloyd to show the position and formation of the Armada as it moved up the English Channel.² After suggesting why the Armada was defeated (based on prior knowledge and what they had surmised so far), pupils were given the task of making a quick list of the key points in the back of their exercise books, referring to pages in their history textbook as required. Lloyd then circulated to support individuals.

At the end of the lesson the class considered a selection of historical accounts of the defeat displayed on the IWB (Episode 5.2). At the beginning of the next lesson they suggested links between these interpretations (Episode 6.1; Figure 2.7).

During an interview after the lesson series, Lloyd reflected on how activity around the IWB appeared to contribute to successful engagement, and enabled him to *shape thinking* through guiding interactions:

The kids seem very interested in what other kids are writing on the board ... Now whether or not that's because they want to pick them up when they do something wrong, or just whether or not it's to see if they come up with

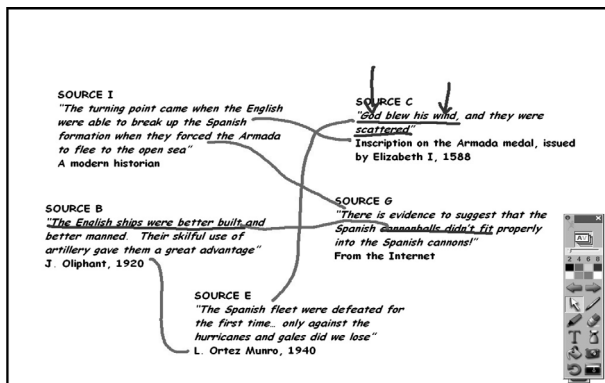


Figure 2.7. Lessons 5 and 6. Pupils' interpretive links concerning defeat of the Armada.

the same sort of thing that they've got? And it's very visual, you can see it; whereas if somebody gives a spoken answer in class, for some kids that's just another person speaking. So here's an alternative way to present ideas and try and build up some group understanding ... a lot of the work's been individual, but it's actually been group work as well because everybody has been involved in using the whiteboard. (Interview)

Throughout the lessons, Lloyd rarely presented the "received" view of events explicitly, but increased sophistication and widened vocabulary through assistive open *questioning* and subtle *funneling* (guiding) towards target interpretation. Providing a supportive environment was a critical underpinning factor in this process of eliciting and building upon pupils' ideas. Rolf observed:

It's about them and their place as a learner ... you create a culture where it is perfectly all right to be wrong ... and not understanding is all right. (Meeting)

Interdependence and Collaborative Learning

Underlying this approach was Lloyd's commitment to developing a mutually supportive and democratic classroom culture in which the teacher is a collaborator and learner, respectful and encouraging of pupils' contributions, "giving views equal status". Lloyd was open to pupils' thinking bringing fresh perspectives on historical objects and situations:

It's very much that you come out of the lesson having learnt some new history based on what the kids have said ... everybody has an equal stake in what happens. It's trying to get away from "teacher as expert". (Meeting)

The technology has given the focus, it's made things interactive, it's helped build some collective learning. It's hopefully got kids to question what they've

thought as well. And it's got them to think about things in different ways as well, the technology's allowed some kids to see what other kids are thinking and then possibly change their perspective. So certainly that's the case for me. And I think you do try to put yourself in a position of a pupil as well, when you are learning from other kids, you know: "Right, what's this taught me and will someone else have learned something from that?" (Interview 3)

As he reviewed the lesson videos, Rolf also noted how the technology was being utilised to support the sharing of ideas:

One of the key things for me is the collegiate sense of learning, and the IWB plays an instrumental part ... the fact that certain images and ideas are projected and pupils are invited to come to the front ... that's a focal point throughout the sequence ... picked up by pupils in interview too; they could "see what the others are thinking". (Meeting).

Lloyd judged that using technology had helped him to cover ground quickly, and in terms of perceived learner enjoyment, satisfactorily. However, he was characteristically cautious in making such attributions himself, preferring to ask pupils themselves directly:

I probably taught them as much in six lessons as I might have done in twelve without the whiteboard. They've probably enjoyed the lessons (most of them) generally. There will be bits of the lessons that they've not enjoyed. But I need to ask them that and see what they think. (Interview 3)

Pupil Perspectives and Learning Outcomes

For Lloyd, another important aspect of involvement in this research was our joint decision to offer pupils the opportunity to feed back about their experience of the lessons. Conventionally, this would have involved pupils being interviewed by an adult – perhaps Lloyd or one of the university researchers. In accord with his conviction that learners had both the capacity and insight to contribute fruitfully to research – as well as pedagogical – activity, and building on previous pilot work with members of his class, we included peer interviewing as part of the research design.

Two members of the class, nominated by Lloyd, were briefed by the university researchers about approaches to group interviewing before conducting a pilot interview and receiving feedback on it. Using a set of simple, semi-structured prompts, they then led discussions with a group of four other class members, both halfway through and straight after the lesson series.

The motivational effects of the IWB envisaged by Lloyd were corroborated by pupil reports that its use made lessons "more social" and "makes people want to get involved". In particular, comments revealed the value pupils placed on

opportunities to share ideas – and how they recognised the contribution of technology in supporting this:

P1: If you're just like working on your own you don't discuss the answer and like find out more and people's different points of view

P2: ... so if you're writing it on the [IWB], you can see what all the different ideas are. (Pupil interview 1)

Interestingly, as Rolf also noted, several pupils also talked in terms of “seeing”, as well as “hearing” others’ thoughts:

You can see more of people's opinions, what they think about the fighting, a paragraph or whatever ... ’ (Pupil interview 2).

Pupils also cited teacher questioning as a helpful aid to peer participation.

While data from the pupil interviews indicated a favourable view of the lessons overall, the depth of their responses may have been limited by the pupil interviewers’ lack of experience in probing techniques, and indeed the shortness of time available for post-lesson conversations. Nevertheless, Lloyd saw the pupils’ contribution as an important tool in developing the sort of democratic practice that he wanted to pursue. Reflecting on his role in supporting collaborative learning, he concluded that pupils’ perceptions of what they had learned from each other should be the arbiter of his success:

I've directed the learning, haven't I? But ... while I've directed things I've tried to use a very open-ended approach to the tasks. And so I think they've been fairly independent and hopefully they've been *inter-dependent* as well. But again I think we need to see from the assignments, but ... perhaps there is a question to ask them, just on pupil voice ... in the questions they've been asking each other ... what have they learned from other people in this module? Which is not really a question that we ask very often. (Interview 3)

After the project, Lloyd set up the Pupils as Learning Partners scheme within the school in which pupils observed lessons, discussed them with the teacher and contributed towards lesson planning (see Chapter 8).

DEVELOPING INTERMEDIATE THEORY

While the case account presented so far has focused predominantly on the overlapping thematic dimensions of developing subject knowledge and strategic use of IWB technology, our discussions in review meetings constantly reverted to the central underpinning theme of *interdependence: collaborative construction of knowledge*. This theme concerns how Lloyd used the IWB technology to underpin his approach of fostering a supportive environment for active pupil participation and responsibility for their own learning. The role of *dialogue* emerged as critical.

In a talk given to colleagues in a teacher partnership group at the end of the project, Lloyd summarised succinctly how our process of review began to give rise to this key focus:

We discussed Lesson 1 all together. Now, through the first discussion, other things of interest began to emerge. Researchers introduced us to a wide ranging vocabulary to describe what was happening in the lesson

We were asked to use the vocabulary if appropriate to describe different parts of the lesson. As we commented on and discussed more of the lessons, more and more the interest shifted to the way the IWB facilitated pupil involvement and *the kind of talk that was happening in the lessons*. The word *dialogic* began to come increasingly into our descriptions/analysis of the lessons. (Lloyd, presentation notes, 2007; italics added)

The following examples elaborate further how this interest translated into theoretical ideas that were refined through our discussions of the practice we had observed.

Example 1: Lesson 1, Review

The process by which the *a priori* framework (see Chapter 1) became encapsulated in our tentative coding scheme began in the first review meeting, with discussion of two terms introduced by the university researchers in comments on the first two lesson videos. These particular terms were derived from Mortimer and Scott's (2003) framework for analysing communicative approaches:

Dialogic interaction – teacher and learners developing ideas together.

Dialogic synthesis – drawing together / building on / elaborating different views, but with no pupil input during synthesis. (Mortimer and Scott describe this type of activity as “non-interactive/dialogic” rather than using the term “synthesis”, which we considered more apt.)

Lloyd felt that coding needed to reflect episodes where learners built on each other's ideas as well as responding to teacher questions. A new sub-code, *dialogic class discussion*, was added to the scheme. Definitions were further refined during Meeting 2 when Lloyd and Rolf suggested that pupils as well as the teacher could engage in *dialogic synthesis*, for example when summarising and weaving together points made during class discussion (either via the IWB or on paper, and in verbal or nonverbal form).

Exploitation of the IWB during this process was characterised using a variety of fine-grained themes, as illustrated in preceding sections. These included for instance *focusing* using IWB-specific features – *spotlighting, zoom, hide and reveal* – to investigate detail and to maintain attention on key concepts and relationships.

We have seen too, how one of Lloyd's central aims, evident in his teaching, was to promote the role of pupils in each other's learning. This commitment to fostering a culture of *interdependence* (his term) was corroborated by Rolf:

L: What is really important is for kids to listen and to learn from what other kids say.

R: That's key to your approach because you model that by listening intently to students ... So kids learn from that ... in an atmosphere of appreciation and of *mutual learning* ... "I have learnt so much from you today," you're saying at the end of one of the lessons, and that's key.

Both teachers went on to distinguish between *interdependence* and *collaboration*, preferring the former as a more powerful descriptor. This led to changing the global thematic category *increasing learner participation, collaboration and independence* to *increasing learner participation, interdependence and responsibility*, reflecting Lloyd's parallel aim for pupils to develop responsibility for their own learning alongside interdependence.

Later, in Meeting 3, discussion yielded finer distinctions between codes, including consideration of the teacher's mediating role in *dialogic "class"* and *"peer" discussion*. The latter term arose as a further separate category in response to the assertion by Lloyd and Rolf that in some of the older groups (a Year 9 top ability set was mentioned), students engaged in productive dialogue within whole class discussion but without teacher aid (especially where grounding in this style of dialogue had been provided by earlier teacher modelling); fostering this approach was considered highly desirable. The teacher's role was deemed to include, for example, assistive questioning and setting ground rules such as the requirement for participants to build on the previous speaker's comments. Lloyd pointed out that once the discussion was set up, the teacher could enter as an equal participant. *Dialogic peer discussion* was not observed during the study, thus it was an 'aspirational' extension of a key code beyond grounded application in the data, sparking teachers' ideas concerning possibilities for development.

During the review, we introduced teachers to wider literature including Alexander's (2004) treatise on dialogic teaching. Lloyd subsequently shared these ideas within the department, and with the pupils. We received the following feedback from him via email:

The pamphlet has created quite a flurry of excitement! ... Discussed some of the pamphlet ideas today with an able Yr 9 group after we had discussed whether the Holocaust was a unique experience. Where writing occurred, it was in response to student contributions. Teacher faded and actually became a contributor and learner. We then talked about the different roles people including me had taken in the lesson. Some consensus that some students, NOT the teacher, had provided the main points for others to reflect on/challenge/shape thinking. Hugely rewarding!!

Engagement with the research process clearly stimulated some creative development and critical analysis of practice in this instance.

Example 2: Discussion of Lesson 3 (see Episode 3.1 above).

We now return to the episode introduced earlier in the chapter where Lloyd revisited the slide that Dan had annotated in the previous lesson and linked together three issues that were problematic in Elizabethan times: poverty, crime and unemployment. A summary of the video clip from Lesson 3 follows.

Lloyd shares objectives: Today we will explore the causes of this poverty and what E's government tried to do about it. Lloyd invites Dan to explain the order in which he linked these items. Dan: "Because if you are unemployed then you don't have any income so you can't buy food and drink and all the necessities. . . . Then it leads to crime because people just can't think there's any way else to get [them]." Lloyd asks if every poor person turns to crime. Class says "No". Discussion continues as other students make contributions and Lloyd responds to them, identifying significant causes and ensuring that students are distinguishing between prioritization and causal linking (Dan had done the latter).

As mentioned, this episode reflects Lloyd's strong commitment to encouraging an active learner role in collective knowledge construction, facilitated by exploiting the unique *saving and revisiting annotations* feature of the IWB. The class was building up a shared interpretation under the teacher's guidance and orchestration; genuine openness and responsiveness to learner contributions were coupled with teacher elaboration and reshaping of pupils' ideas. Lloyd describes this on the grid as follows:

Sometimes I will summarise responses from students but not always. I am consciously wanting the students to listen to their classmates for ideas. Teacher shouldn't always mediate student responses. Such an approach can suggest that teacher must intervene to give an answer status.

He also points out that "when Becky contributes from the back, some of the kids turn and look at her – just emphasises the teacher isn't the sole focus for ideas."

Contextual information in this case was derived from the teacher's interview comments which revealed his secondary motivation for crediting Dan ("because he'd done some brilliant homework that he's emailed me, which I've marked, and he's going to present it to the other kids"), otherwise obscured from researchers. Comments on his grid from Arthur, as subject specialist, illuminated the subject context, noting as unusual both the use of pupil decision making to create a link with the previous lesson, and Lloyd's reference back to joint endeavour ("Can I take you back to where we were when Dan ..."): "In most lessons I imagine that the link would be back to teacher exposition (or similar) or teacher questions". Similarly, colleague Rolf noted on the grid: "This immediately acknowledges role of students in joint investigation".

Our review meetings were necessarily time constrained and, inevitably, discussions had to be selective. Many intriguing issues raised in grid commentaries remained

unexplored. The following exchange around Episode 3.2 (above), illustrates how one new code was incorporated within our framework.

The four commentaries exhibit use of terms introduced by the researchers (bold type) and also reveal the different perspectives of the four observers. In her grid comments, Rosemary noted Lloyd's parallel use of the OWB (Figure 2.5) and IWB (Figure 2.8). At the meeting, she asked him about his rationale for this approach, having also read Arthur's more subject-oriented interpretation of the same episode, as in the following extract from his comments.

“Focus shifts to categories³ on the [IWB] slide – question ‘Can we classify these reasons? Can we put them into some sort of order?’

First approach... is to “work out what we think these words might mean” (referring to the categories). Same method as [T had used earlier] – call for pupil suggestions which are then fed back by T and built up into definitions on the OWB (key method here = tentative language⁴ to encourage contribution and T use of synthesis skills and explication skills – pulling together and glossing pupil suggestions; praise also important – e.g. “I like S's phrase”). T indicates that the definitions will be used “in a minute.”

In his reply, Lloyd firstly noted what he saw as a drawback of the IWB, namely that only one pupil could write on it at a time, “whereas you can have many pupils writing up ideas at once on the OWB”. However, on reflection, he had wondered whether, in this lesson, it would have been better to write up the definitions on the IWB and flick between screens. Rolf pointed out that Lloyd would then have to control the board – and decide which alternate screen to display: “Having material on the OWB means that it supports IWB activity and is accessible to pupils throughout”. Rolf also wondered if Lloyd had planned in advance to use the two boards in this way. In retrospect, Lloyd thought he had probably invoked the approach spontaneously. Lloyd summed up his motivation for using both boards as

A way of publicly exploring the contributions the pupils had made; by putting up the definitions of the headings, you could probably link the IWB to what's on the OWB.

Rolf thought that using the OWB “may have been quicker than IWB for this part of the activity – but more importantly you've got both of them there and can *see* everything there”. We collectively agreed to add a new code to our descriptive framework: *IWB* + *OWB*.

Another specialist from our Faculty reviewed the lesson as a whole (during a discussion with the university researchers after the standard review meetings had been completed) and highlighted the dangers of conflating evidential thinking with causal reasoning, or reliability with authenticity, and the need to treat bias constructively. These specialist contributions neatly illustrate another feature of our approach that was absolutely critical to its success, namely the bringing together of multiple, unique perspectives.

Time	Commentary	Teacher	Colleague	Researcher 1	Researcher 2
	<i>T wonders if Ps can classify reasons, put them in some sort of order. Asks Rachel what is meant by 'social' cause. R: Does it mean you've got a job and now you're doing it and whatever? T: Can we build on that?</i>	Difficult to get a working definition of 'social'. I am trying to assist them in doing this. More effective questioning could have been useful, particularly to emphasise reasons to do with people. Using funnelling. A bit more successful than defining 'social'.	T uses OWB to record answers – perhaps for speed, and so pupils can refer to it and look at the next task.	T effectively gets R to elaborate her initially dubious answer D helpfully makes link with discussion just passed T absorbs and builds on Ps' ideas but seamlessly moulds them towards ideas he wants to get across (reshaping thinking through subtle funnelling)	Challenge Language signals collaborative approach to task <i>Dialogic style</i> + some targeting? Informal assessment? Parallel use of IWB and OWB (using latter as notebook to record / develop ideas into IWB activity) WC equivalent of 'back of book'? T capitalises on S's phrase but affirms all P contributions
	<i>Clare: How different people get along.</i>				
	<i>T writes up 'social' on OWB [..]: 'A social cause of poverty.' Agrees it's to do with people. Notes on OWB. Society seems to be about how people are together. Dan suggests it has to do with treating poor people badly and stuff like that.</i>				
	<i>T writes 'Economic' on OWB and asks Mary for ideas on this. M: Is it when you can just get by? T: Yes, keep going. Ashbal mentions 'bad harvests'. T agrees that this has to do with the economy and comments upon the relationship between harvest, jobs and wealth creation. T writes up definition: 'how money is created'. James adds: Using more natural resources, not like buying something, you can go and make it.</i>	Still not sure Motivation for S. Also enthusiastic because this is a genuinely useful definition which we can use and adapt together.		<i>Public sharing</i> using OWB, <i>positive feedback</i> Building on Ps' idea and extending it to create collective representation of reasons (<i>dialogic interaction</i>)	
	<i>T writes up 'Political': Seth: The government isn't helping. T says this is a perfect description and notes it on OWB. Lara adds: There's nobody to help. T likes Seth's phrase 'not helping' and uses it as a further definition under both 'Economic' and 'Social'.</i>				
	<i>T writes up 'Religious': Lizzie thought that changes in religion meant some people were looked down on. T notes comment on OWB.</i>				

Note. Both researchers also marked this as a significant episode.

Figure 2.8. Extract from combined grid, history Lesson 3.

Teacher Perspectives on the Process

Both Lloyd and Rolf expressed appreciation of their involvement with the project, seeing it as a spur to their own professional development, as well as having potential application in wider school initiatives. Lloyd explained:

It's the opportunity to have my own awareness of different issues raised. That's probably, for me personally, the most important thing; the opportunity to think things from different points of view and different perspectives, ways of thinking about things that I've not done before. That's what keeps you fresher in your work, isn't it? And also working with the people that I've been working with. I mean team work's important to me, I think, and working with all the people in an atmosphere of trust is vital, very, very important indeed – so I've really, really enjoyed that.

Nevertheless, being under such close peer scrutiny, undertaken with the aim of wider sharing among a professional audience, also generated a sense of vulnerability:

I suppose in my mind I'm thinking the outcome of this would be a useful development tool but there'll be lots of people who might watch something like this and say, "That's not very good..." so that's in the back of your mind, I guess, that some people think like that. Not for me that that's a particularly big issue, because it isn't. (Follow up interview)

Overall, Lloyd welcomed the sense of challenge that involvement brought, viewing it positively as "having to think through your ideas". In particular, he found it interesting to tease out nuances relating to dialogue:

I really enjoyed that and I think I learned a lot from that, and it's something I can, you know, reflect on and use in planning in my teaching.

At the same time, he still had considered reservations about the relevance of some academic research (as encapsulated in theoretical terms introduced by the university researchers) to teachers' work. Yet perspectives introduced by the university researchers in relation to what they observed had ultimately stimulated new avenues of analytic thought:

The broader sense [of it] for me was about thinking about how relevant is that academic research to teachers' work. Well it is, some of it. It has to be, because it's clear that what is being described is happening. It's just, I suppose, whether or not some of those earlier definitions of those terms need some change or need adapting to make it more relevant to the classroom, to teachers ...

What are academics looking for, and what would teachers see as no big deal at all, and many of those codings – well, I would probably never have even commented on if I was perhaps watching a lesson or if I was thinking about the lesson that I'd watched. So it's almost like the codes were becoming used

by me, for my own purpose, to try and look at aspects of my teaching that I found interesting.

From a personal point of view this has really crystallised some of my views – more than anything I’ve done for a long, long time, and hopefully will be useful for wider dissemination in school.

ARTHUR’S PERSPECTIVES ON INVOLVEMENT IN THE REVIEW PROCESS

As a teacher and teacher educator who had observed and commented on many lessons during his career, Arthur’s reflections on his role in the review process reveal various ways in which involvement extended his own professional experience and enriched his thinking and practice:

I had observed individual lessons many times... as part of peer or line-managerial observations of colleagues and I regularly observed student teachers teach individual lessons as part of the formative and summative assessment of their teaching practice placements as a teacher educator or mentor. Such observations were limited in two respects: they were observations of individual lessons, rather than observations of a lesson sequence; they were also observations framed by assessment criteria of various kinds (criteria related to institutional models of good practice related to inspection criteria or criteria related to standards for qualified teacher status). Inevitably, in the case of line-managerial or student teacher observations, such observations were high stakes for both observer and observed. Such observations were also ‘real time’ and not filmed.

I had never before had the opportunity to watch and review a sequence of lessons taught by a highly experienced history teacher. Also, I had never been asked to observe in a criterion-free context where my task was primarily to think about the learning, in and of itself, and to theorise what was happening for its own sake – in order to understand and model it rather than to evaluate. It was fascinating to be able to watch and re-watch lessons minute by minute and to think about both what ‘was happening’ (surface phenomena) and what ‘was going on’ (the pedagogic rationale and learning processes underlying surface phenomena).

Nevertheless, he was also very much aware that his comments would be open to evaluative interpretation by Lloyd and Rolf, and to potential scrutiny by a wider field:

My observations were high stakes in this context also, particularly, I imagine, for Lloyd whose practice was being closely observed, but also for me, as my theorisation of practice was being made publicly available for scrutiny by colleagues, including a respected history education colleague [the other

T-MEDIA subject specialist]. I was a little nervous, I think, at the start of the whole process, therefore! As things turned out, however, there was no need to be: my developing understandings of what Lloyd was doing and of what was going on in the lessons seemed to be consistent with or complementary to the understandings emerging in the rest of the team.

Having opportunity to share, expound, and come to common understanding within a collegial space was helpful in mediating anxieties about the potential for misunderstandings to occur. However, over the course of the project, it became evident that Lloyd's pedagogical outlook was very much in sync with Arthur's.

It was very interesting also to have the opportunity to discuss lessons and a sequence of lessons with a team of colleagues with differing interests and differing sets of assumptions about how teaching and learning should be modelled and analysed. It was interesting to talk to Lloyd and we were very much in agreement about most things, I felt.

Arthur's contribution as academic subject specialist brought a critical lens to bear which we as researchers found particularly useful. There was also a measure of exchange in terms of introducing theoretical ideas and viewpoints with which we were familiar. His comments confirm that these processes of knowledge sharing had been of mutual benefit:

It was interesting, however, to note where there were divergences: as a history education academic, rather than a school teacher, I think I could afford to be little more 'purist' about the history-specific (rather than transferable skills) aims of history education and I thought much more in those terms when describing what I understood Lloyd to be aiming to do. It was particularly interesting to work with T-MEDIA colleagues on this as we started out from rather different positions. My background was very much informed by cognitivist approaches to teaching and learning⁵ and I did not know very much about sociocultural theoretical frameworks (such as Wertsch, 1998) at the start of my participation in the project. There were considerable overlaps in our approaches, however, as it turned out.

The conceptual framing from which some of our terms derived, and the intermediate theory that took shape through our discussions, gave rise to additional vocabulary that Arthur subsequently found useful in his own practice as teacher educator, as elaborated in Chapter 8. The process of lesson review itself stimulated deeper thinking about pedagogical strategies for supporting history learning:

One issue that struck me particularly whilst commenting on the lessons was the difficulty I had in separating out uses of technology from teacher actions with a history-specific rationale: I learned a good deal from thinking about these lessons about how the IWB could be used to supplement and enhance interactions whose core rationale seemed to me to be history pedagogic.

Focusing on the technology itself, Arthur concluded that commenting on the lessons and working on the T-MEDIA analyses had been very valuable in developing his thinking about the scope and uses of the IWB and had greatly enhanced his subsequent use of the IWB with his own adult students.

SUMMARY AND CONCLUSIONS

Aside from the substantive findings, the research has illustrated how collaborative microanalysis of lesson videos makes implicit rationale, values and routine practices more explicit, and how they can be used to engage teachers in deep reflection, critique and debate. We know from our interviews, including a follow-up study one year later, that the rich opportunities afforded for engagement in professional dialogue and scholarly analysis were highly valued by all of the T-MEDIA teachers (Hennessy & Deaney, 2009b). This approach offers a significant professional development opportunity – both for the participant who is filmed, and subsequently for other practitioners viewing the material; these kinds of impact are described in Chapter 8.

NOTES

- ¹ WARP ICT Project, 2000–2002: Developing warranted practice in the use of ICT to support subject teaching and learning in the secondary school. Funded by the Wallenberg Foundation. Research partnership established through the SUPER initiative (Cambridge University–schools partnership), see McLaughlin, C., Black-Hawkins, K., Brindley, S., McIntyre, D., & Taber, K. (2006). *Researching schools: stories from a school-university partnership for educational research*. Abingdon: Routledge.
- ² IWBs now offer a dual screen functionality supporting two concurrent digital screen displays.
- ³ See Chapman (2003) regarding teaching causal reasoning and some of the problems that doing this poses.
- ⁴ Pitch is also used here – e.g. the phrase “how money is created” ... is given a rising inflection indicating that the definition being offered is open for further comment/questioning rather than being definitive.
- ⁵ For example Donovan, M. S., & Bransford, J. D. (Eds.). (2005). *How Students learn: History, mathematics, and science in the classroom*. Washington, DC: National Academies Press. Chapman, A. (2009). Introduction: constructing history 11–19. In H. Cooper & A. Chapman (Eds.), *Constructing history 11–19*. London: Sage. is illustrative of my approach.

This chapter was closely based on an article co-authored by Deaney, Chapman and Hennessy in the Curriculum Journal 2009, 20 (4), 365–387 [©Taylor & Francis]. The article entitled ‘A case study of one teacher’s use of the interactive whiteboard to support knowledge co-construction in the history classroom’ is available online at: <http://www.informaworld.com/smpp/content~content=a917657303>.

CASE STUDY TWO: SUPPORTING ACTIVE LEARNING IN SCIENCE

Sara Hennessy with Chris Tooley

INTRODUCTION

This case study offers a vivid example of how we worked with an expert secondary teacher who used interactive whiteboard (IWB) technology and other digital resources strategically to support “active learning” about the process of photosynthesis. As in the previous case study, we report how our collaborative thematic analysis of digital video recordings and other data from a sequence of six lessons yielded detailed, theorised descriptions of the teacher’s own rationale. Beginning with brief introductions to the participants in this case study, we outline the lesson sequence and present the key themes and pedagogical strategies emerging. Referring to examples of lesson episodes, we chart the process of collaborative review, and describe how we came to develop a shared language to describe the practices observed. We exemplify our discussions during the video review process and summarise the intermediate theoretical framework developed.

Further details about the participants and the lessons observed in this case study, plus video clips and other material illustrating the themes emerging and uses of technology, are available in the science multimedia resource freely accessible at <http://t-media.educ.cam.ac.uk/>, incorporating hyperlinks to video clips and other material illustrating the themes emerging and uses of technology in this study.

PARTICIPANTS

Chris, Science Teacher

Chris Tooley is currently Deputy Headteacher at Bottisham Village College, Cambridgeshire. He had previously worked as an Advanced Skills Teacher and was designated by the county as a leading science teacher in relation to his extensive expertise with the IWB; he had also received a commendation in the Innovation category of the National Teaching Awards. At the time of filming he had taught for 15 years at the same school, Soham Village College, and was central in the introduction of the use of technology across the curriculum there, and provision of IWBs in particular. Unlike our other case study teachers, he was an expert IWB user and inducted colleagues into use of the technology. He also had a particular interest

in the development of pedagogy through practitioner research and the development of a knowledge-creating school. In 2005, Chris wrote:

The knowledge creation bit is my general remit – to look at ways in which the college can generate knowledge about what constitutes best practice (Hargreaves, 1999). This is accomplished through a combination of practitioner inquiry, the development of criteria of excellence for subject areas and a variety of initiatives aimed at increasing teachers' reflection on their own practice.

Ruth, Teacher Colleague

Ruth Gallagher had been teaching for 17 years at the time of the study, the last 5 of which had been at Soham Village College, where her key responsibilities included the role of IWB developer. Ruth first used technology in teaching only when she arrived at Soham, beginning on a small scale. She had been using IWBs and data projectors for about 2 years and incorporated their use for a variety of activities during part or whole lessons. Her particular area of professional development centred on exploring and developing the use of the IWB to aid the science department in the delivery of a teaching and learning project on mind maps.

Elaine, Science Subject Specialist

Elaine Wilson was invited to join the team as a Cambridge Faculty subject specialist (Senior Lecturer) in science. She is also an experienced school chemistry teacher and teacher educator involved in initial and continuing science teacher education. Elaine had been using IWBs in her own teaching for several years at the time of the study.

Video files were sent to Elaine and she contributed written commentary on Lessons 3–6, which was circulated prior to our meetings. Her comments and questions were aimed at clarifying and challenging Chris's approach. We later posed them to Chris, e.g. "Had they done this procedure before?" "In your view, could they have devised their own way of answering the question – or is this unrealistic?" She also commented on a draft of the emerging themes account.

Pupil Group

The class who worked with us were a mixed-sex Set 4 out of 5 (with 5 designated the lowest science "ability"), in which there were 22 pupils aged 14–15. Most were white, native English speakers. (One boy had specific educational difficulties and received support from a special needs assistant in the classroom during each lesson.) This was described as a challenging group with some recent temporary exclusions from school. The group lacked confidence (seemingly as a result of their lower-than-average attainment levels;) and were fairly reticent about volunteering information in lessons in front of the cameras. They were also the oldest group we studied.

The class was very familiar with using the interactive whiteboard in science and other subject lessons.

SETTING

The school was a mixed-sex, 11–16 College of 1350 pupils. Soham Village College served a very wide rural area and specialised in both technology and modern foreign languages. Achievement standards were consistently above the national average and levels of educational disadvantage were lower than average. In 2006, the college became one of the first secondary schools in the country to achieve the new ICT Mark awarded by the British Educational Communications and Technology Agency (Becta, now disbanded), to recognise good practice in the use of computers in schools.

LESSON TOPICS AND OBJECTIVES FOR TEACHING AND LEARNING

The material covered was the first part of a new curriculum module on “The Maintenance of Life”. There were some links to earlier work, e.g. the structure of the animal cell covered earlier in the course and also some work on photosynthesis carried out during the previous school year. Chris developed this teaching sequence using the syllabus as his starting point.

The series of six 1-hour lessons spanned an intensive 10-day period within the regular timetable and focused on developing understanding of:

- photosynthesis and the factors necessary for this process (sunlight, CO₂);
- the plant cell structure and function;
- the structure of the leaf in regard to photosynthesis and the importance of chlorophyll (see Table 3.1).

Teaching about these key concepts included a series of planned starters and plenaries intended to link the sessions successfully, ensuring continual review and reinforcement of the concepts. Starters focused on “the sort of things that get pupils across the learning threshold ... to engage with the subject and connect cognitively to previous experience”, while plenaries were “drawing together what had been learnt and priming for the next lesson”. Practical investigations included testing a variegated leaf for starch, testing whether plants need light to photosynthesise and testing whether CO₂ is needed for photosynthesis.

Chris used technology to support the activities and to further his objectives “to explore the topic of photosynthesis in an active and stimulating manner” and to encourage learners to “express their thinking through engagement with both whole-class and small-group activities.” He aimed to use the IWB extensively with “every opportunity taken to make the sequence as interactive as possible” and to vary the use of its features so as to maintain pupil interest. Chris considered the IWB as a tool for “vivid expression of the teacher’s passion” and a means to “overcome the inertia of resistance to learning and so inspire the learner and, in so doing, the teacher”.

Table 3.1. Science lesson sequence: Aims and content

<i>Lesson aims</i>	<i>Lesson content</i>
<i>Lesson 1</i>	Review of the structure of animal cells through guided visualisation. Teacher draws diagram of plant cell on IWB. Pupils develop personal visualisations of key elements: cell wall; sap vacuole and chloroplast. Pupils draw examples on IWB and explain to class. Flexible camera used to project examples from exercise books.
– To understand structure and function of plant cell and differences to animal cells	Equation of photosynthesis introduced on IWB; pupils sort elements using paper mini-diagrams. Pupil moves elements to correct positions in equation on IWB.
<i>Lesson 2</i>	Review of equation of photosynthesis and role of starch.
– To understand structure of leaf and importance of chlorophyll	Practical method introduced using large digital images on IWB.
– To explore how a variegated leaf responds to being tested for presence of starch	Pupils use iodine to test leaves for presence of starch; teacher discusses results and highlights features on projected example. Pupils record methods on “fill the gap” handouts. IWB equation revisited during plenary.
– To understand process of starch testing	
<i>Lesson 3</i>	Discussion of survival of Arctic plants with limited light exposure; pupils suggest their own theories. Practical experiment to test effect of light deprivation using normal leaf as control. Starch test as in Lesson 2.
– To understand that plants need sunlight to photosynthesise and the link between breaking down glucose, respiration and release of energy	Use of IWB to consider the fate of glucose made in photosynthesis (and chlorophyll). Pupil drags labels on IWB to match products with functions. Return to Arctic plant issue using IWB images.
<i>Lesson 4</i>	<i>Square of Truth</i> starter activity on IWB to recap previous lessons. Discussion of statement: “Plants are very clever”.
– To examine whether carbon dioxide is needed for photosynthesis and whether plants give out oxygen	Spotlight on individual elements of equation on IWB to recap. Pupils predict effect of (3 days’) CO ₂ deprivation on a photosynthesising leaf. Teacher demonstrates outcome of starch test, using visualiser. Further demonstration testing for O ₂ as product of photosynthesis. Simulation on IWB to model the effect of altering light, temperature and CO ₂ intensity on the rate of photosynthesis and oxygen production in <i>Elodea</i> (pondweed) sample and in commercially grown tomatoes (with associated profit/loss).

<i>Lesson aims</i>	<i>Lesson content</i>
<p><i>Lesson 5</i></p> <p>Plant detectives 1</p> <p>– For pupils to suggest ideas and theories about leaf structure and colour (what veins carry, how light is absorbed etc) from clues.</p>	<p>Brief recap using photosynthesis equation. Analogy of dismantling a car to find out how it works. Small groups investigate the leaf to see how it is well designed for photosynthesis: examining veins; colour of leaf surfaces; how oxygen leaves the leaf. IWB used to summarise each aspect; flexible camera used to illustrate branching veins. Film clip and animation for consolidation and conclusion. Brief intro to next lesson.</p>
<p><i>Lesson 6</i></p> <p>Plant detectives 2</p> <p>– To identify key parts of leaf and consider their functions</p> <p>– To draw all the learning together and apply knowledge in a new context</p>	<p>Brief recap: matching pairs activity on IWB. Pupils examine cross-sections under microscopes. Teacher demo/explanation using flexible camera image of magnified leaf on IWB. Teacher discusses 3-D model of plant leaf with groups during practical work. Teacher relates 2-D images of leaf structure diagram on IWB to 3-D model; clicks on labels and reveals functions in turn. Question-and-answer, explanation and visualisation using model and IWB images as stimuli. Consolidation using “fill in the blanks” task on IWB, revealing annotated written descriptions/functions for each element. Teacher teaches mime of photosynthesis process in order to “fix it in pupils’ minds”.</p>

CHRIS’S APPROACH

Chris had the following general aims in his teaching:

- to focus upon active learning through offering learners opportunities to express their personal understanding of a topic during a variety of paired, small-group and whole-class activities, especially small tasks which grab attention;
- to give pupils the widest possible range of opportunities for learning in different ways and different styles;
- to add interest, using humour and anecdotes to enliven material that could otherwise be purely text-based (this was often unplanned, “relying on spontaneity and rapport with pupils”);
- to use a range of technologies in order to create excitement and motivation.

USE OF TECHNOLOGY RESOURCES

Chris’s classroom was equipped with a network computer linked to the internet, a mobile interactive SMART Board (normally static) and data projector. Other peripherals included a digital microscope and a visualiser with flexible camera mounting used to display children’s work (Episode 1.2), live images or specimen

A	Cytoplasm	1	Sugar
B	Cell wall	2	Chemical reactions
C	Sap Vacuole	3	Information
D	Nucleus	4	Chloroplast
E	Chlorophyll	5	Cellulose

Figure 3.1. Paired statements activity.

slides. A systematic categorisation (using the video data) of teaching mode across the six 1-hour lessons we filmed showed that the IWB was used for direct whole-class teaching for 43% of the total lesson time. (9% was individual/pair work directly referring to the IWB; 42% no IWB use, 6% mixed-mode activity.)

Chris devised or sourced (from the internet) most resources himself rather than making use of science educational software. Even where he employed a commercial simulation package he edited the scenarios to suit his own purposes. He used generic IWB software (SMART Notebook) purposefully to create engaging, generative learning objects (interactive, self-contained media with built-in learning or revision objectives) that were adaptable to different topics and provided task structure. These content-independent resources offered instant feedback to learners and included a paired statements activity requiring matching (Figure 3.1) and a diagram (Figure 3.2) with images and statements to be matched. A third example is the Square of Truth (also known as Magic Box) where statements are pre-formatted to slide behind or in front of the central square (or other opaque picture) when dragged and dropped. Those that are true stay visible, those that are false disappear. Pupils are asked to propose or predict whether – and to explain why – the statements may be true or false, then to drag them over the central object to receive immediate physical feedback about correctness (Figure 3.3).

These activities were complemented by a deliberately wide range of content-specific digital media resources, including high quality visual images and diagrams (such as the equation of photosynthesis), a video clip Chris had created (showing gas flow), and an interactive animation of a journey into the microscopic structure of a leaf, allowing learners to visualise themselves “seeing the whole leaf and actually diving into it”.

While most of the lesson activities could potentially have been carried out without an IWB (using the data projector and computer alone, or paper resources), the examples below show how Chris exploited the dynamic visual presentation, provisionality, manipulability and immediate feedback **affordances** (perceived qualities of systems that can support or hinder interactions) of the powerful IWB technology present

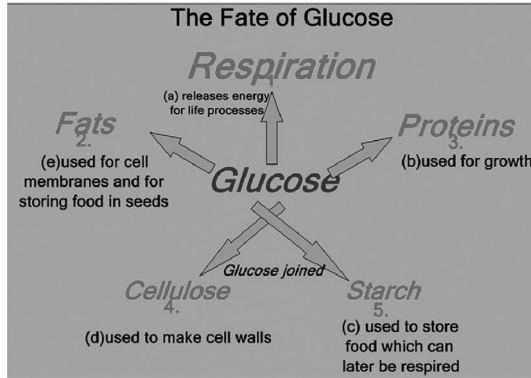


Figure 3.2. Fate of Glucose matching activity.

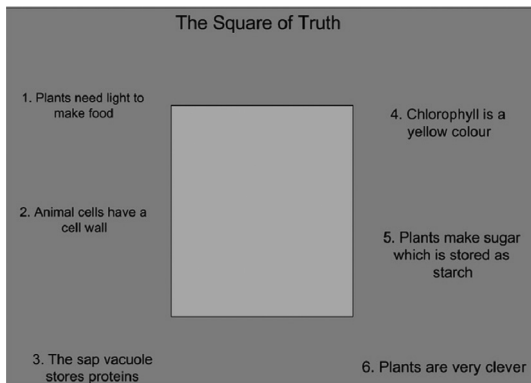


Figure 3.3. Interactive Square of Truth activity.

in his classroom. Teacher and pupil interviews and our observations corroborated previous research findings that the IWB offered significant advantages in terms of ease and speed of use, learner motivation, etc. (Higgins, Beauchamp, & Miller, 2007). Improving technical facility does not of course transform teaching and learning, and as always, the pedagogical strategies employed by the teacher were pivotal in making use of the technology effective, as elaborated below.

THEMES IDENTIFIED

Following the pattern of individual video review and comment outlined in Chapter 1, we also held four meetings during the review phase of the study, involving Chris, his colleague, Ruth, and the two university researchers. Chris's comments reflected his position as teacher of the class; Ruth acted as designated subject practitioner; Elaine commented as subject specialist on what she noted (in Lessons 3–6). Figure 3.4

Time	Summary	Teacher	Colleague	Researcher 1	Researcher 2
	<p><i>Example:</i></p> <p><i>T: How would we work out how Dr B's car works? Take it apart. Where would we start dismantling? P: Front has engine in. T: But car needs petrol so is there somewhere else we should start from?</i></p> <p><i>P: Back.</i></p> <p><i>P: Fuel tank.</i></p> <p><i>T: What system would we use?</i></p> <p><i>P: Follow pipes.</i></p> <p><i>T: To? To engine, through to exhaust, to find out how car works.</i></p> <p><i>T: Today we'll take apart the leaf and see how it works: we will be leaf detectives looking for clues. There are three activities relating back to photosynthesis equation – how does plant get water, CO₂, sunlight, what about chlorophyll, what does it do with sugar made, what happens to the oxygen? [Slide 2: cartoon of leaf detectives]</i></p>	<p><i>Analogy drawn between the way a car works and a leaf. I have deliberately chosen to talk about a notorious member of staff here to engage pupils' interest.</i></p> <p><i>Use of funnelling here to guide pupils to the notion of following through from the petrol tank.</i></p> <p><i>Emphasis shifted over to the pupils to "be leaf detectives" to "look for clues".</i></p> <p><i>Challenge laid down for pupils to use their skill to find out how the process of photosynthesis is actually enacted.</i></p>	<p><i>Analogy model continued. Leads through analogy by questioning how does the car work (humour as car belongs to specific teacher keeps attention). Now today take apart the leaf to see how it works.</i></p> <p><i>Set the scene for lesson.</i></p> <p><i>Uses IWB to be more specific; draws attention to equation, minimises to create space for the leaf to be enlarged to form the focus.</i></p> <p><i>How does the leaf work? Look for clues.</i></p> <p><i>Cartoon focuses on task explained, poses questions.</i></p>	<p><i>Authoritative interaction/ funnelling to make concrete links with dismantling leaf (analogy/ motivating), in order to introduce focus of today's lesson: scene setting/ priming.</i></p> <p><i>Outlines tasks: sharing objectives</i></p>	<p><i>Analogy: authoritative interaction; assistive questioning to help Ps think logically about investigating the system. Revealing item 3 on screen visually links discussion back to lesson activity.</i></p> <p><i>Orientates within knowledge framework; indicates limitation of analogy by contrasting design complexity of car/ leaf.</i></p> <p><i>Leaf detective slide gives limited info. Cartoon adds humour. (T gives more detail verbally). Direct link made between processes to be investigated and elements of equation.</i></p>

T= teacher P = pupil

Figure 3.4. Extract from commentary grid, science Lesson 5.

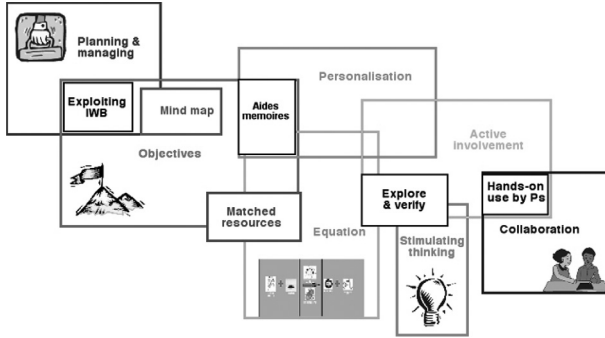


Figure 3.5. Science theme diagram for multimedia resource.

offers an example of grid commentary from this case study. This section elaborates the emerging themes (highlighted throughout the text using italics), also summarised succinctly in the diagram in Figure 3.5 which is used in the multimedia resource.

The Teacher's Approach to "Active Learning" Using the IWB

Chris construed his own role and that of the IWB as facilitating the pupils' *learning journey*. His first key strategy for facilitating the journey was *fostering active involvement in learning* through participation in IWB-supported activity, discussion and scientific thinking. His general approach was one of:

using the technology to provoke thinking and not to tell the answer ... to see as many ways as possible in which you can get them to see the mystery of what there is there, and to make them want to find the answer.

Chris planned to use the IWB as interactively as he could, to provide "as many active challenges as possible" and to move away from its use as a glorified overhead projector. However, he mainly operated the IWB himself since physical manipulation by learners (illustrated below in Episode 1.2) was deemed to be "of secondary importance", and giving everyone a turn at the board was time consuming: "The most important thing is that they're actively learning in whatever sense ... It can be interactive at a cognitive level rather than a physical level". Pupils invited to the board were chosen at random (or if they had been less active beforehand) "to keep them on their toes" and build up their confidence. Certainly learners appeared highly motivated and engaged in all of the activities, and teacher-pupil rapport was impressive.

Importantly, Chris tried to ensure that all pupils remaining seated were involved in the process and had "a personal stake in the outcome," for example by asking pupils to vote or canvassing opinions after a peer had sorted, matched or responded to statements on the IWB. This allowed the class to build on a peer's thinking and, for these (often self-conscious) adolescents, it created a safer forum to express their

thinking than speaking out in class or coming up to the board. “The focus is on the board ... it just takes the spotlight off the child, they can feel freer to give their ideas knowing that not everybody is looking at them”. Instead, however, “everyone is in the spotlight”. He also challenged the whole class by withholding feedback, asking “Which ones do you think are wrong?” and soliciting explanations. “So all the way they are being challenged ... and participation could be picked on at any moment ... It would have been very very difficult for any pupil to be passive in their learning”. This served a particular pedagogical goal: “You are engaging them all in that sort of browsing through the provisional nature of the knowledge before you then start showing them ... a way through [that has] been developed as a class”.

We now illustrate these and further elements of Chris’s approach using three critical episodes collectively identified in the first lesson.

Episode 1.1: Plant Cell Introduction

Chris described Lesson 1 as aiming to “reactivate students’ earlier knowledge of the animal cell and extend it to cover the plant cell”. In this initial episode he began by explaining (with the aid of displayed diagrams and the Hide and Reveal tool to create suspense) that the aim of the next few lessons would be looking at the plant cell and the process of photosynthesis – how plants make food. After introducing the plant cell by drawing a freehand diagram on the IWB (Figure 3.6, left side), pupils helped (verbally) to label the image. Chris used this activity to gauge their levels of recall; their contributions concerning differences between plant and animal cells formed a critical part of the diagram. Then he introduced the functions of a new component: the cell wall. He *handed over responsibility* and challenged learners to “create their own imagery” and record it in their exercise books so that they would remember the protective and supportive function. He gave examples from previous

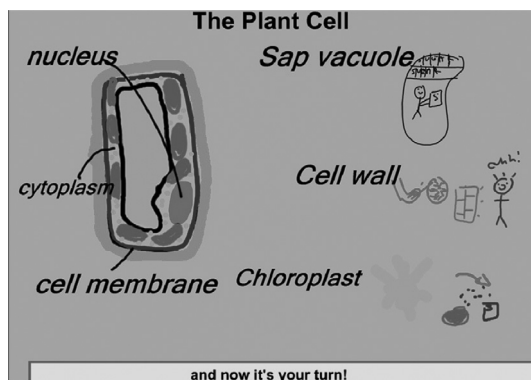


Figure 3.6. Plant cell diagram and Mandy’s and Rowena’s IWB representations of sugar storage.

classes, offering guidance and scaffolding (see glossary in Appendix 6) for pupils to use in generating their own *aides-memoires*. Pupils produced a variety of colourful and personally meaningful images (e.g. Figure 3.7); some drew heavily on the given examples while others expressed ideas more creatively.

Asking learners to construct their own representations and notes as *aides-memoires* was part of a wider view of the IWB as an aid to cognitive engagement through encouraging pupils to visualise themselves in a particular scenario or to relate a concept to themselves. Chris felt that his approach to whole-class teaching was subtly different from the traditional one in which the teacher would be trying to get all learners to come to the same understanding. It was “pupilcentric”: “You are actually addressing a class of individuals and trying to challenge them individually in their learning. It’s just that they are doing it together. So it’s corporate individual learning that you are trying to sort of set up”.

Episode 1.2: Sharing Images of Sugar Storage

Mandy and Rowena shared their personal representations of sugar storage with the class by drawing them freehand on the IWB (Figure 3.6, right side) and verbally explaining them (e.g. the cell wall protects a football player from a ball kicked towards him). Chris discussed, grouped, shrunk and labelled the diagrams. This left room for further images – so that the working space became infinitely expandable whilst visual prompts remained. The tool for converting handwriting into typed text was used to aid legibility of plant cell labels and correct pupil spelling, as well as to “implicitly reinforce” the aim of quality presentation. Three pupils’ illustrations (e.g. Figure 3.7) were instantly projected for the class to see by placing their books

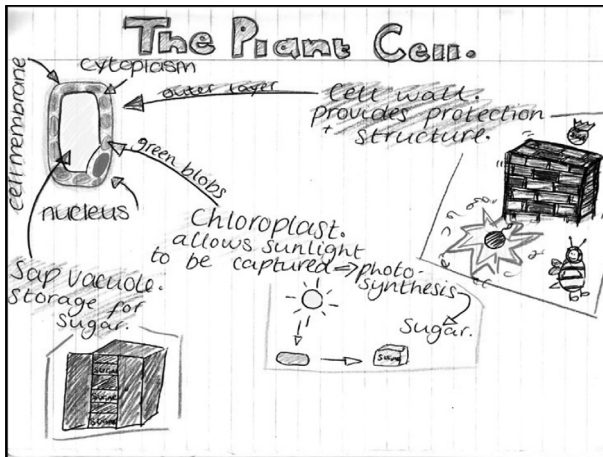


Figure 3.7. Lucy's representation of sugar storage in exercise book.

under the flexible camera (iCam, a kind of visualiser) and the pupils explained them to the class.

This episode illustrates how learners actively participated in collective whole-class activity around the IWB. Chris clearly *legitimated the diversity and drawing on of peers' ideas*. He and Ruth asserted that this *public sharing* and *showcasing* of pupil work was popular and both gave learners confidence to articulate their reasoning (“because they produce much higher quality work using pencils and colours in their books than when using the board directly”) and prompted other pupils' thinking. This relates to the notion that IWB use supports scaffolding of learners' thinking by hearing others' suggestions and explanations and comparing them to one's own (Jones & Tanner, 2002).

The IWB was thought to take some of the focus away from the teacher and to make it easier for learners “to engage much more openly ... to interact, to make comments and take risks because it's a [neutral] physical object there” rather than a teacher awaiting a correct answer. It served as a visible, manipulable *object of joint reference* throughout, with the teacher exploiting this by publicly interpreting the display to explain key concepts and helping learners to explain their own, pertinent ideas to the class. In subsequent lessons, digital images of practical methods were considered effective in “setting visual bookmarks in students' minds to guide the next stage of the practical. This process frees me up to circulate with students”. Dispensing with written instructions (often copied verbatim) also involved “much more processing” by learners. In discussing the next episode we see how a graphical representation of the photosynthesis equation was also employed as an object of joint reference.

Episode 1.3: Constructing the Photosynthesis Equation

Chris introduced the *equation of photosynthesis* for the first time using colour pictorial images of its components and an equation template on the IWB (Figure 3.8). The class were given paper mini-diagrams that replicated the IWB component images in miniature (which we termed *matched resources*) and asked to cut up and order them into a correct equation, justifying their arrangements and discussing them with peers. Chris circulated, talking to small groups, *strategically questioning and challenging* their ideas, with the intention of provoking pupil evaluation of their current frameworks and active, higher-level thinking. The task presented opportunities for learners to apply their knowledge and for Chris to formatively assess their individual understandings and offer responsive assistance as he circulated. Diary and observation data showed that these interactions solicited some clear learner misconceptions about the roles of gases. However Chris deliberately withdrew his support (*fading*), not divulging correct answers too easily, leaving some pupils with temporary uncertainty. This reportedly motivated pupils to “want to know the answer” and *primed* them for the subsequent manipulation on the IWB.

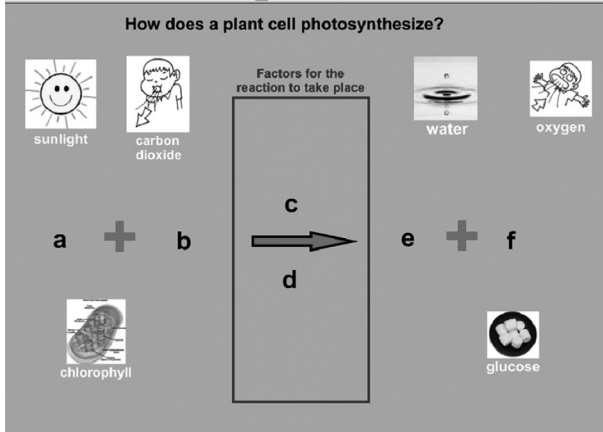


Figure 3.8. Template for constructing photosynthesis equation.

One girl then came up to the board and completed the equation by *dragging and dropping* the elements. Pupils verified their own diagrams against her model and revised them before sticking the correct version into their books. This relates to the research literature which suggests that testing viability of conjectures and understandings against corporate meaning is an important component of interactive teaching (Jones & Tanner, 2002). Chris finally summarised the equation and highlighted the need to verify it empirically next time, introducing the uncertainty of scientific theory.

This episode illustrates how the equation displayed on the IWB was used to stimulate thinking and *support stepwise knowledge building*, a central theme throughout the whole lesson sequence. The equation served as a pivotal support to make a normally invisible process explicit. It was used to connect activities or lessons together, to represent visually the principles underlying phenomena observed during pupils' practical work and to prompt them to consider questions such as: "Is light really necessary? Why doesn't an artic willow die without light? Why do leaves have a waxy cuticle? How do we know oxygen is produced?" Knowing how the equation works and using clues to find out were deemed important.

Displaying the equation on a recurring basis played a major role in *orienting learners* or "setting the scene" (Ruth). Our subject specialist pointed out that it was helpful for learners "to see where they are on the journey and where this lesson fits in". Pupils similarly pinpointed "breaking [the material] down so it's easier to digest" as important in making complex concepts accessible and memorable. Chris tried to show, however, that understanding of photosynthesis is not a linear process of acquiring discrete facts, and he aimed to deepen links between facets of a larger, complex body of underlying knowledge. This notion of using the IWB as a powerful tool for orienting and constructing layers of increasingly sophisticated ideas was

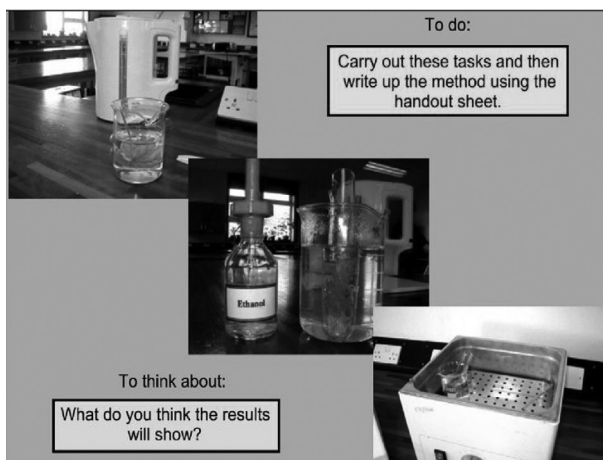


Figure 3.9. Pictorial instructions for experiment.

generalised to other science topics, too. It highlighted the major role played by the equation and other visual cues in *reigniting prior learning*, an evocative term coined by Chris and subsequently adopted as part of the wider project terminology.

The equation was used in every lesson albeit in different ways, and with various IWB tools (e.g. it was enlarged or annotated, components were revealed or spotlighted and discussed in turn) for different purposes: it was in fact continually deconstructed and reconstructed. *Revisiting* of this screen in subsequent lessons exploited a key feature of the technology and was described by Chris as “like seeing the same person but knowing them better each time – seeing new dimensions of the same thing”. *Revisiting* was considered to combine continuity with familiarity, easing pupils into the lesson and “reactivating the memory” – clearly important for subsequent knowledge building.

The use of mini-diagrams in this episode (and several others) greatly assisted this process by providing a succinct, permanent *record of the outcomes of class activity* in exercise books. Pupils themselves recognised the transience of technology products and wanted records “for reference” and as memory aids. These *matched resources* were used by Chris to draw pupils into the activity, *scaffold* learning, and increase “thinking time” through minimising time spent copying or drawing difficult diagrams. They could be annotated and personalised rather than starting from scratch; this was another major form of fading, with the resulting representations offering “semi-scaffolding” that remained available. (In other lessons they helped to structure experimental method write-ups; teacher assistance was lessened through first giving direct instructions on carrying out a practical experiment, then deliberately displaying only hints and ideas on the IWB: Figures 3.9 and 3.10.) Mini-diagrams were also physically manipulated by pupils here, with the equation template on the IWB (Fig. 3.8) acting as a scaffold.

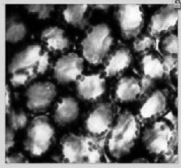
Leaf Colour

1. Compare the colour of the top of the leaf with the bottom of the leaf.

Stick some examples in your book to help you remember

Clue

The green colour is caused by the chemical Chlorophyll.



2. Try and work out why there is this difference in the colour of the leaf and note your ideas down in the back of your book.

Figure 3.10. Comparing leaf colours – screenshot showing hidden clue revealed.

Chris additionally used matched resources because:

- a “multi-sensory exercise book” offers sophisticated colour images, modelling high standards of presentation and accuracy which seems to motivate learners to take more care too;
- images are more powerful and succinct than text; they create “visual anchor points in lessons”, particularly useful for revision or stimulating instant recall of previous lessons.

Pupil Perspectives and Learning Outcomes

Pupils confirmed the above points made by Chris about matched resources when interviewed (in groups, by two of their peers, as described in Chapter 1). They particularly appreciated the public visibility of projected images, texts, videos and demonstrations, and the clarity and quality of “proper diagrams from the internet” rather than “sketches onto the whiteboard.” This reportedly “made us remember it easily and it stays in our mind, so come examination time we know all the answers.”(!) Indeed the group’s final biology test scores were significantly higher than those of the parallel “low ability” group in the other half year.¹ (Pupils were randomly assigned to the two classes, both ranked 4th out of 5 ability levels). The parallel group was taught by a different teacher, also using an IWB. (Chris’s classes had higher test scores than those of other teachers generally, hence his Advanced Skills Teacher status. We acknowledge that his innovative and supportive pedagogical approach may have increased scores regardless of technology use, however this difference was widely attributed within the school to his effective integration of digital technology.² Participation in the research is unlikely to explain

the difference in any case since the teaching filmed was naturalistic and our analysis and reflections followed it.)

Pupils also told us “he gives us everything in picture form so it’s much more easy to remember” and “it’s less writing.” In Lesson 5, Chris himself referred a pupil to the image of the equation stuck in his exercise book, using it as an aide-memoire to help him think about the role of veins in the leaf.

Use of matched resources as a pedagogical strategy was highly unusual; we and other researchers have found that while revisiting slides is observed, saving and printing IWB work for later use is an underdeveloped practice at present. Offering mini-diagrams or images could be construed as providing a bridge between activity within the public classroom arena and private learning spaces (Hennessy, et al., 2007).

Finally there was some further (albeit cautious), qualitative evidence for learning in the final teacher interview.

It’s hard to say how much they actually learned until later lessons, where you start more formally assessing and seeing if they can apply those ideas. But certainly ... they were starting to take discrete bits of information and apply them. And they were sort of able to put together the information from the equation that they’d actually met beforehand, and starting to reason about what things actually were. So rather than a surface understanding ... we’re developing real long-term learning. It’s still got to be reinforced as they go through. But I was pleased with the start that we made and pleased with the evidence of earlier learning.

DEVELOPING INTERMEDIATE THEORY

Integrating Sociocultural Theory into our Collaborative Analyses

The case story outlined above is peppered with ideas and terms exemplifying the intermediate theory developed through our independent video review and subsequent team discussions. The process of selecting, appropriating, applying and refining relevant theoretical ideas using teachers’ own language where desired is elaborated further in this section through discussion of previous and further examples of practice.

At the start of Lesson 1, Chris used a vivid narrative to take the class through a visualisation of the animal cell, then used the hide and reveal features of the IWB to outline the lesson sequence. He considered that this feature “keeps the screen active and draws the attention of the learner to what is about to be revealed”. Chris explained why he had done the visualisation – “to re-engage your memory with what the animal cell is” – and what the aim of next few lessons would be: looking at the *plant* cell, and the process of photosynthesis, how plants make food. “This morning will challenge you to make it memorable”.

In commenting on this episode, teacher and university researcher perspectives were initially seen to have different (albeit unconflicting) foci. For example Chris and his colleague Ruth mainly commented on the provision of a sequence overview

whereas we highlighted how Chris appeared to be handing over responsibility to pupils by asking them to “make it memorable”.

Later on in the lesson sequence, the teachers began to draw on the existing theory that we had introduced and to comment from this perspective. For example, during Lesson 3 Chris encouraged a pupil who was annotating mini-diagrams (which matched IWB displays depicting stages of their practical activity) to “Put anything you like, it’s your notes”. In the post-lesson interview, he explained how this activity enabled learners to “engage at a much deeper level with the work” and how technology “giv[es] you that capacity to allow the kids the flexibility to actually express themselves in the way ... they want to”. However, when he came to comment on the video (following introduction of sociocultural theory in the first review meeting), Chris summarised the same episode as *shifting responsibility towards the learner* and spoke of using technology to *scaffold* the task; these phrases thus became part of (and contextualised within) our shared theoretical framework. In our review meeting discussion of Lesson 4, Ruth applied *shifting responsibility* to an incident where Chris had written in his commentary: “IWB screen here reminds pupils of the task to be accomplished – this frees me up to discuss issues with pupils”.

Chris’s notion of pupils “developing personal memory” highlighted the ways in which they “translate what’s going on with the board to what they produce in their books”. In our second review meeting he explained that asking pupils to record personal representations in the form of notes or sketches also edged them away from the *scaffolding* initially provided. “There are clues there, but ultimately they are actually making it into their own work” and “thinking for themselves”. Chris ensured that learners were “*actively participating* rather than copying and cutting off from the class” by requesting pupils’ representations or notes to be recorded as “rough work” or plans in the backs of their books. As he went around the room he challenged any evident direct copies from the board, prompting learners to consider what was happening and why.

Active learning meant that support from Chris was not only measured but gradually withdrawn or *faded* once it was no longer needed, as he himself described in relation to Episodes 1.1 and 1.2, where the pupils’ representations offered them permanent records.

You can really model what you are doing on the board and then talk through different examples, but very much the emphasis [is] on them to think about what for them will be memorable and for them to take control of their learning ... we’ve led them up to this point but it’s time for me to fade now and then even to withdraw from it.

Teacher assistance was also withdrawn in other lessons through giving direct instructions on carrying out a practical experiment, then deliberately displaying only hints and ideas on the IWB so that pupils had to generate their own diagrams and comments during recording and writing up. These examples illustrate how the

well-established terms *scaffolding* and *fading* (J. S. Brown, Collins, & Duguid, 1989) were appropriated and reapplied in this new context of technology use.

Collectively Refining Codes

Often the labels or definitions for the provisional codes were collectively refined. *Fading / withdrawing support* was originally qualified with “cognitive or physical withdrawal” and Chris suggested that a more teacher-friendly description could be “increasing use of prompting rather than exposition”. A university researcher pointed out that there could also be “decreasing” use of prompting to stimulate thinking. Chris responded by pointing out that this links to pupils taking on a greater role themselves, a link that was made explicit in the revised definition of fading as “can be cognitive or physical withdrawal, for example by decreasing levels of prompting”. It also links with “giving responsibility to learners”.

Another example of our dialogue concerned the nuances of *verification*.

Chris: Who is doing the verification?

Sara: It was used by both you and the pupils, in the context of ‘scientists say X but we need to test this out’. It’s posing to the class the task of verifying [in the course of] doing a practical investigation.

Chris: Is it verification of ideas, verification of theory, does it help in unpacking what’s been verified?

Ruth: Or is it a process? You’re verifying the process they’ve actually gone through. This leads to verification of what they started out trying to do.

Chris: An end rather than a process.

Rosemary: You can propose that something is verified, or to be verified?

Chris: That might be more confusing though.

Sara: Perhaps it means verification of ideas or theories, but it is open to debate as to who is doing it?

Chris thought the code definition should say explicitly – “by teacher” or “by pupil”, otherwise it could cause problems when trying to code. Sara suggested it could also be verification by groups in collaboration, which may be more common. We ultimately agreed to amend the code to say “by teacher and/or pupils”.

The university research team initially provided a provisional, skeleton coding scheme based on strategies emerging from previous research, and we jointly assessed its applicability to the science case. Teachers were quite happy to reject terms that did not fit. For instance, Chris expressed difficulty with *differentiation* of teaching strategies according to different learner needs because he did not consider it possible to be non-differentiating in a lesson. We mutually agreed to discard the term.

Table 3.2. Mortimer and Scott's (2003) framework of communicative approaches

	<i>Interactive</i>	<i>Non-interactive</i>
<i>Dialogic</i>	A Teacher and pupils explore ideas, generate new meanings, posing questions, offering and listening to and working on different views	B Teacher considers various points of view, setting out, exploring and working on different perspectives.
<i>Authoritative</i>	C Teacher leads pupils through sequence of questions and answers with the aim of reaching one specific point of view.	D Teacher presents one specific view

We introduced the terms *dialogic interaction/discussion*, *dialogic synthesis*, *funnelling* / *authoritative interaction* and *authoritative exposition* after Mortimer and Scott's (2003) framework of communicative approaches (see the original conceptualisation in Table 3.2) was first flagged up in Elaine's specialist commentary. This took place between our first and second review meetings and led to our incorporation at that point of these variations on Mortimer and Scott's themes into the evolving coding scheme. Two of these terms were defined in Chapter 1 (under Phase 3).

Developing the Learning Journey Framework

Likewise, traffic was not all one way in terms of who proposed elements of the theoretical framework. An example of reciprocal input within the project that had enormous significance for us was Chris's own introduction of the idea of a *learning journey* in Meeting 2, as alluded to above. He construed this as a scaffolded pathway towards achievement of new learning (knowledge and skills), facilitated by the teacher and aided by technology – and spontaneously put forward a complex graphical representation of our developing thematic framework in these terms (Figure 3.11) which he had prepared using mind mapping software. (He also proposed a diagram helpfully portraying and linking the emerging affordances of the IWB.) Ruth welcomed the diagram as a very useful summary of our evolving coding framework and intended to review Lesson 4 with it, proposing it could be much quicker to use than the multi-page list format. Chris talked us through the representation and explained his underlying reasoning, as in the meeting excerpt below. This also illustrates how through the detailed discussion, continuing in the following meetings, the diagram was iteratively developed; the process of mapping relationships between themes for the first time triggered further organisation of our ideas. Various changes were agreed – including re-siting “**ZPD**” [**zone of proximal development**], adding “development of tools for learning”, removing footsteps and locating pupils on the ladder steps.

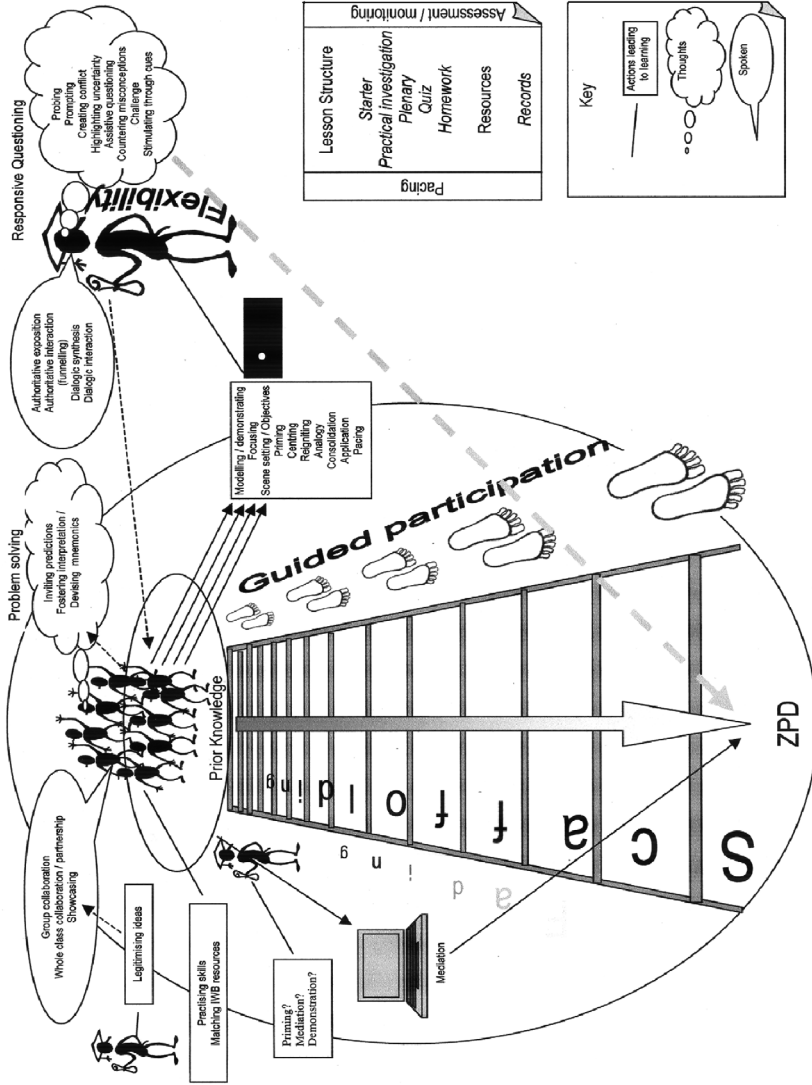


Figure 3.11. Chris's learning journey theme diagram.

Chris: The key in the bottom right hand corner is key to it. The fact that anything that comes in the rectangles [represents] the actions of people, but then you've got thought processes and the spoken. So, if you start with the teacher, we've got the four different forms of talking to the class there, coming out of the mouth, so starting with authoritative exposition and going down becoming increasingly interactive as you go down. And you've also got the thoughts of the teacher in terms of the responsive questioning, those things we agreed. So I just carried on through the coding [scheme] and put some things in, in draft: how the teacher can think about responsive questions by probing, prompting, creating conflict, highlighting uncertainties, questioning misconceptions, challenging ... some views. And there are actions that the teacher might actually do. The teacher might model something, or might demonstrate something. So modelling would be something that the kids will do afterwards, and demonstrating would be something that they wouldn't. Then you do the focusing, on this little image on the right hand side of the WB with the spotlight picture on it. Setting the scene, objectives and the little arrows, coming from the people there, is that they will all be watching, seeing the actual outcomes of the teacher action; priming them, centring them, reigniting, analogy, consolidation, application, pacing, assessment monitoring. So these are actually actions of the teacher.

In terms of the pupils, the teacher might alter the dotted arrow coming across to the pupils and then up, so the teacher decides to set activities to the pupils which are going to cause them to think. So, coming out of the bubble there, you know, inviting them to make predictions, fostering interpretation, devising mnemonics, things that they deliberately set as cognitive activities for the pupils. Equally, you've then got activities – group collaboration, whole-class collaboration, partnership showcasing – whereby the pupils will be talking and expressing their ideas, and that sort of more outward expression of their [ideas]. The pupils are sitting inside their existing knowledge and the whole idea is to move them towards, or into the ZPD, so I've done that scaffold coming from it, like a sort of train track, trying to show you the steps to move towards the ZPD. And also, if you look on the ZPD there are these great big dotted arrows from the top righthand corner downwards with the idea that the teacher's responsive questioning is all aimed at getting the pupils from where they are to the ZPD, again, actually moving them forward in their understanding.

By the side of the scaffolding there, we've got the word 'fading', to try to show the removal of the support there, so the pupils are becoming more and more independent as they move towards their goal. The footsteps actually should be moving in the right direction ... Then the teacher, again appearing in the top left hand corner, with the showcasing, the fact that the teacher may then play the role of legitimising the ideas of pupils when they showcase and actually not allowing misconceptions to be fostered and reinforced.

Things that the pupils can do again: practising their skills, matching the IWB resources. Within the role of ICT then, mediating the response and actually taking them from where they are to the ZPD. And the teacher's possible roles within that, that the teacher possibly could be priming the use of the ICT, could be mediating the use of the ICT, could be demonstrating the use of the ICT, but not necessarily, so that the teacher is sort of over there. The question marks after those are because they are things that could happen, but not necessarily. And then we go finally over to the teacher on the top right hand corner with this idea of flexibility, the fact that the teacher then sort of has an overall flexible approach to all of these uses, to actually see what's happening at the time.

So to me, it actually allows you to think much more clearly about what are pupils actually thinking about here? What are pupils talking about? What's a teacher thinking? What's a teacher doing? What are the actions that they're taking? To be able to sort of look at a lesson and actually find out more clearly which of these codes were appropriate or not. So they just reflect sort of my understanding at the moment and on the right hand side, the lesson structure. ... I am aware that we are going to look at those today and they may need to be redrafted from there. But certainly, personally, it has made me feel more confident that I've got some idea of what these codes actually mean. But how much it transfers and translates across, I'm not sure. [...]

Rosemary: I was looking at the heading 'Responsive questioning' and wondering whether it should be a responsive assistance rather than question?

Chris: Yes, you're probably right, yes. [...]

Rosemary: And that would certainly tie in with the overall picture of progressing through the ZPD.

Sara: So should that say "prior knowledge" then, where it says "knowledge"? Because it's not the target?

Chris: Yes. So should it say "the zone of proximal development"? Is that right? Should it actually say "new knowledge" in there somewhere?

Sara: Well, that would be what you came out with at the other end, wouldn't it, I suppose. It's knowledge that you construct within the ZPD isn't it, really? Its kind of hard to portray really, isn't it?

Chris: So ZPD should be the whole area.

Sara: Yes, that's right, I think they're operating in this whole area here. This is the ZPD in a way. Scaffolding takes place within the ZPD, which helps them to move beyond it. Once they've moved beyond it, they've constructed new knowledge. So maybe the top of the ladder comes out of new knowledge.

Chris: Right, okay. So if we put ZPD around the top and sides, and this is new learning at the bottom, rather than knowledge, because it could be skills, it could be ...

Sara: Yes, “new learning” is better, yes. Why are there lots of arrows coming out here?

Chris: The idea is that the teacher does these things and the pupils are then particularly drawn to looking at what the teacher is actually doing ... so the pupils then respond to it ... but then the pupils work much more independently in terms of working out their own processes. So it’s more a partnership between the two with the teacher leading it, than problem solving or the group collaboration model. That was my thinking.

Ruth: So the idea is that this lot here allows them to take these steps along, so watching that leads them to start the next step. [...]

Chris: Is it worth taking these [foot]steps out of the diagram? Or make it explicit by having it lead towards independence?

Sara: Yes, we could have some sort of area at the top, or the bottom ... which represents the new learning ...?

Chris: So it’s all about the potential for going further again, isn’t it? So actually building up that potential within them for effort.

Sara: Yes, that’s the notion of cognitive apprenticeship, isn’t it? That they’re actually developing the skills to do their own thinking and reasoning, and learning, which is very much part of the guided participation framework. It’s all within an apprenticeship, a framework if you like. It’s all the examples from everyday life where children are learning what their parents are doing, or tailors are learning what the master tailor was doing ... being an apprentice and learning through imitation, through dialogue, through having things explained, through increasing their participation gradually, first from just being an observer and then taking part. So you can see pupils in the same way.

Rosemary: In some respects you need some other footsteps beside these, gradually withdrawing, and fading.

Sara: Yes, but they could be steps going the other way actually, getting fainter. That would be quite nice.

Chris: Wouldn’t it be the same to have them fading away?

Sara: Well the teacher’s footsteps would be retreating into the distance, as the pupils were getting more confident ... I find it really hard to create images that really represent it. Anyway, we know what we mean by “fading”, so footsteps aren’t necessarily essential, are they? But I do quite like these ones getting bigger because it shows that the pupils’ role is increasing. That’s what we could

do actually, is take out the guided, and just make it increasing participation ... going alongside the development of new learning.

Rosemary asked Chris to expand on his placement of *group collaboration (whole-class collaboration and showcasing)* in terms of the ZPD. Although it was entirely his own formulation I realise now that Chris's explanation (below) resonated with Mercer's "intermental zone of development", a shared communicative space in which teachers and learners negotiate their way through an activity, creating shared knowledge through language and joint action; if the interaction is productive, it will be finely attuned to the extent of the learner's changing understanding as the activity progresses (Mercer, 2000a, p. 140–141). The teacher becomes no longer the instructor or even facilitator, but the potential creator of a "community of inquiry" in which pupils become apprentices in collective thinking, under their teacher's expert guidance (*ibid.*, p. 161).

It's just saying that these are activities where, rather than the teacher being the person who is directly involved, the pupils very much are expressing their learning and working with each other to develop their understanding and to share and to learn as a group rather than as an individual. So they would collaborate on their ideas, so it could be in a link to the problem solving, collaborating on their ideas. The whole group, the whole-class collaboration/partnership would involve the teacher to some extent. (Chris, Meeting)

Input from both teachers and university researchers led to radical revision (see final iteration in Figure 3.12) and cumulative insights that ultimately informed our development and representation of intermediate theory. For example, an outcome of our discussions over time was that codes were ultimately clustered under the three main themes collaboratively identified through our review:

- fostering active involvement / learning / personalisation
- supporting knowledge building
- responsive assistance

They formed groups of strategies for facilitating the learning journey. Further, interrelated themes such as affordances of the technology and modes of communication ran throughout, underpinned by planning, structuring, and managing. *Motivation* and *rappport* were seen as all-pervasive, as was *feedback*. In fact, Chris had identified the latter as a key unifying factor – two-way between teacher and pupils – that had been omitted from his first diagram:

It's that very fine balance – which is not the sort of fine balance that you *plan*, [but what] you *feel* when you're actually within a class ... probably something that's missing from here is this ... whole aspect of feedback. It's about how you react, how you change, what time you move on the pace, where are [the students] actually getting in terms of moving towards the new learning. And all the time, there's feedback coming from the students in all sorts of different ways and that's then informing your thinking on the hoof.

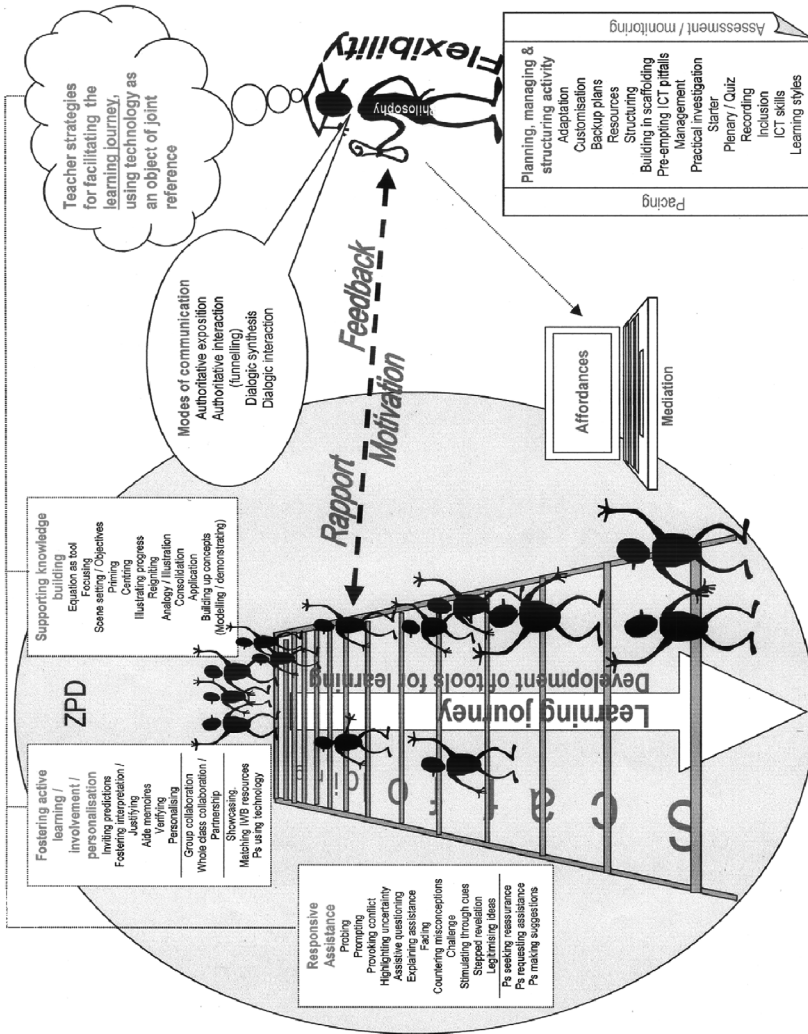


Figure 3.12. Final science theme diagram.

Chris proposed that the diagram (and its counterpart illustrating affordances of the IWB) may be used in looking at practice in other subjects and wanted to keep it as generic as possible. His aim was to make it “stand alone”, since he considered it could be very useful as a self-assessment tool or checklist for teachers to use in looking at their use of IWB use over a series of lessons.

Teacher Perspectives on the Process

The teachers were generally positive about the utility of the theory building process. For instance Chris asserted that

[although] things don’t necessarily fit neatly into categories, it clarified what you did and allowed you to analyse it to a greater extent, making you see what the differences were and identify what you were trying to achieve with one technique over another.

The perceived impacts of participation upon the teachers and their colleagues is described in Chapter 8. The process of developing intermediate theory was, however, convoluted and inevitably not always comfortable at the time. While teachers’ practices were never criticised, they were questioned in the course of trying to tease out the underlying rationale, and in our third meeting Chris commented that he found the close scrutiny quite frightening. He found it hard not to be defensive and to keep an open mind about why things were happening in his classroom. Ruth found getting to grips with all of the new terminology a little difficult while Chris found this a bit easier, having created his diagram, as he had had to start picking out things. He reported that he still found himself taking a section of video, really thinking about it, and going back to the diagram to ask himself which aspects he would have actually used in the given situation. In the meeting he stated:

It’s a different language, trying to explain something you just do naturally now, trying to disassemble it. ... I’m working on the basis of all of those minute-by-minute responses you have with pupils, they give you that feedback, that you feel you have about whether the lesson is working, which is based on lots of small interactions and facts and things coming your way: but it’d be very hard to take that apart and explain why you had that feeling things were going well, why you perceived the learning was taking place.

He pointed out that this makes it difficult for teachers to code their own practice, particularly after a significant time lag (for logistical reasons he was reviewing the video 2 months after teaching the lessons). Moreover, Chris described how he found multi-tasking tricky. It was quite difficult trying to code what he was seeing at the same time as keeping his intentions in mind, as well as “what it felt like to be doing it, my perceptions ... and the degree to which, with any experience you try to make

sense of it and in doing so you lose some of the veracity of what your memory actually is". Finally, increasing understanding of the terminology over time was counterbalanced by the expanded nature of the scheme and sheer number of codes we had developed. Applying multiple codes to certain sections could be labour-intensive and there was constant revisiting, although we all agreed that the coding scheme offered very comprehensive coverage of the data. In sum, we all found the nuanced coding of classroom interactions on many different levels to be a complex and time-consuming process, which is very difficult to shortcut.

Until now the discussion has focused largely on the integration of the four main participants' perspectives, but the subject specialist also played a key role in the process. An example of a question put forward by the specialist in her written comments concerned a matching activity ("Fate of Glucose") in Lesson 3 (Episode 3.2; see Figure 3.2), taking place while pupils were awaiting the results of a practical. Chris told the class: "We need to cover a bit more theory to help you understand the answer you should get in 10 minutes' time". The outcomes of glucose conversion were initially hidden and revealed one-by-one as the teacher talked through the slide. Chris's grid commentary described this as follows, showing the clear influence of the sociocultural theory being applied in this context.

Use of IWB to *scaffold* understanding of the fate of glucose. Use of *assistive questioning* to *funnel* pupils to an understanding of the key terms being revealed. Use of the hidden text affordance of the IWB – further structuring the explanation.

Use of floating text to challenge pupils to make correct pairings. Some are based on previous activities and existing knowledge – others are within the *ZPD* of pupils – they will be dealing with the idea of starch being broken down to glucose and then respired which is the information needed to explain why the dark leaf was lacking in starch.

The use of the IWB allows this information to be introduced without giving the game away. It is presented in a different medium from the practical investigation, requiring deeper cognitive processes to apply it to the investigative context.

Chris then circulated as pupils attempted the task, chivvying and prompting, using assistive questioning to make links with earlier work and as in Episode 1.3, advising on strategy but not supplying answers. A boy, Terry, was then invited to drag and drop these (Respiration, Fats, Protein, Cellulose, Starch) on the IWB to link them correctly with their functions, and the class was asked not to comment yet. Chris read out Terry's results and asked the class to compare them with their own. He asked how many of the class thought Terry had 0, 1, 2, 3, 4 or 5 right, and pupils raised their hands each time. The specialist asked, "What was the purpose of this canvassing?" Raising it with Chris at the review meeting elicited considerable insight into his rationale:

The point of it is very much to reinforce the fact that they are all involved in a process, and to try to delay the giving of the answers before people commit themselves to their views ... they are [thus] far more likely to want to know whether they are right or wrong and ... that makes it more a public recognition of whether they've got it right or wrong ... it gives them that ... extra sort of concentration ... There's a technique that I've been using for a few years now in terms of getting them all to ... express and verbalise their understanding... if they give the wrong reasoning, with the class you can then enter into a discussion about understanding where it's actually gone wrong. ... lots of unspoken misconceptions can then be picked up in that way. It's just a nice, almost safe forum, within which they can put their hands up and just be more involved in the outcomes. So [the canvassing] gets you so much more value out of that process and gets the kids more engaged. ... suddenly the lesson is going much faster for them.

You could easily produce a slide to follow up where you just press a button and suddenly all of them will be in the right places. But this actually gets you so much more value out of that process and gets the kids more engaged ... it's preventing kids from being able to be passive recipients.

The affordances of provisionality and direct manipulation on the IWB enable items to be re-positioned until a correct combination is achieved. In this episode the teacher exploited these while guiding the class in revising the representation. He gave learners themselves the responsibility of diagnosing errors, allowing an incorrect swap to be trialled, giving feedback and soliciting feedback from peers to lead towards an ultimately correct representation.

Megan got it the wrong way round ... I didn't just move it, I asked the class what do other people think? And you could see lots of people shaking their heads. Again they were participating there.

This activity also illustrated a key scaffolding strategy underpinning classroom interactions which we termed *provoking conflict* in pupils' minds – namely getting them to evaluate their current thinking by: setting up a new idea in conflict with it, challenging pupils, proposing alternative suggestions, or applying ideas in a new context and seeing if pupils remain satisfied with the application. This is related to the CASE (Cognitive Acceleration in Science Education) notion of creating conflict in order to stimulate the development of a mental “schema” (initially described by Piaget & Inhelder, 1973) or general ways of thinking (Adey, Shayer, & Yates, 2001). Use of the technology to provoke conflict was enhanced here and in other activities through Chris's questioning of pupils in ways stimulating them to follow their reasoning through, to consider its logical outcome, and perhaps to become uncertain. Ultimately the aim was to move their thinking on, as Chris's own grid commentary for this episode described: “I am still challenging the pupil's ideas but from the opposite viewpoint from before. I am trying to get Tony to ‘invest’ in his ideas and to see whether they can stand up to scrutiny”.

SUMMARY AND CONCLUSIONS

As indicated at the end of Chapter 2, the case studies have illustrated how collaborative microanalysis of lesson videos in specific subject areas served to make explicit the teachers' strategies and underlying rationale. Our resulting narrative account can be summarised as follows, using the intermediate theoretical terms based on the aspects of sociocultural theory that we jointly appropriated, developed and refined.

Chris's pedagogical, subject and technical expertise meant that he was able to devise and source a wide range of sophisticated technological resources and to use these strategically and with great fluency, to support development and deepening of understanding of the photosynthesis process. The case study demonstrates some "advanced pedagogical practices" (Ilomaki et al., 2003; 2006), employing these resources to help in reigniting learners' prior knowledge, visualising thinking and complex concepts and supporting collaborative activity directed towards pupil explanation and stepwise knowledge building. Using the IWB and other digital resources facilitated both authoritative exposition of scientific concepts and more active learning in this context: describing a procedure, sharing objectives with pupils and charting the learning journey, supporting storytelling, priming for activity, setting the context for provoking thinking, offering a forum for making explicit, manipulating, challenging, connecting, evaluating and synthesising ideas. By distilling out these strategies through thematic analysis of this case study (and incorporating them in the multimedia resource), we hoped to offer some ideas that could be generalised to other subject, topic and learner contexts.

The teachers increasingly made suggestions that shaped both the detailed coding scheme and characterisation of global themes, as illustrated above and in the other case studies too. We have shown here how science teacher Chris moreover actively contributed to our joint theory building by voluntarily undertaking to devise complex graphical representations of the intermediate theory under development that were adopted by the whole team. Chris and Ruth both subsequently perceived their involvement in T-MEDIA as important forms of professional development and their perceptions are elaborated in Chapter 8.

NOTES

¹ A t-test showed that the difference was statistically significant: $t(37) = 2.57$, $p < 0.005$.

² The teacher effect is known to be the major factor in pupil learning, however the removal of ordinary whiteboards and permanent location of IWBs in classrooms means that controlled studies comparing technology use and non-use become very difficult to conduct.

This chapter was closely based on a chapter co-authored by Sara Hennessy and Rosemary Deaney with Chris Tooley entitled 'Using the interactive whiteboard to stimulate active learning in school science', published in M. Thomas & E. Cutrim-Schmid (Eds.), Interactive Whiteboards: Theory, Research and Practice (pp. 102–117). Hershey, PA: IGI-Global (ISBN 9781615207152). Copyright 2010, IGI Global, www.igi-global.com. Posted by permission of the publisher.

CASE STUDY THREE: FOSTERING COLLABORATIVE INTERPRETATION OF POETRY IN ENGLISH

Sara Hennessy with Jackie Bullock

INTRODUCTION

This case study illustrates how we worked with an expert secondary teacher who used interactive whiteboard (IWB) technology to foster construction of collective interpretations of poetry with an “anti-social” theme. As in the previous case study, we report how our collaborative thematic analysis of digital video recordings and other data from a sequence of six lessons yielded detailed, theorised descriptions of the teacher’s own rationale. Beginning with brief introductions to the participants in this case study, we outline the lesson sequence and present the key themes and pedagogical strategies emerging. We exemplify our discussions during the video review process and summarise the intermediate theoretical framework developed.

Further details about the participants and the lessons observed in this case study, plus video clips and other material illustrating the themes emerging and uses of technology, are available in the English multimedia resource freely accessible at <http://t-media.educ.cam.ac.uk/>.

PARTICIPANTS

Jackie, English Teacher

Jackie Bullock had taught for 10 years at the time of the study, the last 8 of them at Soham Village College, where she was Head of Year and responsible for developing technology within English. Her main area of interest was using technology interactively and she specialised in drama. Jackie had undergone both in-house and external training in IWB and technology use in the classroom, and she had substantial experience in using a range of software together with data projectors and digital cameras in teaching. She had limited experience of IWB use before T-MEDIA filming though. Jackie had conducted research in a number of areas within English and drama, including the impacts of technology use and learning styles on pupil achievement. She had evaluated educational software for a national organisation and also visited Canada to compare the use of technology in English and Canadian schools.

Tina, Teacher Colleague

Tina Lawton had taught at Soham Village College for 5 years at the time of filming. She was Assistant Head of Year as well as Leading Edge Researcher for English. She was also a mentor for student teachers. Tina was particularly interested in interactive technology, including IWBs, and she had researched the impact of a variety of learning styles on teaching poetry to pupils aged 11–16. Like Jackie she had received both external and in-house training on IWB use and technology use in the classroom, and had developed expertise in using projectors and IWBs as well as producing resources to assist other Faculty members. After filming she moved to Saffron Walden County High School and subsequently took up a post at Bottisham Village College. Tina continues to develop her interest in researching practice and is still working with IWBs.

Sue, English Subject Specialist

Sue Brindley was invited to join the team as a Cambridge Faculty subject specialist (Senior Lecturer) in English. She is also an experienced school English teacher and inspector, adviser and officer for the national curriculum and assessment body, and teacher educator currently involved in initial and continuing teacher education. Sue had been using interactive whiteboards in her own teaching for a number of years at the time of the study. She was sent the lesson video files and contributed written commentary on all lessons.

Pupil Group

There were 29 pupils aged 14–15 in the class who worked with us: they were a mixed-sex, middle set – Set 5 out of 11 (with 11 designated lowest English ‘ability’). Most were white, native English speakers and the group was described by the teacher as “lively and intelligent”. The class was very familiar with using the IWB in English and other subject lessons.

SETTING

The school was the same one participating in the science case study reported in Chapter 3: a mixed-sex, 11–16 college of 1350 pupils. Soham Village College served a very wide rural area and specialised in both technology and modern foreign languages. Achievement standards were consistently above the national average and levels of educational disadvantage were lower than average. In 2006, the college became one of the first secondary schools in the country to achieve the new ICT Mark awarded by Becta to recognise good practice in the use of computers in schools.

The classroom had free seating in rows at tables, with some mixed-sex arrangement (by choice). However, the classroom was quite cramped so Jackie could not easily move between the tables.

LESSON TOPICS AND OBJECTIVES FOR TEACHING AND LEARNING

The material covered related directly to the poetry component of the English GCSE¹ course and the lessons observed comprised the pupils' first introduction to the 2-year course in the autumn term. The module – comprising 20 lessons on “Anti-social Poetry” (including teenagers with social/emotional problems, and a drama component) – was developed by the teacher and spanned a period of 6½ weeks (half a term). We observed the first lesson (introduction to the module) purely as a familiarisation session, and then another 8 lessons, video filming 6 of them, as follows. The 8 main lessons observed over a 5½ week period were numbers 2, 3, 4, 7, 8–10 and 17; these were renumbered as Lessons 1–8. Renumbered Lessons ‘2’ and ‘4’ were audio-recorded but not filmed; observation and note-taking during these two lessons provided continuity for the research team in analysing the other six. Lessons selected for observation mainly contained activities exploiting technology (except Lesson 7), whereas the others mainly related to GCSE coursework and exam practice tasks, including speaking and listening assessments. All lessons lasted roughly an hour.

The module covered three set poems in turn followed by a longer, more involved activity towards the end of the videoed lesson sequence, namely the pupils' exploration during Lessons 6 and 7 of themes emerging across the three. This served to build up ‘analytical stamina’ in the words of our subject specialist and was also the prime occasion where the teacher relinquished to learners her control over the imagery encountered. It included a creative activity in Lesson 7 to produce a collage that brought together the visual imagery that pupils had identified in the poems in a highly imaginative way (taking digital photographs and sourcing other images themselves). This process of creating visual representations of their own interpretations rather than through the written medium was used as a basis for subsequent drafting of a personal comparative (coursework) piece about the three poems (not observed). In the final lesson (8) observed, pupils drafted their own poems.

In the past Jackie had run several of the activities without the IWB, but had recently built in “more of a technology focus”. The pupils had done some previous work on poetry, including discussion and research, in Years 7–9 (ages 11–14); the module built upon this experience.

As well as participating in whole-class activity, Jackie planned for pupils to work both individually and together on joint tasks such as role play and discussion groups for some of the time.

Jackie's overall aims and objectives (see more detail in Table 4.1) were:

- for pupils to become more confident at being able to analyse and offer a commentary on poetry with the theme of anti-social behaviour in terms of content, mood, literary techniques;
- to promote reflection on the motivation and behaviour of characters and what we might say about society's values

Table 4.1. English lesson sequence: aims and content

<i>Lesson aims</i>	<i>Lesson content</i>
<p><i>Lesson 1</i></p> <ul style="list-style-type: none"> – To enable pupils to reach an understanding of the characteristics of the persona in the poem – To extend pupils' vocabulary when talking about this poem and poetry generally – To identify and appreciate the effect of language and alliteration 	<p>T reads out poem "Stealing" by Carol Ann Duffy. Class discuss character's motivation for theft as teacher annotates poem on IWB.</p> <p>Question-&-answer (Q&A) about two projected images and what they convey. Pupils discuss with neighbours, then report back ideas. Teacher annotates on IWB.</p> <p>CD-ROM: Pupils define words presented. Pupils work in groups with thesauruses to match terms summarising the persona with lines of poem.</p> <p>Teacher goes through pupils' responses, moving phrases under each line of poem on IWB.</p> <p>Teacher introduces alliteration, marks words displayed beginning with 'm' suggested by pupils.</p> <p>Homework for next lesson is to consider what kinds of sounds the poem has and why it has so much alliteration? Clue given.</p>
<p><i>Lesson 2 (not videoed)</i></p> <ul style="list-style-type: none"> – To appreciate the alliteration used in the poem – To develop a more personal understanding of the persona of the poem, his/her background and potential reasons for their particular crimes 	<p>Continuation of discussion about alliteration in poem "Stealing" and character's motivation, supported by statements on IWB. Pupils copy statements in order of perceived importance.</p> <p>Teacher goes through (annotated) poem text on IWB, highlighting words indicating alliteration in response to pupil suggestions and discussing.</p> <p>Task set to create a role play, create interview based on poem. Teacher elaborates task and Pupils briefly discuss why people steal.</p> <p>Pupils begin task, mainly working with neighbours; they discuss, prepare, write down conversation. Homework is to finish the scripts. Teacher introduces next lesson on another poem by same author and theme of looking at the kind of person society is creating.</p>
<p><i>Lesson 3</i></p> <ul style="list-style-type: none"> – To identify similarities between poems – To be able to use poems to reach an understanding of their presentation of society – To explore a topic through the eyes of a given persona 	<p>Class review of last lesson's task asking pupils to produce and present a role play of dialogue between character in poem and other; one group of 3 boys perform from their script. Teacher discusses with class what these poems tell us about society.</p> <p>Teacher introduces "ASBOs" (Anti-Social Behaviour Orders) and discusses with class. Pupils assign different kinds of people to Yes/No categories of support for ASBOs in their books while teacher circulates and offers assistance.</p>

<ul style="list-style-type: none"> - To select and prioritise information for individual purpose 	<p>Teacher manipulates characters on IWB as pupils feed back ideas. Teacher had outlined GCSE Speaking & Listening coursework task to be carried out in assigned groups of 5, but fire alarm precluded this.</p>
<p><i>Lesson 4 (not videoed)</i></p>	<p>Brief teacher introduction, then groups had 20 mins to rehearse role plays concerning ASBOs, building on yesterday's preparatory work.</p>
<ul style="list-style-type: none"> - To encourage pupils to adopt views of others - To explore issues collectively - To argue a point of view making use of evidence and example 	<p>Each of 4 groups performed their role play for the class for 4–8 mins. Pupils used / read from notes and took initiative to varying degrees during role plays. Teacher intervened in each group's discussion after a short time to prompt pupils and include all. Teacher assessed pupils during performances, recording marks.</p>
<p><i>Lesson 5</i></p>	<p>Class discuss images representing hippies and their lifestyle. 3rd poem of sequence ("Hitcher" by Simon Armitage) is introduced using anthologies and read out by author on CD-ROM.</p>
<ul style="list-style-type: none"> - To generate mental connections between the 3 poems, to understand how the poems develop a sense of identity in terms of a persona's character - To identify how images can enhance our understanding of society - To identify words and phrases which reveal emotions about contrasting lives 	<p>Guided discussion and Q&A about topic of poem – murder of a hitchhiker – using photographic images as stimuli. Poem annotated by teacher on IWB with pupils' ideas. Pupils work individually to find words from the poem that reflect (a) today's society and (b) relate to the hippies' world of the 60s. Teacher goes through this with class, highlighting phrases for (a) & (b) in 2 colours & annotating poem with pupils' ideas. She discusses use of slang spellings to convey casual attitude.</p>
<ul style="list-style-type: none"> - To use ideas contained in poetry to create more developed characters 	<p>Pupils decide and record in books which words are associated with which of two further photographic images (briefcase/rucksack); teacher circulates.</p>
<p><i>Lesson 6</i></p>	<p>Teacher reviews yesterday's work on 3rd poem, using sorting task related to images of briefcase and rucksack (pupils use IWB), annotates slide with key words. Introduction to notion of metaphor in poetry, illustrations.</p>
<ul style="list-style-type: none"> - To identify metaphor in poetry - To interpret the literal and intended meanings of metaphor - To transfer written metaphor into visual images 	<p>Pupils explore similarities between the 3 poems [persona, mood/tone, what they reveal about society, use of language] through class discussion. This is followed by individual note-making. Pupils draw images to reflect metaphors in the poems, 3 pupils draw theirs on IWB. Whole class "hide and reveal" activity distinguishes literal meaning from interpretation</p>
<ul style="list-style-type: none"> - To create a visual representation of the similarities between the three poems 	<p>Teacher sets collage task (for next lesson) and pupils begin to prepare for it by drawing images related to poem themes.</p>

Table 4.1. English lesson sequence: aims and content (continued)

<i>Lesson aims</i>	<i>Lesson content</i>
<p><i>Lesson 7</i></p> <ul style="list-style-type: none"> - To consolidate all of the ideas discussed over the last few weeks via preparing collages to visually represent the similar images conveyed by the 3 poems studied - For pupils to demonstrate an understanding and personal interpretation of the poems – using their imagination to capture the mood of the poems and the emotions of the personae as well as illustrating metaphors and actions contained within them - To record this in a creative, kinaesthetic way <p><i>Lesson 8</i></p> <ul style="list-style-type: none"> - To identify features and techniques of Duffy and Armitage's poetry and to use these to write own poem to feature alongside those studied, in terms of style and theme - To have confidence in writing in a form that may be uncomfortable - To look critically at own writing and to edit and redraft to make poems more interesting 	<p>Teacher reiterates collage task to whole class, illustrating and asking them to record at least 15–20 images and words they will use to create collage in next lesson.</p> <p>Pupils start work. Teacher solicits ideas from pupils and records them on IWB.</p> <p>Pupils continue working; some work in their books, 5 pairs use internet to find images, and 2 pairs use digital cameras to photograph images around the school grounds. Teacher reviews images collected, with pairs.</p> <p>Teacher questions pupils about their collage ideas.</p> <p>Homework is to write a commentary explaining what poems show about characters and mood.</p> <p>Collages* created during next lesson and photographed by teacher. Pupils went on to write exam-style essays.</p> <p>*("The collage task also aims to develop pupils' ability to select important quotations and to attach these to the images that they create in their minds")</p> <p>Teacher introduces and elaborates task using IWB: writing a poem to fit in with the ones studied.</p> <p>Q&A and annotation of pupil responses on slide re tone, rhythm, sentence length, speaker, imagery/description.</p> <p>Pupils write poems in silence; teacher stimulates pupils' ideas by projecting possible techniques, questions and suggestions at periodic intervals. Teacher circulates, prompting and helping.</p> <p>For last 10 mins, 10 pupils word process their poems at PCs while the rest write them out by hand.</p>

- to use different strategies facilitate access to the poems by a wider group of pupils and to appeal to different strengths and weaknesses in the class;
- to use the poems as a springboard for different aspects of the GCSE course: speaking and listening, reading and researching, creative writing, essay writing;
- to use these approaches as opportunities to increase understanding of the poems;
- to use technology to facilitate pupil learning by increasing engagement and motivation, offering more short activities to provide increased pace, variety and fun in IWB-supported lessons.

Once again, themes defined on our coding scheme for this case study are in italic font throughout the following sections, where we outline Jackie's pedagogical approach.

JACKIE'S APPROACH

Jackie expected the use of different technologies to facilitate pupil learning in various ways, including helping pupils understand the general themes underlying the poems. In her initial interview she described her intention to exploit the technology

so they don't just see ... a poem in isolation, they get a broader understanding that they can bring to it: because poems are image-based, actually transforming those text-based images into concrete images that they take photos of, or find images themselves. So they are starting to realise similes and metaphors by creating them and capturing them, not just saying "this is a simile", you know, going beyond that.

She also asserted that "when it comes to completing the work they take more pride, quite often, in the work that they produce on the computer (as my first research project showed!)". She was concerned about managing time, though, ensuring that the activities fit the planned assessments by

making sure they have sufficient time on each thing, but not too much time. And that they're not getting too bogged down with the IT aspects of things, but the actual learning of the poems and the learning of the techniques.

A central focus of Jackie's approach was to create a *supportive classroom environment* in which collaboration could successfully take place, and her comments about this resonated strongly with those of our history teacher, Lloyd (see Chapter 2). The IWB was deemed particularly helpful here "in terms of planning, and planning extras just in case the pupils need extra help". While activity and discussion were strongly directed, Jackie demonstrated enthusiasm for the work and valued pupils' contributions, especially "when the pupils give it no value themselves":

There's no sense of them getting things wrong in the lesson. Whatever their comment is, it's always valid. So prompting, reinforcing, encouraging, I guess modelling, the way that I'm responding as well. (Interview)

The teacher thus took the role of inquirer, questioning pupils' rationale and listening to their ideas, making the most of their collective resources. Her interactive teaching included an element of assessment and monitoring of progress. In particular the wider range of activities that the IWB offered was considered to increase opportunities for *formative assessment* on a whole-class basis and "on an informal basis through individual discussion".

Use of Technology Resources

Jackie incorporated use of technology within the module primarily via the IWB. At the time of filming, the English department was entirely kitted out with IWBs and their use was well integrated into the teaching of most teachers. Jackie's classroom was equipped with a network computer linked to the internet, an IWB (fixed to the wall) and a data projector. Desktop computers were available at the perimeter of the room. She also used an "Interactive Poetry" CD-ROM published by Heinemann (2004a) to support study of the chosen poems. Her flipchart files included ClipArt and other images downloaded from the internet. Pupils were regularly encouraged to use digital cameras, particularly to create storyboards and to make PowerPoint presentations to show to their peers. In one of the lessons we filmed (Lesson 7), they used the cameras to capture images around the school grounds, and these were then used in preparing collages to visually represent the themes common across the three poems studied. Pupils were also expected to use the internet in this lesson to research the general theme of the poems to "get a broader understanding that they can bring to it" and to find, or create their own images by "transforming those text-based images into concrete images that they take photos of".

A systematic categorisation (using the video data) of teaching mode across the six 1-hour lessons we filmed showed that the IWB was used for direct whole-class teaching for 53% of the total lesson time. (14% lesson time was individual/pair work directly referring to the IWB; 25% was no IWB use; 8% was mixed mode activity.)

Jackie purposefully exploited the IWB technology in developing – and modelling construction of – interpretations of poetry. She did so through using its dynamic visual presentation, provisionality and other interactive technical features, for example engaging the class in:

- capitalising on *availability of multiple resources*, in particular using a range of high quality visual images, but also other media, as in the Lesson 5 episodes described below;
- using *textual annotation* (including labels, links) extensively to facilitate public sharing, generation and recording of ideas in response to projected stimuli, e.g. annotation of an animated "Flower Power" ClipArt image to record pupils' ideas (Figure 4.1);
- using *graphical annotation* (including circling, colour highlighters) as *analytic tools*, e.g. to draw attention to features describing the persona of the poem;

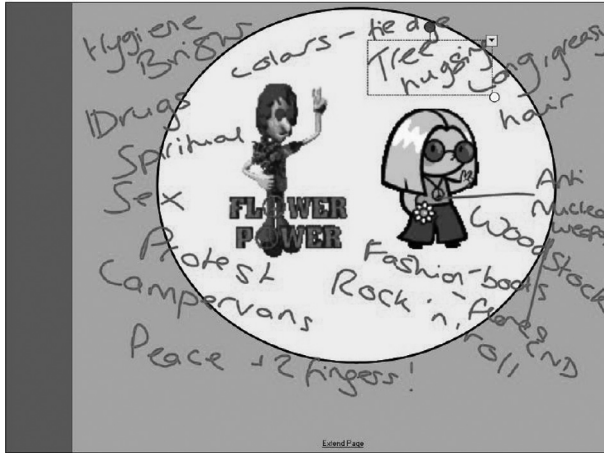


Figure 4.1. 'Flower Power' textual annotation.

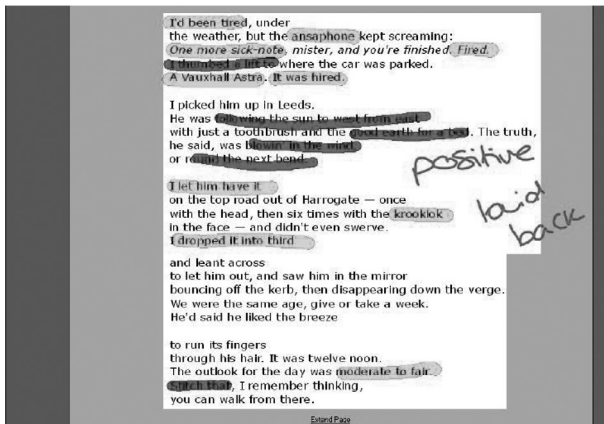


Figure 4.2. Graphical annotation of poem 'Hitcher'.

Figure 4.2 illustrates colour-coded highlighting of modern and old-fashioned phrases in the poem "Hitcher" in Lesson 5, and circling of "slang" terms;

- *focusing*, e.g. exploring the persona in the poem "Stealing" by scrolling through and annotating the displayed text;
- occasional use of *drag-and-drop* for classification, e.g. assigning types of people as those who might, or might not, support anti-social behaviour orders
- (ASBOs), or tactile manipulation by pupils themselves assigning phrases relating to lifestyles of personae to briefcase and rucksack (Figure 4.3).

In sum, technology resources were used as visible, manipulable, dynamic *objects of joint reference (OJR)*, *scaffolds* and *stimuli* for analysis of themes and poetic

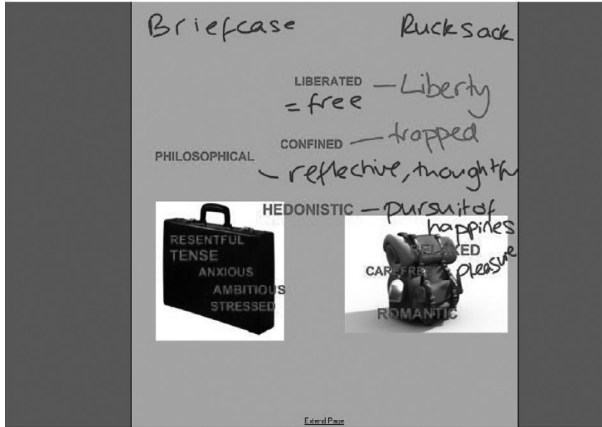


Figure 4.3. Drag-and-drop classification activity.

techniques. IWB technology was particularly helpful in displaying, annotating and manipulating images and texts, as elaborated below.

THEMES IDENTIFIED

Following the pattern of individual video review and comment outlined in Chapter 1, we also held four meetings during the review phase of the study, involving Jackie, her colleague, Tina, and the two university researchers. Jackie’s comments reflected her position as teacher of the class; Tina acted as designated subject practitioner. As the subject specialist, Sue’s comments and questions were aimed at clarifying and challenging Jackie’s approach. Her commentary was particularly valuable in generating material for suggested alternative approaches to the practices depicted, final versions of which were integrated into the “Alternatives” screens of the T-MEDIA English CD-ROM. We shared the commentary and alternatives suggested with Jackie (some examples appear below) and posed questions about them during her final interview.

This section elaborates the main themes emerging (highlighted throughout the text using italics), also summarised in the diagram in Figure 4.4, illustrating them using a number of critical episodes that we collectively identified. (An interactive version of the diagram with hyperlinks to video clips and other material illustrating the themes appears in the English multimedia resource at [http://t-media.educ.cam.ac.uk/.](http://t-media.educ.cam.ac.uk/))

The Teacher’s Use of Images and Other Media to Stimulate Thinking

This case study was characterised by Jackie’s creative use and *annotation of visual images* to provide an *object of joint reference*, to *focus the class and stimulate pupil*

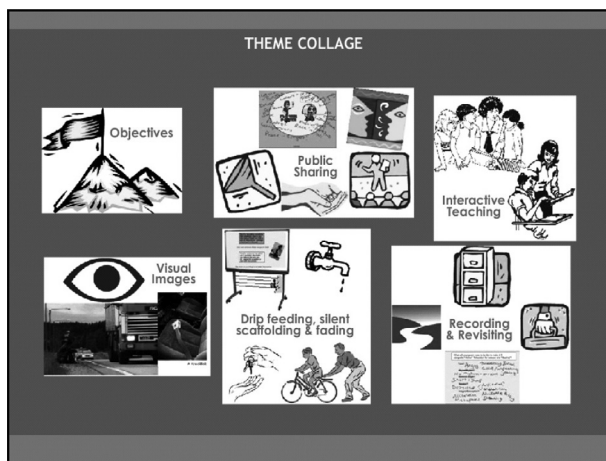


Figure 4.4. English theme diagram.

thinking, hence “to elicit a deeper response” (Tina) and “make them think laterally” (Jackie). In particular, the teacher was *encouraging empathy or personalisation* – “seeing oneself in the text in order to understand the text beyond oneself” (Sue). Jackie described the pictures as provoking learners to come to a personal understanding of the underlying issues and motivations, using their imaginations, their prior experiences and knowledge:

[The images] generally were used to inspire the students to make their own immediate reaction and response to the themes, the characters, the ideas, the locations ... It just gives them a bit of a concrete visual image to latch on to if they couldn’t imagine it for themselves, or if they were imagining themselves in that role, and only had one particular interpretation. ... So it either gives them the support of what that person might be like or leads them [towards] a different way of thinking. (Interview)

The images were used to increase *relevance* by socially *contextualising* the three poems:

Some of the others were just to set things in context really, so there was the picture of the crook-lock and the picture of the DJ’s headphones and so on, and they were really to get them to think about ... what these poems might be saying about society and how society might be changing. So that picture of the crook-lock with the question, ‘What does this image reveal about our society?’ produces some fantastic responses, you know about how we’re all really possessive, we all spend too much money. (Interview)

Jackie expressed the importance of choosing the right image; her care in selecting *high quality images* was appreciated by most pupils in interview. Many of them

came from the Heinemann CD-ROM, which removed the pressure of having to create all of the resources from scratch, but also proved somewhat constraining. Thus Jackie picked out the pictures that she liked, altered the tasks slightly and produced her own versions instead. She included a range of other resources too. This theme is illustrated later on by perusing the activities of Lesson 5. First, we introduce the interrelated themes of *public sharing of ideas*, the activity context in which the images and other stimulus resources were often used, and *interactive whole class teaching*, the pedagogical approach typically used by Jackie to mediate their use.

Public Sharing of Ideas: Supporting Collaborative Interpretation of Poetry

A key theme throughout the lesson sequence was the soliciting and *public sharing of pupils' own ideas* in order to support the notion of thinking through meaning, and supporting whole-class collaboration in constructing interpretations of poems. Annotation was used to display learner contributions – “a visual representation of their train of thought as it develops” – and by both teacher and peers in brainstorming (as represented in Figure 4.1) and building on those ideas to develop collective understanding, confidence and self-esteem – whilst permitting individuality. This process of active *co-construction* included *audible praise* and *relay* of selected individual ideas to the whole class, following small group discussions.

Collective annotation on the IWB was considered by Jackie to generate “more constructive comments and more exploratory thought” than work in small groups, followed by more sharing of ideas in the whole-class setting and the “drawing together of those ideas, both physically and metaphorically” (Meeting). Jackie elaborated on this:

In the past they'd be on a photocopy that they'd have in front of them so they'd be looking at their own. They might have their own annotations, but then the *collective annotation*, I think, generated more comments and more constructive comments and more explorative thought than if they were doing their own in small groups and pairs, because they are responding to each other's ideas.

[In group discussion] the comment's been made and it's been heard but it's then not visually made permanent for it. Because [on the IWB] it is a *permanent record*, isn't it? So whether they've caught onto an idea as it's been said or whether they look at it 20 minutes later, it still happens to be on the board. I think it's quite important because some kids will pick up an idea immediately and others won't. They'll cotton on to it at a later stage and I think that's really important, isn't it?

This process could yield ideas new to the teacher herself: “If you try to teach something, you've got 30 minds in front of you and you haven't heard the same things before” (Interview). It was the key way in which Jackie exploited the interactive features of the IWB, as it was also used non-interactively to display text and images as stimuli.

Jackie *modelled* how to annotate poetry with ideas and to engage in “making comment on the complexity of the themes and ideas – the poet’s motivations”; this was “vitally important for critical analysis” (Colleague comments, Lesson 1 grid). She also modelled the extraction of illustrative phrases (e.g. see Episode 5.4 activity depicted in Figure 4.2) and the linking of ideas when comparing poems:

[Annotation] is a good way for them to see the train of thought as it develops, so if a student mentions something that then another student makes a similar comment to, you can then go back and link them together ... it’s a visual representation of their train of thought. (Interview)

This process of collaborative interpretation was exemplified in Lesson 6 (see Episode 6.2 below). Recording pupil contributions publicly was considered by Jackie to push pupils to develop ideas and to enable the teacher to facilitate pupil learning where ideas were not forthcoming, by focusing on particular words or images and asking directed questions about them. Our subject specialist, Sue, noted a tension here between getting pupils to critique and respond imaginatively to poetry and the inevitable pressures imposed by the assessment framework, and Jackie echoed this.

Where Jackie recorded pupils’ ideas on the IWB (e.g. Figure 4.1), Sue suggested that pupils seeing their *own* handwriting is more powerful. Jackie acknowledged that this could “give them more ownership of their ideas, put them under a bit more pressure to think for themselves rather than collectively as a group ... produce more involvement from certain pupils if they knew that they were going to be doing something”. However she preferred not to invite pupils up to the board usually (though they did come up in Lesson 6) owing to the constraints – lack of time and physical space – reportedly operating here:

When you’ve got people brainstorming ideas, it’s quite quick isn’t it? And if there’s one person writing it down then generally you can get all of it. If you are having to stop each time for someone to make what is quite a long journey from getting up, moving their chair and so on, to the front, writing it, not being sure about how to spell something, the pen not connecting with the board and all those kind of technical hitches that can happen, the flow of concentration from the kids just goes, immediately. I do have them come up sometimes, especially with lower ability students, because they get really motivated by coming up to write something but that lack of concentration from the rest of the class does spoil things sometimes and it makes it more of a behaviour management situation. (Interview).

Interactive Whole-Class Teaching

Using an IWB was considered by the teachers to require an *interactive teaching style* and one that impacts [cognitively] on pupils by “stimulating *active learning*”. It also raises pupil expectations; they come to want experience of sophisticated and entertaining dynamic resources on the whiteboard, and to manipulate them too. The

teachers postulated that pupils' experiences of autonomous use of sophisticated technologies outside school exacerbate this desire.

All of us characterised Jackie's teaching throughout the lesson sequence as a *mix of funnelling* or authoritative interaction and *dialogic interaction/synthesis* (see definitions of these terms in Chapter 3 or glossary) – *whilst exploiting IWB resources and features* – often evident within a single episode. For example in Lesson 6, pupils were observed to be offering their own ideas in response to some prompts intended to characterise motivation of a persona in the poem. Jackie endorsed these ideas but also led them to “voice what she had in her mind”: “This gives them two sets of ideas and they have two things to work with” (Meeting). For instance:

Pupil: In the end he might have killed someone.

Teacher: What is his reason for being so anti-social?

Pupil: He could be someone important if he had the chance. He's blaming education.

Teacher agrees: And the government, his parents, everyone, apart from?

Pupil: Himself.

One researcher described this process as “like steering a moving object. You elicit a thought and then work with it” (Meeting). Our analysis thereby recognised the teacher's marked influence through *prompting* pupils towards target ideas, *assistive questioning*, *filling in* gaps in their understandings and vocabularies, rephrasing and exposing them to alternative perspectives (reshaping thinking). At the same time, on some occasions she used stimuli on the IWB in the course of soliciting, and drawing on learners' own contributions too, and/or *probing* to clarify or develop understanding of themes or definitions. Lesson 5 is used to exemplify this in more depth.

Lesson 5: The poem “Hitcher.” The activities of Lesson 5 portray Jackie's use of a range of visual images and other media, coupled with an interactive teaching style, to stimulate pupil thinking. Figure 4.1 illustrated how in Lesson 5 (Episode 5.1) Jackie introduced the alternative lifestyle of the hitchhiker persona of the poem “Hitcher” by first displaying the “FlowerPower” animation and annotating the slide with pupils' prolific ideas about hippy culture. This was a preparatory brainstorming activity, deliberately building upon pupils' previous knowledge about hippies “as a way into discussion of the typical hippy or hitcher and exposing the prejudices that people have for other people” (diary). The brainstorm format and some elaboration of pupil ideas by the teacher created a collective representation as the outcome. Tina's interpretation of this for us through her comments on the grid made tentative use of thematic coding (terms in brackets) in describing the commonly observed mix of *dialogic interaction* and subtly *reshaping pupils' thinking*:

T allows Ps to come up with ideas. A way of T finding out how much they already know. Ps able to engage with the time period through visual representation.

Clues in the images to assist. These images link directly to the lesson and act as a way to socially contextualise the poem. Questions allow T to extend thinking and ideas and to discuss preconceived ideas. This also reinforces confidence of Ps as they can see how much they already know. (*Dialogic interaction – funnelling and focusing*)?

Stimuli used were not always visual. The introduction to the poem additionally used printed anthologies, the projected text, and photographic images, and an audio recording of the poet (Simon Armitage) reading his own poem aloud, coupled with a photograph of him (Episode 5.2). The audio resource proved a powerful stimulus, as Jackie and her colleague explained:

Listening to him I think you get a real sense of the type of person he is, [which] really dominates that particular poem, because you can almost imagine that speaker being the speaker in the poem. He's got a nice northern accent that makes him sound very down to earth and a typical kind of man that you might meet in a pub ... Simon Armitage is probably the first person to say that the interpretation of the poem comes from the listener and every time he reads a poem it's always different ... with different length of pause or move of the head a particular time and so on. So this is just one particular performance if you like. (Jackie, Interview)

The reading of the poem by the poet gives Ps the chance to hear how the poet meant his words to sound. Showing an image of the poet helps Ps to realise that not all poets are old or dead (Tina, Grid commentary).

And to see somebody who looks like their uncle or father, who's living in this contemporary world and writing poetry now I think is very important for them. (Tina, Meeting)

Both Sue and Jackie pointed out the added value of the IWB technology here in seamlessly integrating the audio and visual resources into the lesson. Sue's comments about using the poet's own voice to introduce a poem were both appreciative – reinforcing the points above made by the teachers – and questioning:

I loved the fact that she showed Simon Armitage speaking, that's fantastic, a lovely resource; it brings home to the students that this is a real person, that they are around still, and when you use something that has the author's voice, quite often they will read it in as kind of bland a way as they can in order not to inform an interpretation; what sits beneath that it is the notion that poetry's meaning resides with the reader not with the writer. Once the writer has released it that meaning is only one of many. But ... I didn't hear Jackie discuss [with the class] why she was doing it.

Sue also suggested that “it would have been fantastic to see the drafts that he'd written, so you could see this poem doesn't emerge in any perfect way,” giving

pupils some insights into the process of writing a poem. Jackie subsequently agreed, although she was uncertain if Armitage drafts existed (she had used drafts of Shakespeare sonnets in the past as these were widely available).

The audio playback was followed by guided discussion and questioning (*dialogic interaction*) concerning comprehension of the subject matter – the murder of a hitchhiker – referring to the text of the poem, projected and scrolled so as to *focus* all pupils' attention. Jackie's own grid commentary described this part of the episode as follows, illustrating her application of our evolving thematic framework.

Dialogic interaction encourages Ps to *empathise* with persona and decide for themselves why the hitchhiker was attacked. T pointing out that we are all guilty of prejudging people – Ps placed in same position as persona. T chooses relevant quotation to support P's idea – *modelling* technique that they will need to develop. T expands upon persona's attitude to work and lifestyle – *authoritative exposition*.

Jackie's aim here was to use ideas contained in poetry to create more developed characters.

I was trying to get an understanding of lifestyle that the businessman has so when we next look at his feelings about the hitcher they've got some firm quotations that they can use in their exams ... but also interpret them and say what tone this creates, what it suggests about the lifestyle of the different personas. So trying to be analytical, encourage their independent thinking. (Interview)

She modelled this analytic process through *dialogic synthesis* during a question-and-answer session, and as alluded to in her grid commentary, through linking lines of the poem to pupils' comments and making references to their earlier responses concerning hippies. Jackie thereby built on learner contributions to highlight the notion of stereotyping and to guide pupils towards understanding that the poem is authored from the viewpoint of a salesman under pressure. University researcher commentary noted that pupils rose to the occasion by giving thoughtful and elaborate answers. For instance:

Lucy: You could just have an opinion of them, like you could think that all hitchhikers are cheap worthless people who are not worth the time of day ... and then anybody who you find hitchhiking, you would have that opinion of, no matter who it is.

Teacher: Okay.

Lucy: So no matter who or where it is, you can always think that his type is scum.

Teacher: Okay, so he holds this view about hitchhikers and they're all the same. Yes? Based upon, perhaps, a previous experience? Yes? Someone he knew.

Lucy: Sometimes just if you see one hitchhiker, sometimes the appearance could be not particularly attractive ...

Teacher: Okay.

Lucy: ... and from that you could then think that all hitchhikers are like this one person.

Teacher: Right, so we're stereotyping? We're categorising people. We're pre-judging them based on one little idea, or one person that we saw. Just like you were doing with hippies. When I said "what do you associate with hippies?" and you were coming up with Drugs, Sex, Rock 'n Roll, protesting, being smelly, lack of personal hygiene, standing up for your rights, all these kinds of things. So this hitchhiker is being tarred with the same kind of brush, being prejudiced against, being prejudiced by this guy.

This account illustrates how the respective commentaries and interaction within the research team and with the subject specialist all contributed to our collective understanding of the teaching and learning in this lesson.

Jackie next displayed a photograph of a bedraggled hitchhiker being passed by a large truck, in order to stimulate deeper pupil thinking about the persona of the poem and allow pupils to imagine a hitchhiker's experience (Episode 5.3). She asked the class, "What can you tell about him?" Then, working in small groups, pupils briefly discussed the relation of the image to their earlier discussion while Jackie circulated, using questioning to draw out, elaborate and gently challenge pupils' (often stereotypical) ideas about hitchhiking and hippies. This is summarised in the following video summary of her discussion with a group of four boys and the associated excerpt of the grid (Figure 4.5).

<i>Teacher</i>	<i>Colleague</i>	<i>Researcher 1</i>	<i>Researcher 2</i>
<i>T encourages Ps to express own views ... Encourages Ps to see hitchers in an alternative way – from hitcher and driver's point of view. Vital for Ps to explore range of responses and interpretations for exam.</i>	<i>T uses the views expressed by Ps but continues to draw out a deeper understanding using assistive questioning.</i>	<i>T talks through ideas with Ps (dialogic interaction), helping them to elaborate them and to make links with prior discussion of themes and hence understanding of society today.</i>	<i>Dialogic interaction; assistive questioning (probing, prompting); T praises P contributions and builds on these; but also puts forward alternative views to broaden P thinking.</i>

Figure 4.5. Excerpt from grid commentary for small group discussion with teacher in English Lesson 5.

Video Summary

P describes how he put thumbs up to a hitcher recently. He thinks they should work and pay for their own transport. T: Does poem contain those views too? P: Definitely. T: There are still people with hippy lifestyles. How does hitching fit in with them now? P: They don't want to hurt the environment so they don't have own car, but don't mind going in other people's. T: Does the hitcher know where he's going? P: No; he's got nothing to look forward to. P: He could be a tramp. T: Some people hitch and see where they get to ... You say they may go to a place because they're bored. But if you're on holiday it may be a nice way of life. P: It depends on the kind of person who picks you up. T: And for the driver? P: The kind of person you pick. T returns to the persona, and his life. P: It's structured everyday [whereas] hitcher's life has twists and turns every step of the way ... P: Depends on money. T: And luck, but at least you have opportunity to do something different. You may meet someone nice or unusual. Group agrees hitcher's life is not all routine.

Related interview excerpts incorporated in the grid included:

T: I tried to get them to think of a more positive lifestyle of a hitchhiker ... I was trying to challenge their ideas and develop their ideas, and then in the class trying to do the same thing.

P: It was difficult relating the two, like the hippies and the hitchhikers, together at first. Once you spoke about it, it became more easy.

Jackie went on to annotate the photograph with pupils' ideas during a plenary discussion of hitcher and hippy lifestyles, and drawing out links with earlier discussions. Figure 4.6 shows how the pupils' views (including some stereotypical ones) are summarised.

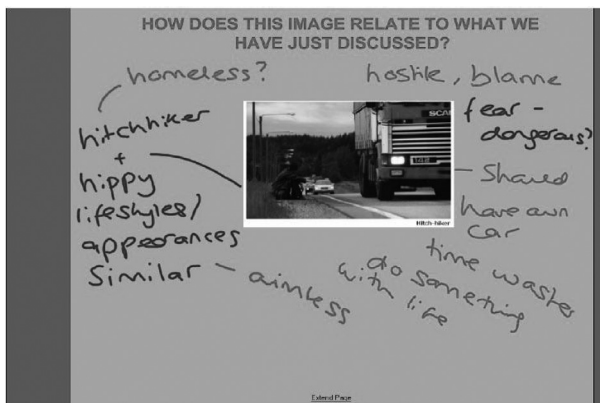


Figure 4.6. Textual annotation of photograph during discussion of poem 'Hitcher'.

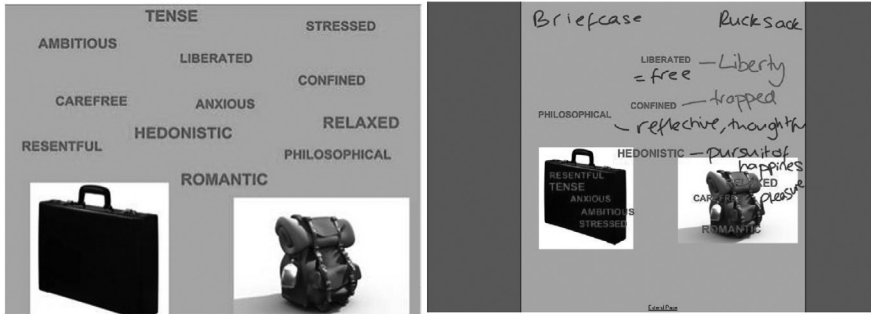
This episode again exemplified *dialogic interaction*. The pair work additionally illustrated how the teacher was *handing over responsibility for learning* to pupils (elaborated later on), and how they were *rehearsing* ideas for the class plenary that followed. These themes are further elaborated below and illustrated with additional examples from Lessons 8 and 6 respectively.

Rehearsing Ideas

Rehearsal of ideas (orally / on paper, with peers / individually) before voicing them to the whole class was a commonly observed strategy. It was conceived by the team as an important form of *priming* for subsequent use of the IWB and as a method of *confidence building*. Tina pointed out that some pupils have difficulty in immediately responding to a question and benefit if they are able to step back briefly, with time to consider and discuss an idea. Engineering this into the teaching avoids any embarrassment, and trying things out on each other enables pupils to formalise their thoughts. Hence, offering occasional opportunities for rehearsal of ideas ensures that everyone has made a decision of some kind and can justify their reasoning. In some cases rehearsal was part of an extended activity aimed at exploring and understanding the behaviour and motivations of characters in depth, as in Lesson 3 when pupils scripted and performed a group role play of an interview or conversation about anti-social behaviour orders (ASBOs) based on one of the poems. Some activity involving the IWB can be construed as a form of priming; the IWB was sometimes used as a stimulus for talk and for ideas constituting a foundation for subsequent pupil writing or the collage construction. Alternatively, in the Lesson 5 discussions summarised in Figures 4.5 and 4.6, the group work is priming pupils for whole-class work on the IWB. This theme and that of *dialogic synthesis* are now exemplified in an account of the two critical episodes identified in Lesson 6.

Lesson 6: Synthesis of Themes Across Poem

In Episode 6.1 Jackie reviewed work done in the last phase of Lesson 5 when a set of words relating to the lifestyles of the personae in the Duffy and Armitage poems the class had studied was displayed on the IWB. In that lesson pupils had begun making columns of words in their exercise books, using dictionaries and thesauruses to find out meanings of unfamiliar vocabulary (priming). In this lesson, Jackie called on a group of four pupils to come and assign the words to the briefcase or rucksack pictured on the IWB (symbolising the hitchhiker and businessman), using the drag-and-drop facility (Figure 4.7a). A class discussion of the meanings followed; some terms were placed centrally after discussion as these were ones whose meanings pupils were uncertain about (Figure 4.7b); this activity offered an opportunity for formative assessment. Pupils subsequently recorded meanings in their books and Jackie used this activity to reinforce and illustrate the notion of metaphor. Pupils generated their own examples during the course of a further lengthy dialogic class discussion.



Figures 4.7a & 4.7b. Understanding lifestyles of the hitchhiker and businessman.

Jackie’s aim was to consolidate learners’ understanding of the ideas previously discussed. She described this as an “initially simple task but one which requires pupils to understand the representation of two lives and to extend vocabulary in preparation for exam style questions” (Grid). The activity sparked some discussion about the meaning, context and usage of words such as “romantic” and “hedonistic”, encouraging pupils “to try and work out the sense or meaning that the poet is attempting to achieve” (Tina, Grid).

Sue commented that using the IWB themselves as in this episode helps learners to be “active makers of meaning”, important in English. Tina elaborated this in her grid commentary:

Ps are confident to contribute and move words around on the IWB even though they are not completely confident about the answers. This allows the opportunity to revisit language already learnt and for further language extension.

Likewise, researcher commentary pointed out that the technology affords *provisionality*; the teacher dragged words around on screen to pursue learning points and pupils could make changes to their choices. In our meeting discussion, the teachers appreciated that “the rest of class were keen to correct mistakes but not in a negative way”. They observed that: “Lower down the school some pupils can be a bit unkind about errors” though they felt this “had a lot to do with how the lesson was set up initially; it’s the ethos of each lesson, how the teacher interacts ... At this school there’s a culture of pupils being quite happy to share ideas. They are often told how creative it can be and things aren’t usually right or wrong. It gives learners confidence to analyse and evaluate different ideas – and that’s vitally important”. This describes a *supportive classroom environment*, as mentioned above.

Reflection upon this episode at our meeting led Jackie to suggest that she could have asked pupils to explain their choices as they went up to the board or they could have already justified these in their books or explained them to a partner. Pupils like the speed of this type of exercise as they can all make a choice without having to do further work! However Jackie felt that with her support, and through

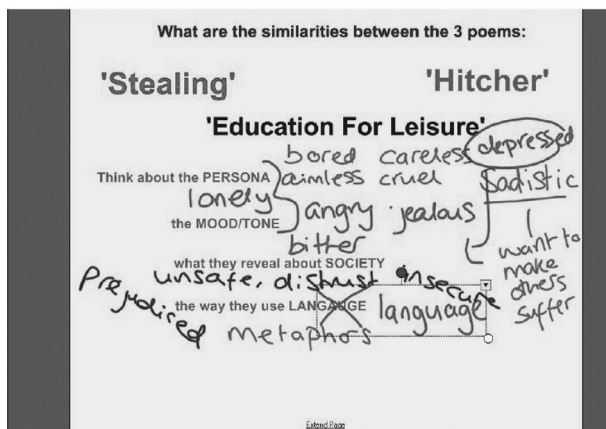


Figure 4.8. Collaboratively identifying themes across poems.

building on each other's ideas, pupils had progressed in their understanding of new vocabulary: "The definitions that some of the pupils gave at this point certainly showed an increased understanding – which, as the group shared their ideas, built up to a fuller definition" (Diary).

Episode 6.2 later in the lesson involved unguided pupil identification of themes across the three poems, working individually, followed by class discussion of the similarities between the poems; this was scaffolded by images from the poems being projected on IWB and it was characterised by dialogic synthesis by the teacher as she and the class constructed a shared understanding (see Figure 4.8).

These activities acted as priming for the subsequent tasks to draw images to reflect one of the metaphors in the poems (three pupils drew theirs on the IWB) and to "create a collage of words and images that capture the mood and subject of the three poems we have studied" (mostly completed in the following lesson). Jackie considered these activities to have been successful in terms of pupil learning:

I was really pleased with the response to the task of comparing the three poems in terms of persona, mood, context and language and was especially pleased that many of them were then able to identify that metaphor had been used in the other two poems, even though I had not pointed this out at the time. This showed real learning and improved confidence in recognising metaphor and understanding their effect in showing emotions. (Diary)

Recording and Revisiting Ideas

Significant "added value" – above and beyond other forms of ICT – is provided by the powerful facility offered by an IWB *to save and archive work, images and annotations and call these up again* in subsequent lessons.

How is this character feeling?

Lonely
Worried
Betrayed
Bored
Frustrated
Depressed
Determined
Confused
Annoyed
Thoughtful
Anxious
Sad

Male teenager

How does this image reflect our society today?

What significance does this image have for the persona of 'Education For Leisure'?

Lonelier society
More complicated technology
Media is vital to us all
-> lazier
-> less independent
-> enables us to communicate across world
Society is unsofatable!

A DJ's headphones

8/9/05

We are going to study another poem by Carol Ann Duffy.

Choose a suitable word that might complete the title of the poem.

Boxers Life Delinquents
Leisure
Education For
Chickens Fun
Cats Entertainment
role in society
what is its purpose? who?

Figure 4.9. Revisiting earlier themes.

Being able to annotate them immediately, keep the photo on there is a really good way of keeping their ideas there and then referring to them again, so if they've forgotten, or if you want to re-emphasise a point then you can go back to it quickly.

For example, in Lesson 3, three annotated slides from the previous lesson (e.g. see Figure 4.9) containing images and/or prompt questions as stimuli, plus recorded suggestions from pupils (relating to a role play based on the poem "Stealing"), were displayed and themes emerging from class discussion were recapped. Images without annotations were also revisited as a form of *silent scaffolding* in the final lesson (8) observed. Familiar photographs evoking key themes and characters (e.g. see Figure 4.10) were displayed as *aides-memoires* (we adopted the term originally floated during the science case study analysis and incorporated it into the coding) alongside the suggested techniques for beginning to write a poem, and supplemented with oral prompts. This is elaborated below under 'Developing intermediate theory.'

The teachers maintained that without the IWB, pupils would have to make more notes, which hinders participation and slows lesson pace. Lessons using the IWB (particularly for brainstorming) "can [instead] move at the speed of the teacher and the responses from the kids". *Recording ideas and discussion* on the IWB was considered to develop pupils' learning "by seeing something on the board that triggers off a thought" and to facilitate preparation for assignments and revision. Jackie asserted that *revisiting* allows her to "prioritise what they are going to remember", "*focuses* students in the same place" and *makes connections* with their previous discussions and jointly constructed interpretations much more easily than reading their notes, which may be incomplete. (This is *reigniting* learning again: another term originally added during the science case study.) Sue again felt that pupils seeing their *own* handwriting is even more effective, but agreed that revisiting annotations was "very helpful [in that] it transports them immediately back to that

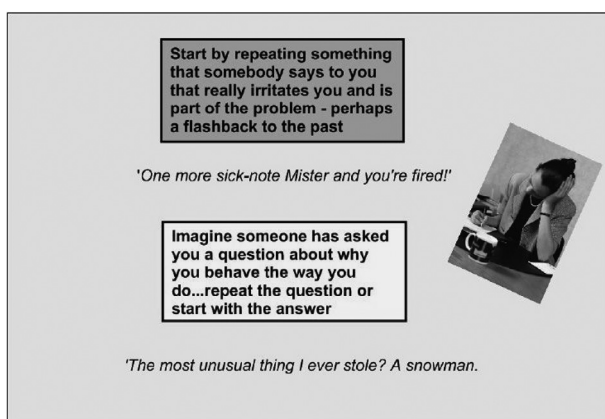


Figure 4.10. Resource for silent scaffolding.

point” and “contributes to a seamless lesson”. Moreover it fosters “*shared ownership* of the response to a poem,” as the teacher elaborated:

It’s really easy to ... show them the images and poems again and the things that they said about them, the key words that we’ve talked about, and it’s all *their* ideas, it’s not just the resource. It’s not my ideas, it’s, “Oh yeah, I said that” or “I remember us talking about that” ... and it isn’t polished. I think my handwriting on there shows that this was done in our lesson, it’s not pre-prepared, it’s real.

Episode 6.1 likewise illustrated revisiting: the class reviewed a Lesson 5 IWB activity which listed columns of words relating to lifestyles of the hitchhiker and businessman personae. Pupils were asked to review this in their books and Jackie also showed a slide used in Lesson 5 (Figure 4.7b).

However, recording in pupil books was used sometimes too; Jackie explained that asking the students to record their ideas in their books focused their discussion and meant that I had more time to go around the room to listen to their ideas. (Diary)

DEVELOPING INTERMEDIATE THEORY

The themes outlined above exemplify some of the intermediate theory developed in the English case. The *process* of integrating relevant ideas from sociocultural theory into our collaborative analyses and refining them using teachers’ own language is now elaborated further through discussion of our final group of themes, illustrated mainly with examples from Lesson 8.

Collectively Refining Codes

As in the two previous case studies, there was a two-way interaction between university and teacher researchers in proposing elements of the theoretical framework. A key example of the reciprocal process comes from Lesson 8 where the class were writing their own poems to fit in with the three poems they had studied. Jackie started them off using a series of IWB slides as prompts; these included small versions of images displayed in previous lessons, which she described as “a visual memory jog to remember the discussions”. *Revisiting* of previous images was supplemented this time with oral and printed prompts to stimulate thinking before poem writing. Some slides presented ideas for techniques pupils could use when writing their own poems, and these were projected in sequence onto the IWB. The prompts exploited use of image, colour, and different fonts, again priming pupils for creativity. Examples included:

“Who/what do you take your anger out on? Describe what you do to it/them.”

“Imagine that you are watching yourself do something from the outside ... describe what you see.”

Time	Video Summary	Teacher	Colleague	Researcher 1	Researcher 2
0:12.11– 0:13.59	<p>T projects a possible technique and a question (with examples from poems). T: Here are some suggestions to start you off. Pick up your pens and in your mind think, "I know who I'm writing from the point of view of. I'm not me any more". T continues making suggestions for the persona and reasoning behind their thoughts/ actions. Maybe they are trying to prove something to the world ... have been let down". Ps should think about where persona is and what has happened in his life. T talks through slide and examples to illustrate techniques.</p>	<p>T anticipates difficulty starting poem. Speaks in 1st person as if they are the persona – transferring thinking in this way to class. T prompting Ps to write specific type of poem. Very real examples given orally with support provided visually.</p>	<p>This slide provides further ideas and T constantly challenges Ps to think by giving examples for them to work with. This helps those who will be struggling without singling them out. All Ps seem engaged. T circulates constantly giving ideas and feedback. Dialogic synthesis</p>	<p>T continues to structure activity for Ps, using (scaffolding) <i>personalising</i> mechanisms (thinking themselves into role) and illustration to give them a handle on the writing task; also allows option of using own way of starting off (<i>giving responsibility</i> for exploration where they can take it: <i>differentiation?</i>)</p>	<p>Scaffolding continues. T guides Ps towards starting point. T models two alternative approaches but leaves open for further ideas. <i>Fading</i>; handing over responsibility. Ps to focus only on launch at this stage. Having provided an earlier overview of the task, T structures / paces / activity sensitively so as to render it manageable.</p>

T = teacher P = pupil

The teacher interview and diary excerpts below elaborate the teacher's rationale in the above episode.

Diary: It was important to establish a comfortable and relaxed environment for the writing process to begin so I didn't want to "intrude" into the lesson too much but still wanted to scaffold the writing process for those pupils who would undoubtedly need help. The SMART Files I produced contained sufficient structure for the majority of the class to start writing immediately – the examples of how the poems studied had begun, were presented visually and orally as I know that some pupils would pick up on what I was saying rather than looking at the board. The SMART Files were not intrusive as they were always there in the background.

Interview: Really what I did was just look back at those three poems and picked out the ways that some of them started or the ways that they were developed, the types of mood. ... and the way that they've resolved their discussion of a topic. So ... those slides were ... prompting them: you know imagine you're the speaker, you're really irritated, what is it that's irritated you? [...] I used it as a scaffold, as a structure for them so they could use as much or as little of it as they wanted to. ... it was really just about giving them ideas. ... "we've done this already, remember? You commented upon the effects of the alliteration and the metaphors, now's the time to have a go at just using them".

Figure 4.11. Sample commentary grid: silent scaffolding.

Grids did not always contain four comments per episode, of course, but the excerpt in Figure 4.11 and the marking of this as a "critical episode" by all four reviewers shows that here there was a clear consensus between all of us concerning the effectiveness of Jackie's structured and supportive approach, with the IWB resources being an integral component. We agreed in the meeting discussion that the process of building up understanding of the poems' themes involved crafting staged and constantly responsive *scaffolding* support; this is linked to the previous notion of authoritative and dialogic interaction in combination. The slide shown at this stage contained some suggested starting strategies, such as "Imagine someone has asked you a question about why you behave the way you do ... repeat the question or start with the answer".

Discussion of this lesson during the review meeting resulted in some additions to the developing coding scheme, in particular the notion of *drip feeding* ideas and support throughout the lesson – originating from Tina's comments on the grid later in the lesson, after the excerpt above:

By slowly building in the different stimuli, the T allows Ps to work with one idea at a time. ... this also acts as a further [nondirective] framework for their developing narratives.

Constantly *drip feeding* examples assists Ps to frame their ideas but use their own words and phrases.

This process encompassed modelling the process of interpretation, and deliberately *constraining tasks* through gradually introducing ideas or support throughout a lesson, as Tina elaborated during our meeting discussion:

Tina: It's like drip feeding isn't it? Constant drip feeding ... when Jackie was going round just sort of talking them through it ... and you find that pupils who have really focused on what they are doing aren't listening but those that are still struggling a bit, they can stop and listen and think, "Oh yes, I can see where to go now" and they get on. Sort of constantly giving them a reinforcement ... maybe helping them to realise that what they are doing is actually the right thing.

Sara: It's constantly responsive assistance, isn't it? [Tina agrees]

Jackie: But it's responsive assistance that is then shared.

Tina: And not to any one specific pupil, just sort of to the whole group, and if they want to listen and share, they can, and if they don't, they don't need to.

In Chapter 3 we offered examples illustrating how the terms *scaffolding* and *fading* (J. S. Brown, et al., 1989) were adopted and reapplied in a new context, namely in science learning supported by technology use. The English teachers were already familiar with the term *scaffolding* before our study, and the discussion in the meeting of Tina's comments developed the notion of drip feeding in terms of Jackie having used the IWB slides to provide a subtle form of visible background support, evocatively termed *silent scaffolding*:

Tina: I think it's part of *scaffolding*, isn't it? It's just much more subtle and it's a continuous process.

Jackie: Yes, I was going to say it's whilst they are in the middle of doing something rather than before.

Sara: Making suggestions as well.

Tina: There was something about the SMART Board being unobtrusive, so as a background.

Sara: That's related to this *drip feeding*.

Jackie: But within the role of [technology].

Tina: Yes, it's sort of like a *silent scaffold*, if you like!

Jackie: With visibility I guess! With visibility for the whole class, a memorable *object of joint reference*.

[...] Tina: That's the nice thing. It's constantly there so there's no fuss. You can just look at it. Nobody knows, it doesn't matter, it's there, it's a reference point. And for some that's very important.

Jackie: And the multimedia aspect of that as well. For example I'd used some of the images that we'd already used. I used different colours for different sections. I used italics I think, for the quotations. So just the fact that it's [technology] meant that I could do all of that.

This dialogic exchange illustrates how a theoretical concept was co-constructed (mainly) by the teachers, through adaptation and extension of an existing concept to a new context of application, whilst capturing the natural language descriptors. Drip feeding was construed as either oral or visual image-based. Both of the terms coined by Tina were added to the coding scheme. Note that Jackie had already suggested after discussing Lesson 5 that scaffolding could be visual and “e.g. visual images” had been added to the definition. Tina had commented: “If we only think of scaffolding in one way, we may not think of something as scaffolding when it is”. This discussion was the precursor for the further extension of the term after analysing Lesson 8.

The addition of the new terms confirms the importance of research knowledge selected for application to practitioner contexts being “susceptible to practical tweaking” or “filtering, fragmenting or fiddling” (Bevan, 2006); that is, it was selected on the basis of the researchers’ sense of its relevance and facility for local adaptation. This point recognises that (contrary to popular belief among student teachers at least) there is no one-to-one relationship between educational theories and practice such that the former can be applied in their entirety; instead they provide a frame of reference and a language with which to name and critically analyse many of the issues that teachers face daily (Gordon & O’Brien, 2007). Theories can be applied in multiple ways, as shown by the cases of bridging theory and practice reported in this book and in other settings, including within different disciplines (*ibid.*).

Strategies suggested could be adopted or drawn upon, or not, by learners; in other words, approaches were placed within reach, providing “differentiated guidance”. There was observation evidence for pupils using the support available as Jackie had intended, for instance starting off by writing independently, then referring to slides for further ideas. Important here was the notion of privacy. Tina pointed out that there was:

visibility [for individuals but] invisibility for the whole class, a memorable [*object of joint reference*] ... It’s constantly there so there’s no fuss. You can just look at it. Nobody knows, it doesn’t matter ... And for some that’s very important. (Meeting)

In interview Jackie highlighted success of the IWB prompts in terms of pupils referring to the slides for inspiration:

There’s no way on a normal whiteboard would all of those things be up there, and on the handout it’s all there at the same time. Whereas with the SMART file it wasn’t overpowering at all.

I saw them looking up at the board and then getting on with their own writing and then if they’d run out of ideas looking back up at it again. ... They used it as much as they needed to. Different students within the group relied upon it completely and then others sort of listened to what I was saying, looked at it maybe and then just did their own thing.

There was some corroboration of this from our observations and from a pupil focus group too:

It was quite difficult getting ideas to write your poem, and how to start it and things like that ...

We're not really familiar with poetry writing. ... She was like explaining things and how to write your own poem using pictures and text on the SMART Board ... [These things] were very helpful. Normally some teachers just read things out ... and it's not as visual if you like, you can't understand it as well.

The silent (and verbal) scaffolding was intended to encourage and legitimise expression of different ideas, along with offering processing time:

Something else that is really important and not necessarily linked to the whiteboard is allowing them time to process information and to give their ideas in lots of different ways. If you scaffold something for them you have to allow them to work within that scaffold and come up with their different interpretations. (Tina, Meeting).

Fading Support

Scaffolding support is always temporary, of course, and its gradual withdrawal – or *fading* – was encapsulated within the theme of *increasing pupil independence* by *handing over responsibility* to learners. This was facilitated by IWB use where resources are transiently displayed. The teacher's aim here was to provide pupils with the tools to illustrate and support an interpretation; she described the activities as an investment for their future work on poetry and creative writing. Some evidence was there across lessons for increasing pupil independence (from the teacher). Reflecting on the writing of pupils' own poems in the final lesson videoed, Jackie described how

they've worked fantastically, independently ... become far more confident in reaching those interpretations themselves, and honing their own style, picking up on things that they like in the poems that they've read. ... There's very little, "Oh, mine's not right" coming from them any more. (Interview)

Independent working was more visible in some cases than others:

There's always scaffolding for them, but they can access it at whatever level they want to ... then they can move on from it. ... The tasks as well have been differentiated to allow them either to tell the story of the poem and just go into more detail about them, or to have their own idea completely and just to use the style of the poems [e.g. in writing the story of an original character that has socially unacceptable ideas]. And the ones that I would have expected to stick closer to the poems have done. But they've still taken it and used it in their own way. They've made it their own. (Interview)

A further example of *handing over responsibility* was seen in Episode 5.3, as described under Lesson 5 above, where pairs of pupils discussed a new projected image and were asked, “How does this image relate to what we’ve just discussed?” (Figure 4.6). Tina, as well as both university researchers, pointed out in their grid comments that here Jackie was continuing the ongoing process of linking the image to ideas, by handing over responsibility to learners to do this themselves through discussion. Tina explained in one of the meetings how she looked for critical episodes related to this theme when reviewing the videos alone:

I watched it again and I stopped it and at points I went back again and watched another little bit. I think more because I was trying to think, “is there a shift somewhere here, is there something that to me seems a very critical moment?” At one stage I remember thinking, “yeah that really moves the students from one level to the next level” and that might not necessarily be focused on a particular use of the ICT but for me as a teacher I could see that shift, and that may well be something that moves them on to being much more independent learners. You know that higher critical thinking may be not necessarily in this scenario but when they come to do something similar again they will already have that sort of grounding and be able to move on much quicker.

Note that *fading* is an example of a term that we did not modify, but applied to various activities observed in several episodes, as above and again shortly after Episode 5.3, where pupils were asked to work in their individual anthologies to “Find words from the poem (‘Hitcher’) that [a] reflect today’s society ... and [b] relate to the hippies’ world”, underlining these using a straight line for modern phrases/words (e.g. technology) and squiggly lines for outdated phrases from the 1960s. Jackie drew sample lines on the IWB slide (Figure 4.12). The aim was to “identify words and phrases which reveal emotions about contrasting lives, so how the poems show

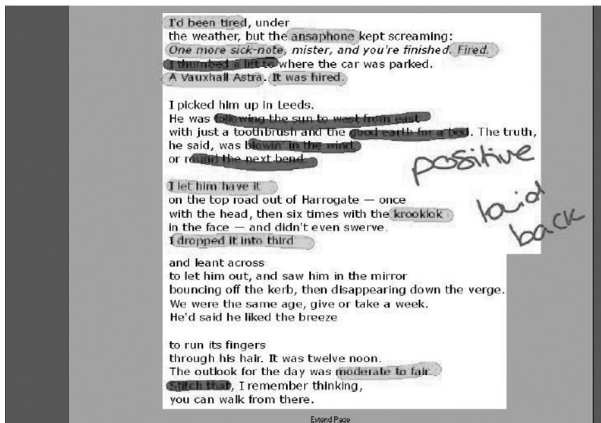


Figure 4.12. Underlining modern and hippy era phrases.

how people feel about two different lifestyles”. The task generated in-depth pupil and teacher–pupil discussions about society’s fear of strangers. This activity acted as further priming for the following Episode 5.4, where Jackie went through the poem on the IWB, highlighting the phrases identified in two colours and annotating the poem with pupils’ ideas. The aim was basically one of modelling, giving learners the “opportunity to look at language change and language tone”.

In this case it was only Tina who had noted the terms *scaffolding* and *fading* in her grid commentary, which stated: “*Scaffolding* of task to directly engage Ps with the language of the poem. (*Fading* and *focusing* used here.)” She was asked to explain this in the subsequent review meeting, where the rest of the team began to understand and concur with her perspective:

Tina: I think I felt that Jackie was backing out because she was giving them the opportunity to express what they wanted in their way.

Jackie: I think it was also me fading, I think it was the other kids in the class fading. As we said a moment ago, they have to make an individual choice and respond to it individually ... it’s a very simple task to underline words and put a squiggly line under a word.

Tina: I think perhaps that’s what I meant by the scaffolding, it was giving them a framework to work within: “this is what you are going to be doing, this is how you are going to be doing it”, but ...

Jackie: ... and how you might do it in the future as well.

Tina: ... but allowing them then to do that in their own way. And it’s made me look at the way that we scaffold things very differently because traditionally we would scaffold them perhaps with writing frames, which is definitely not what you are doing here. You are giving them other ways to scaffold their thinking, but also to scaffold the way that they are actually going to interpret what they are thinking about.

[video clip played; teachers talk over it:] Tina: That’s where the scaffolding comes from.

Jackie: Yes, so it’s not just the question, it’s the interpretation.

Tina: [The examples are] giving them an idea of ... the things that they could be looking for. I think that’s right. Because it’s too open-ended otherwise and also you sometimes need to give them some examples just to get them started, to give them confidence to get started on what they’ve got to do.

Jackie: So they find a brand name, and then ... ‘oh that sounds modern too’, ‘don’t know why but I think it is’.

Tina: Because often the language is similar, isn’t it? And if they can identify one word then they will look forward and identify something ...

Jackie: Like spellings and names, yes.

Tina: Yes, spelt or misspelt. I think that's what I meant there.

Sara: OK, and the fading?

Tina: That was allowing them then to go on and make those interpretations for themselves. So you've given them some stimulus but they've then got to go on and do the rest of that work for themselves and you are backing off. You've given them one idea, or maybe two ideas, but there are lots of other ideas within that that they will hopefully pick up on, once they've got started.

Our understanding of what pupils were taking away from these lessons is informed by Rogoff's (1995) description of how individuals increase their participation in an activity by *appropriating* the processes of communication and shared decision making themselves. In this case it was the processes of devising and supporting an interpretation, and of making connections across texts, that were modelled. Further mechanisms for increasing pupil independence along with *peer collaboration* included class discussions in which any views expressed were considered and developed. An additional aim was thus to foster individual responses to the emerging shared understandings and analyses of language (emphasising metaphor and tone) and its impact. Our analyses indicate – and the pupils' own poems confirm – that responses to the poetry were personal in some places, and influenced in others by the representations jointly developed by teacher and class using the IWB in partnership. The latter were themselves a mixture of iteratively developed, composite interpretations and collections of individual responses.

Pupil Perspectives and Learning Outcomes

The teachers identified several episodes where pupils demonstrated their learning gains. In Episode 5.4 for instance, pupils pointed out that the poet had dropped the 'g' and replaced it with an apostrophe in phrases such as the hitcher 'followin' the sun' and 'blowin' in the wind', a specific poetic device that Jackie herself had not previously picked up on, as she described in interview:

They are really beginning to think for themselves. They are noticing things that I hadn't noticed about language and they are relating it to character and mood... they've got it! If they do that in an exam and they notice apostrophes and they say, 'this suggests the character is relaxed and comes from a different mentality to the driver', and they can explain that and quote it, they've got fantastic marks for that... It was because [the words] were there on the board and because they were all looking at it, they noticed something. And I was then able to pick up on it.

She continued by highlighting learners' increased confidence and analytic skills:

Rather than some glib answer they might have given a few weeks ago they were actually able to say that it does reveal something about the character, whereas when I asked the alliteration question a few weeks ago they were stumped to begin with. They are beginning to have the confidence to take the initiative, saying why something might be written the way it is. Getting down to the minutest detail, the piece of punctuation on the page. So I really think they are beginning to see what we can learn from poems and how poems all have something in common.

So looking at the technical terms that we've been using – the metaphors, the alliteration, the rhyme, the repetition. I think they're beginning to see how one poem might use alliteration but oh yeah, here's another one that's using it; or here's another poem that's using a little bit of rhyme here so why is it doing that?

Tina's grid commentary for this episode independently corroborated Jackie's view:

Pupils' views towards hitcher are changing. Clearly developed ideas about the persona of poem and of the hitcher directly linked to the language of and the structure of certain phrases in the poem... Pupils are now beginning to identify particular words and phrases they would be confident to use if having to write an analysis of certain poetic devices used by the poet to create meaning.

Pupils' own poetry writing during Lesson 8 illustrated further development, as Jackie described:

I was pleased with the way that they had taken my suggestions on board and had picked up on many of the techniques used by Duffy and Armitage such as suggesting there is a second voice involved in the poem, use of language that reflects the speaker's character, interesting metaphors, effective repetition, selective alliteration and rhyme and an overwhelming sense of anger and jealousy directed at another individual. (Jackie, Diary)

And looking at what they've written, they really have created that feeling of anger or boredom or resentment, or whatever it is. They're really raw, they really are full of emotion. (Interview)

Rob, who thinks he's the worst writer in the world, he's really impressed me over the last few weeks with his story and his poem is great. . . He began by writing, 'Am I a monster?' It's really good. . . He's used the techniques really well and he was proud of it. He passed it to one of his mates to look at it – he *must* have been proud of it. And seeing that first reaction from him and from some of the others, 'I hate poems, oh, I'm not writing poems', and [now] they've all written them and they are showing them to their mates. (Interview)

Feedback from pupil interviews on what they had learned about the topic was likewise positive, but unfortunately not particularly detailed:

P: We got to learn about the structure of poems and like the things that are contained in poems, like alliteration, rhythm and stuff.

P: And we had to relate them to the other poems, like the Stealing and Education for Leisure, what we've done in other lessons.

P: And we used metaphors.

Moderator: What helped you to learn them?

P: The pictures and the big writing, and how she explained it and all the SMART Boards.

Jackie summarised pupil learning as follows:

They've picked up on poetic techniques; they've become more confident in reaching their own personal interpretations of the poems; they no longer see poetry as being scary and difficult... They've got shared terminology, shared evidence that they can talk about with familiarity. ...And they'll all have a really good piece of original writing coursework: from what I've read so far they're all of the quality I would expect from the group, or better. And that's because of the stimulus material and the way it's been presented to them I think.

Teacher Perspective on the Collaborative Process

We conclude this chapter with a verbatim account by Jackie, describing in her own words for other practitioners and researchers how we negotiated the shared coding scheme and narrative account using mutually accessible language (Triggs & John, 2004). The perceived subsequent impacts of participation upon the teachers and their colleagues are described in Chapter 8.

The terminology ... to begin with I actually felt it was a little intimidating. To come from speaking in a classroom situation with colleagues, to then going into the University of Cambridge with some academics, who I respected but was a little in awe of I have to confess, to look at this terminology. To begin with it was a little difficult to get my head around it. But as we started to comment upon the lessons, myself and my colleague found that we were writing to begin with in our own language that we would both understand and felt comfortable with and then we became a lot more aware of how what we were saying was actually the same as what Rosemary and Sara were saying, but the way they said it sounded better and also enabled us, after a while, to understand a little bit more of what we were doing and to try and maybe appreciate what we were doing in a way that we hadn't necessarily done before. Having taught for 6 or 7 years, it was quite easy for me to become complacent about the things that

I did every day, so to see it through a fresh pair of eyes and to be given an academic code or technical term enabled us to, not only appreciate what we were doing, but also to see through what we were doing in a different way. So, for example, funnelling, the idea of taking lots and lots of ideas from a class or from a range of lessons and filtering it through into something that is perhaps purer or more concentrate enabled me to sort of understand the way that my lessons were often going, and all of these ideas were being shaken around and then sort of purified and condensed into something more meaningful or more important.

And now, sort of looking back with that wonderful thing hindsight ... the idea of sharing terminology amongst colleagues is fantastic. We did really appreciate the opportunity to discuss these lessons, and although my colleague wasn't having the same treatment as I was with the videoed lessons, she really enjoyed the opportunity to discuss my lessons, compare them with hers, and it opened up more discussion and collaboration between us.

Jackie's enthusiasm for the process of developing theory with colleagues extended to her idea of developing a common terminology with pupils too. She felt this might increase awareness of teaching and learning strategies in lessons, appreciation of learners' strengths and weaknesses, and a sense of shared experience.

And if collaborative theory is beneficial for us, then surely it is for students too? And although I haven't perhaps done this as much as I would like to, it could be something that I could then generate amongst the students within my class, giving us a greater awareness of what's going on in the classroom, both for the students and myself. Perhaps identifying our own terminology that they can coin the phrases, rather than me, giving them a greater appreciation of what's going on in their lessons and a greater sense of our experience being shared. Surely the most beneficial way of doing this is to say to the students: "I value what you see as being important, so you describe it, you come up with the terms in the way that you can understand it." So, like I learned from Rosemary and Sara, then maybe I could help them to refine what they are trying to say too.

SUMMARY AND CONCLUSIONS

This case study adds further weight to the studies presented in Chapters 2 and 3 in terms of illustrating how working together with practitioners to review lesson videos can support intermediate theory building. Our resulting narrative account of the pedagogical strategies observed in English can be summarised as follows.

Jackie's creative use and annotation of visual images focused pupils and stimulated their personal understanding of the underlying themes, characters and motivations in a triad of poems. Group discussions of hitchhiker images helped pupils to formulate and rehearse their thoughts before voicing them with greater

confidence during plenary discussions, illustrating the commonly observed strategy of priming for subsequent technology-supported whole-class activity. The IWB was also used sometimes as a stimulus for ideas underpinning subsequent pupil writing or collage construction – a reverse form of priming. These strategies underpinned the public sharing and co-construction of interpretations through communicating and developing complex ideas and connections between ideas, modelling analytic and writing processes, and scaffolding using projected images.

The two teachers played equal roles in shaping the development of the coding scheme and identification of global themes. Examples of formulating intermediate theory terms included Tina’s notion of Jackie “drip feeding” ideas and support verbally and visually throughout the lesson, ultimately developed in terms of a subtle form of visible, optional support for pupils’ poem writing, known as “silent scaffolding”. We end this chapter by again using Jackie’s own words since they summarise the process we went through together in a nicely succinct way:

So, in conclusion, this shared analytic account, it really was the process of discussion between academics and teachers, looking at the same lessons from four different perspectives, individually. Then coming together and creating terminology that we all felt comfortable with and the combination of academic research and hands-on teaching enabled us all to share the language, but also to see what was going on, perhaps in a different way.

Both teachers subsequently perceived their involvement in the project as an effective form of professional development and their perceptions are elaborated in Chapter 8.

NOTES

¹ General Certificate of Secondary Education: standardised examination taken in a number of subject areas at age 16. English Language, mathematics and at least one science subject are normally compulsory, and English Literature is usually taught to all students too even if they opt out of the examination.

LOOKING ACROSS SUBJECTS AND SETTINGS

The teacher's role, at best, involves a complex shifting of perspectives from the "more-knowledgeable-other" to the "co-constructor of knowledge" to the "vicarious participant". Effective teachers orchestrate the use of ICT, the interactions around it, and their own interventions. (Sutherland, et al., 2008, p. 6).

INTRODUCTION

The previous three case study chapters have illustrated how we worked with expert secondary teachers who used IWB technology to analyse and document their practices in the areas of history, science and English, and to co-construct with the participating practitioners and subject specialists an interpretive framework. This chapter describes and illustrates the diverse ways in which common themes and pedagogical strategies were manifested across the subject cases. Note that individual rather than subject culture differences are highlighted since a single teacher per subject cannot be assumed to be representative. The emphasis here is on summarising the themes emerging rather than the processes of constructing them since those processes have already been described in the preceding three chapters. (The cross-subjects analysis was carried out by the university researchers after the other case studies.) However the overall outcomes of the process of intermediate theory building – the main elements of the framework collaboratively developed for describing teacher mediation strategies related to interactive whiteboard use – are first summarised in Table 5.1.

The analytic codes listed in Table 5.1 were defined in more detail and woven into the longer narrative account in the next section – where inter-relationships are also described and concrete exemplars offer illustration. Of course many examples straddle more than one theme. Inevitably, there is only room for a brief presentation of each of the numerous examples, but in many cases further elaboration has already been offered in the case study chapters, and all examples are fully illustrated and analysed on the multimedia resources freely accessible at <http://t-media.educ.cam.ac.uk/>. Note that there are some inter-relationships between categories, and the intermediate theory column contains sets of emergent codes related to – not necessarily directly defining – the formal terms listed; there is no definitive 1:1 correspondence. Many of the formal terms listed were themselves adopted and used on some occasions in addition to being replaced or elaborated through use of the new terms depicted

*Table 5.1. Terminology emerging from intermediate theory building process
(across subjects)*

<i>Formal theory</i>	<i>Intermediate theory</i>
dialogic interaction	dialogic class discussion, dialogic peer discussion
dialogic communication (non-interactive)	dialogic synthesis
scaffolding	drip feeding, injecting information, feeding in ideas, silent scaffolding, use of keywords
coaching	
responsive assistance	clarifying parameters, constraining tasks, stepped revelation, avoiding alienation, provoking conflict filling in (diagnosed gaps in knowledge) shaping and reshaping thinking, revoicing learning journey
fading	deferring response, hide and reveal (withholding and timely release of teacher knowledge)
shifting responsibility	giving responsibility / ownership to learners active involvement, vicarious involvement
focusing	focusing on correct / salient part of response annotation, highlighting patterns / similarities / differences / links illustrating progress / orienting scene setting / priming for forthcoming activity / centring rehearsing ideas (individually or with peers before class activity)
tailoring to learners' skills and interests	empathy or personalisation relevance (socially contextualising) challenge targeting / calling on individuals differentiation
articulating intersubjectivity	interdependence, public sharing, public dissemination, teacher relaying pupil views to class / individual / group
guided participation	peer collaboration – 'phone-a-friend', peer tutoring and direction encouraging expression of different ideas / highlighting diversity showcasing pupil work supportive learning environment collaborative construction of knowledge collegial, inclusive, democratic classroom culture pupil as expert, teacher as learner, giving status / value to pupil contributions
reflecting exploring	encouraging analytical / independent thinking supporting exploration, prediction and verification capitalising on unexpected outcomes and errors

<i>Formal theory</i>	<i>Intermediate theory</i>
fostering generalisable skills	developing tools for learning / remembering transferable skills
modelling	
consolidating and reinforcing	reigniting / revisiting prior learning (and annotations) mini-plenaries (interspersed throughout lesson) aide memoires, matching digital resources with miniature paper copies intertwining technology / paper resources, corroborating manual methods use of multiple resources

in Column 2. In particular, dialogic interaction, scaffolding and fading were terms very often employed by teachers. Likewise some terms not listed (funnelling, authoritative interaction, modelling, affordances, zone of proximal development, assistive questioning, spiralling) were adopted and used without modification.

The across-subjects narrative originally included our fourth case study subject area of mathematics too. This can be viewed in its entirety as a downloadable resource on the “Across subjects” multimedia resource available at the same site. The mathematics examples are omitted from this chapter since the case was not dealt with in detail in its own chapter, thus the themes and examples from mathematics would have been difficult for readers to follow. Moreover, a small number of further thematic categories and codes emergent across subjects were concerned with teachers’ planning and task structuring, lesson pacing, managing use of technology and so forth but these are not included as they are less relevant to the themes highlighted in the case study chapters. (The full set of themes is, however, presented in the “Across subjects” multimedia resource, with hyperlinked video exemplars as in the four separate subject resources.) The across-subjects theme map is duplicated in Figure 5.1 and a breakdown of the remaining themes by subject case appears in Table 5.2; details of how the themes were manifested in the various subject areas again appear in the following narrative account under ‘Cross-subject themes identified.’

USE OF TECHNOLOGY RESOURCES

The themes outlined below are elaborated via this summary of *how* the English, history and science teachers (Jackie, Lloyd and Chris) exploited IWB technology – in particular the affordances of dynamic visual presentation, provisionality and technical interactivity – to support learning by using:

- multiple resources: a range of visual images, texts, diagrams, animations, audio / video clips, simulations, quiz, paired statements activity, flexible camera (“iCam”) in science

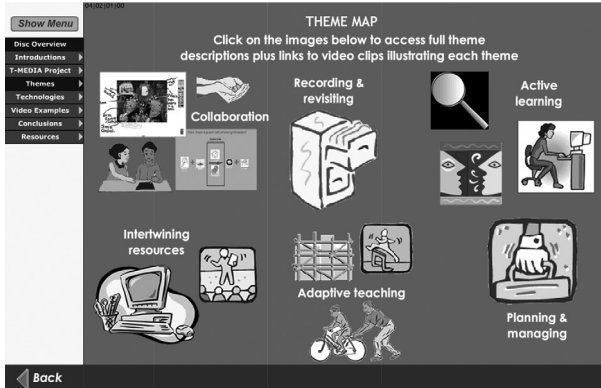


Figure 5.1. Cross-subjects theme map.

Table 5.2. Themes emerging by subject case

Theme	English	History	Science
Supportive environment for collaborative working	Co-construction	Co-construction 2 nd order concepts Collegiality	Public sharing
	Focusing & making connections	Focusing & making connections	Focusing, Orienting Equation Knowledge building
Stimulating active learning & dialogic interaction	Interactive teaching	Active learning	Active learning
	Dialogic interaction	Dialogic interaction	Explore & verify Dialogic interaction
Adaptive teaching	Vicarious involvement	Hands-on learner use of technology	Hands-on learner use of technology
	Scaffolding & fading	Vicarious involvement	Vicarious involvement
	Transferable skills	Scaffolding & fading	Stimulating thinking
	Visual images	Transferable skills	
Intertwining resources	Personalisation	Personalisation	Personalisation
	Rehearsal, priming	Intertwining resources	Intertwining resources
Recording & revisiting	Rehearsal, priming	Rehearsal, priming	Rehearsal, priming
	Revisiting	Revisiting	Revisiting
	Smooth & turbulent lesson flow		Aides memoires Matched resources

- textual annotation (labels, thought bubbles, tick/cross, handwriting conversion to aid legibility and/or pupil spelling), especially to facilitate sharing of ideas
- graphical annotation (circling, highlighting, underlining, shading) as analytic tools, e.g. to render complex ideas and language more concrete and salient or draw attention to particular features
- focusing, e.g. spotlighting, enlarging, zooming, hide and reveal, overlay, scrolling, to investigate detail, orient, maintain attention on key concepts / relationships, reveal “correct” answers, or create suspense
- drag and drop for classifying or arranging components (e.g. photosynthesis equation)

In sum, technological resources were employed as publicly visible, manipulable objects, scaffolds and stimuli for thinking, and tools for shared communication. Individual themes are now described.

CROSS-SUBJECT THEMES IDENTIFIED

Supportive Environment for Collaborative Working

This theme describes how the science, English and history teachers respectively exploited interactive whiteboards to create a supportive environment for co-constructing conceptual scientific knowledge, interpretations of poems and understandings of historical events, and how they modelled those processes.

Public Sharing of Ideas

Many of the exemplars of this theme illustrate active pupil participation in collective whole class activity. This *public sharing* and *showcasing* of pupil work was believed both to give pupils confidence to articulate their reasoning and to prompt other pupils’ thinking and evaluation. It relates to the notion that use of projection technology supports scaffolding of pupils’ thinking by hearing others’ suggestions and explanations and comparing them to one’s own. Here it served as a visible, manipulable *object of joint reference* throughout the lesson sequences, with the teachers exploiting this by publicly interpreting the display and helping pupils to explain their own ideas to the class.

EXAMPLE. In **Science Episode 1.2** (see Chapter 3) Mandy and Rowena drew their own diagrams of sugar storage freehand on the IWB (Figure 3.6) for the class and interpreted them verbally, then Chris used the iCam to project Martha’s complex diagram from her book.

Co-constructing Interpretations

A central theme emerging in both English and history was creating a supportive environment for the active *co-construction* of interpretations – of poems and

historical events or artefacts. The soliciting and *public sharing* of pupils' own ideas in the whole class setting was strongly supported by collective *annotation*. This was followed by the drawing together of and building upon the ideas generated to develop collective representations, understanding, confidence and self-esteem – whilst permitting individuality. This process represented the key way in which Jackie and Lloyd exploited the interactive features of the IWB. Spotlight and zoom features also supported building up of vivid pictures in history by facilitating public sharing of ideas.

Jackie *modelled* the annotation of poetry, critical commentary on the poet's motivations and the complexity of themes and ideas, and the extraction of illustrative phrases. In history the process of generating ideas and thinking more deeply about different problems involved simultaneously teaching **second order concepts** such as **causal reasoning** and **historical inquiry**. These were taught through subtly modelling (in different contexts) what historical analysis and inquiry are (using the IWB), with a broader aim of developing pupils' responsibility for their own learning, plus critical reading and analysis skills applicable in everyday life. The technology was integral to this process, allowing processes of historical thinking to be made graphically explicit on the IWB which functioned as a form of collective notepad at the front of the class (Deaney, et al., 2009).

EXAMPLE. In **English Episode 5.4** (see Chapter 4) Jackie led the class through an analysis of the poet's language, modelling identification of slang and tone in the text to convey a casual attitude and provoke emotional reactions (highlighting the phrases identified), and modelling annotation of poetry with ideas and themes.

EXAMPLE. **English Episode 6.1** (see Chapter 4) illustrates construction of shared definitions of vocabulary relating to lifestyles of personae through teacher-led discussion and annotation. Here Jackie called four pupils to come and assign the words to the briefcase or rucksack pictured on the IWB (symbolising the hitchhiker and businessman), using drag-and-drop. The meanings were discussed by the class and recorded in books.

EXAMPLE. In **History Episode 1.2** (see Chapter 2) analytical thinking was fostered through pupils identifying salient features of a portrait of the young Queen Elizabeth I, annotating it and drawing inferences. Learners were required to interpret their peers' thinking by drawing links between features of the image and descriptive labels around the picture that others had already written without comment. Pupils thereby "guessed the thinking of others and extended their own knowledge" (Lloyd). This activity developed a collective, enhanced understanding of the "golden age" of Elizabeth.

EXAMPLE. In **History Episode 6.1** pupils annotated sources concerning defeat of the Armada on the IWB and justified the links they made. Lloyd encouraged pupils to develop a sense of historical inquiry, understanding the variety of reasons for the English victory.

Collegiality

Underpinning the theme of supporting collaboration was the notion of fostering a sense of collegiality through developing an inclusive, mutually supportive classroom culture. All of the teachers gave status to and valued pupils' ideas, developing the sense of a shared (albeit teacher-led) journey of discovery and of overcoming difficulties together. The use of language such as 'we' served to reinforce this to pupils.

EXAMPLE. In **History Episode 1.1** (see Chapter 2) Lloyd used the famous Armada portrait to introduce the central notion of the 'golden age of Elizabeth' and pupils annotated it to indicate how the picture depicted that: "*We're starting to build up a picture of this woman now, using this portrait, aren't we?*"

EXAMPLE. In **Science Episode 3.1** Chris reminded pupils of how "*we* focused specifically on the question there, "Is chlorophyll needed for a plant to photosynthesise, and *we* found out the answer was yes..."

The teachers thus took the role of inquirer on some occasions, questioning pupils' rationale and listening to their ideas – making the most of their collective resources. The technologies used were particularly helpful here, for example 'in terms of planning, and planning extras just in case the pupils need extra help' (Jackie). The display board in particular (being neutral) was thought to take some of the personal focus away from the teacher and to make it easier for pupils "to engage much more openly... to interact, to make comments and take risks because it's a physical object there" rather than a teacher awaiting a correct answer (Chris).

Collegiality was strongest in history where (as described in Chapter 2) Lloyd took a *democratic approach* that treated pupils as collaborators or even 'experts' (for example in bringing salient perspectives to bear):

It's very much that you come out of the lesson having learnt some new history based on what the kids have said... everybody has an equal stake in what happens. It's trying to get away from 'teacher as expert'.

He created a classroom community that reflected the collective knowledge of its members, describing this as 'interdependence'. (He tried to ensure equitable use

of the IWB by all pupils too.) The IWB technology was harnessed to enhance this preferred participatory approach. See the example of **History Episode 1.2** above; Lloyd claimed that he had learned a lot about the paintings through exploring them with pupils: “We’ve all come with different understandings of what this means and we’ve built a more collective... view.”

EXAMPLE. In **History Episode 3.1** (see Chapter 2) the class worked together towards understanding the problems facing Elizabeth, the causes of poverty and relationships between them, through discussing a previously annotated text and dialogic class discussion – eliciting, reinforcing, elaborating and extending learners’ ideas rather than simply presenting authoritative views.

FOCUSING, ORIENTING, AND CONCEPTUAL AND PROCESS KNOWLEDGE BUILDING

Focusing: Helping Pupils to Make Connections

Recording pupil ideas publicly on the IWB and using the annotation feature or scrolling through displayed text was considered to stimulate development of ideas, for example by *focusing* on particular words or images and asking directed questions about them. In English this included colour-coded highlighting for categorisation and circling of key uses of slang in **Episode 5.4** (see Chapter 4; Figure 4.12). It facilitated the linking of ideas when comparing poems, offering

... a visual representation of their train of thought as it develops, so if a student mentions something that then another student makes a similar comment to, you can then go back and link them together. (Jackie)

We saw above how in **History Episode 1.2** joint annotation of the portrait of the young Elizabeth with descriptive labels involved pupils building directly upon each other’s contributions by connecting their labels with features of the image.

Orienting Learners

In science the equation of photosynthesis (see **Science Episode 1.3** in Chapter 3) was repeatedly displayed and manipulated on the IWB as a pivotal support to chart and illustrate what Chris described as the ‘learning journey’. As mentioned in Chapter 3, it was used in every lesson although in different ways for diverse purposes (further episodes included 2.3, 3.1, 4.2, 5.1, 6.1). This is described further under the theme ‘*Revisiting*’.

The equation showed how concepts were linking and building up across the sequence, playing a major role in orienting learners – in other science topics too – by illustrating what had been covered, how this fitted into the complex ‘bigger picture,’

and what remained. For example at the beginning of Lesson 3 Chris ‘set the scene’ by explaining that the class would focus on sunlight in this lesson and he looked ahead to the next one. He pinpointed light and chlorophyll factors in the equation as the current focus.

STIMULATING ACTIVE LEARNING

All of the teachers were concerned with *fostering active involvement in learning*, defined in terms of physical participation in technology-supported activity or discussion and/or cognitive engagement. Chris talked about using the technology to “provoke thinking”, to “engage with the mystery of science,” to provide clues “to make them want to find the answer”, as in the idea of ‘Leaf Detectives’, and to support storytelling. He exploited the IWB in stimulating scientific thinking through engaging pupils in prediction, exploration, verification and problem solving: “[Predicting] gives people some sort of investment in the answer... they’re having to engage with their earlier ideas, they’re having to be prepared to justify their answers using some scientific knowledge.”

EXAMPLE. In **Science Episode 3.1** Chris posed the question “Do plants need light to make food?” pointing out that some plants have no green leaves and some get no sunlight for 6 months; learners carried out an experiment to investigate this, comparing leaf starch levels between a normal plant and one kept in the dark for 48 hours.

EXAMPLE. A pairing quiz-type activity in **Science Episode 6.1** (see Figure 3.1) used the IWB technology to provide “as many active challenges as possible” for all pupils; Chris chose one girl, Rita, to carry out the activity on the board while requiring other pupils to mentally consider her answers, “not just saying it’s right or wrong but asking [the class] to vote on how many were right, picking on the people who thought there were some wrong. . . . It would have been very very difficult for any pupil to be passive in their learning.”

Active participation was evident throughout all of the history lessons, where Lloyd encouraged pupils to take responsibility for their own learning. There was extensive emphasis on pupils making and justifying their own contributions, and learning to evaluate competing interpretations. **History Episode 1.2** – pupil annotation of the portrait of the young Elizabeth – is an example of this. In **Episode 3.3**, learners used drag-and-drop to assign causes of poverty to categories on the IWB, justifying their decisions during whole class discussion while Lloyd teased out their thinking. And in **Episode 6.1** (above) pupils annotated sources (concerning defeat of the Armada) on the IWB and justified the links they made.

Interactive Whole Class Teaching (and Dialogic Interaction)

Stimulating active learning in English was linked with the *interactive teaching style* associated by the teachers with using an IWB – “It forces you to move about” – and impacted [cognitively] on pupils. *Mode of communication* emerged as the critical feature of interactive whole class teaching here and indeed in all subjects. **Dialogic interaction** involved learners and teacher sharing or exploring ideas, often in a completely open-ended way, and **dialogic synthesis** enabled the teacher to bring together and shape pupils’ thinking. Lloyd’s approach in history was particularly firmly rooted in a dialogic style of communication and all of the selected examples exemplify this. The crafted interplay of classroom dialogue with the various affordances of the technologies used was evident.

Teaching throughout the lesson sequences was in each subject characterised to some extent as a *mix of dialogic interaction/synthesis and funnelling or authoritative interaction* – *whilst exploiting technology resources and features* – often evident within a single episode (especially in English). Our analyses thereby recognised the teacher’s marked influence through prompting pupils towards target ideas, **assistive questioning**, **filling in** gaps in their understandings and vocabularies, rephrasing and exposing them to alternative perspectives, i.e. **reshaping thinking**. At the same time, on some occasions the teacher was using stimuli on the display board in the course of soliciting, and drawing on pupils’ own contributions too, and/or probing to clarify or develop understanding. One researcher described this process as “like steering a moving object. You elicit a thought and then work with it”.

In **English Episode 5.3** (see Chapter 4) dialogic interaction was observed between the teacher and a group of pupils discussing the annotated image of a hitchhiker. In the following **Episode 5.4** dialogic interaction occurred in conjunction with ‘funnelling’ towards target ideas as Jackie led the class through an analysis of the poet’s language (slang, tone).

In **History Episode 1.2**, during joint annotation of the portrait of the young Elizabeth, as we have seen, learners offered ideas, elaborated them and built on each other’s contributions. We also saw how **Episode 3.1** involved the class working together towards understanding the problems facing Elizabeth and the causes of poverty, using textual annotation and dialogic class discussion.

EXAMPLE. Dialogic synthesis was observed in **Science Episode 4.2** after Chris asked pupils to predict whether starch would be found in the leaf of a plant deprived of CO₂, normally needed for photosynthesis. During the discussion Sherrie used an analogy with a plant leaf in the shade being able to stay alive, postulating that the plant can thus deliver starch to a deprived leaf. Chris responded as follows.

C: Very interesting. So what you’re thinking about are things like light. When you get a plant, the top leaves have got light and the bottom leaves haven’t, have they?
P: No, so maybe they send it down?

T: So maybe they send it down. So maybe there's an example there that Sherry's using, sort of a different view that we'd like. There are plants that are shaded, but when you shade a leaf, it still stays alive, so maybe the same is true here for carbon dioxide.

Interactive whole class teaching included an element of *assessment and monitoring of progress*. In particular use of the IWB in English was considered to increase opportunities for both formative and summative assessment, but especially *formative assessment*, both on a whole class basis and through individual discussion. Jackie asserted that this was because a wider range of activities could be offered.

Hands-on Use of ICT versus Vicarious Pupil Participation

Hands-on use by learners – annotation, manipulation of objects or freehand drawing to represent their ideas on the display board – was observed on a few occasions in English and science and very frequently in history. In history, *vicarious involvement* of pupils in classmates' activity at the IWB (e.g. through guesswork, voting) was considered to demand more concentration from all pupils and to encourage debate and risk taking whilst avoiding alienation.

Examples again included **History Episode 1.2** (pupil annotation of the portrait of the young Elizabeth), **Episode 3.3** (pupils assigned causes to categories on the IWB, justifying their decisions during whole class discussion) and **Episode 6.1** (pupils annotated sources and justified the links they made).

Further examples already elaborated above included **English Episode 6.1** where pupils categorised words relating to the lifestyles of personae into two categories through dragging and dropping. In **Science Episode 1.2**, Mandy and Rowena drew their own diagrams of sugar storage on the IWB and in **Episode 6.1** Rita used drag-and-drop to represent for the class her matching of plant cell features with functions.

Chris deliberately chose pupils with shakier understanding or asked the least active group to come and explain the depth of their understanding so that there was more room for discussion. However opportunities for physical manipulation on the IWB by pupils were inevitably limited by numbers and were in fact deemed to be of secondary importance: "The most important thing is that they're actively learning in whatever sense," ideally motivated by "a personal stake in the outcome".

Chris asserted that activity "can be interactive at a cognitive level rather than a physical level". Voting with a show of hands or canvassing class opinions after a peer has interacted with the IWB ("Which ones do you think are wrong?") was a key activity which created a safer forum for pupils to express their thinking than speaking out in class. It placed the focus on the board, "taking the spotlight off the child, they can feel freer to give their ideas knowing that not everybody is looking at them." Instead "everyone is in the spotlight" through being challenged to evaluate and verbalise their understanding or misunderstanding.

A key example was **Science Episode 6.1** (Figure 3.1). Chris asked the class to vote on how many of Rita's matching pairs of plant cell features with functions were right, after individuals had undertaken the activity in their own books. Learners checked or revised their diagrams against her correct model before recording the correct version in their books. Earlier research suggests that testing viability of conjectures and understandings against corporate meaning is an important component of interactive teaching (Jones & Tanner 2002).

Scaffolding and Fading

The **dialogic** style of interaction already described under the theme of Interactive Teaching characterised an *adaptive teaching* approach (Randi & Corno, 2005) in which teachers continually assessed (informally) and adjusted to learners' needs (*responsive assistance*) to move forward both individuals and the class group. A central notion underpinning adaptive teaching was **scaffolding** of learning through structuring of activities, through **dialogic interaction** and **funnelling**, and through drawing on pupils' own examples and suggestions as a resource (as outlined earlier). Scaffolding was evident in some form in all of the classrooms observed, as was the strategic withdrawal of its support (**fading**). Fading was encapsulated within the theme of increasing pupil independence by *handing over responsibility* to learners and stimulating them to take the next steps themselves. An example was **English Episode 5.3** (see Chapter 4) where the teacher handed over responsibility as small groups of pupils discussed the relation of an annotated image of a hitchhiker to their earlier discussion of the poem.

Projected display served as an **object of joint reference** during introductions and mini-plenaries with the class throughout lessons, and an important focus for dialogue with small groups. Use of the (non-digital) whiteboard allowed output to be annotated too. In history Lloyd regularly drew on a range of (ICT and non-ICT) resources, including peers, during scaffolding. His introduction of a writing frame in the last lesson demonstrated a balance between modelling an approach and withdrawing support to encourage pupils to develop their own writing structures.

In **History Episode 6.1** (see above) where pupils annotated sources on the IWB and justified the links they made, Lloyd scaffolded through questioning, e.g. "Look at the wind again Jack. Is there any other source that we haven't looked at that we might be able to join with Source C?"

In English the process of building up understanding of the poems' themes involved crafting staged and constantly responsive scaffolding support. As elaborated at some length in Chapter 4, this encompassed modelling the process of interpretation, and deliberately *constraining tasks* through a gradual (verbal and visual) *drip feeding* of ideas or support throughout a lesson, as colleague Tina described it (**English Episode 8.2**). Closely related was the notion of a *silent scaffold* also coined by Tina on the same occasion and defined as optional, unobtrusive support. Described by the teachers as more subtle than verbal scaffolding, silent scaffolding was notably

“a continuous process... whilst [pupils] are in the middle of doing something rather than before they do it.” Slides presenting ideas for techniques to use when writing their own poems were projected in sequence onto the IWB in order to provide this kind of background support. Strategies could be adopted or drawn upon, or not, by pupils, i.e. approaches were placed within reach, providing *differentiated guidance*. Pupils used the support available as Jackie had intended, for instance starting off by writing independently, then referring to slides for further ideas.

In science Chris again used *scaffolding* strategies, to respond to individual and collective learning needs and to stimulate higher level thinking. Questioning was prominent; drama and narrative (storytelling) were also employed to stimulate curiosity and focus attention on the key aim of an investigation. As in English, these interactions and techniques were again supported by use of the IWB as an *object of joint reference* – to provide clear instructions or visual cues. Examples include the story of the plant kept in the dark (**Science Episode 3.1**).

Chris withdrew support after scaffolding; asking learners to create their own notes, annotations of mini-diagrams and graphical representations of new concepts and processes in their notebooks (see ‘Recording’) were major forms of *fading*. The resulting representations offered permanent records and aides-memoires so that ‘semi-scaffolding’ remained available. A prime example was the generation in **Science Episode 1.2** of pupils’ own personal representations of how the cell wall protects and supports, after Chris gave them some examples from previous classes, and pupils’ sharing of them with the class.

Teacher assistance was also withdrawn through giving direct instructions on carrying out a practical, then deliberately displaying only hints and ideas on the IWB. Pupils therefore had to make the information their own during recording and writing up, using diagrams as they saw fit and adding their own comments (**Science Episode 3.1** again).

Transferable Skills

Fading was facilitated by transient display of resources on the IWB, for example in English. Jackie’s aim here was to provide pupils with the tools to illustrate and support an interpretation; she described the activities as an investment for their future work on poetry and creative writing.

Our understanding of what pupils were taking away is informed by Rogoff’s (1995) description of how individuals increase their participation in an activity by **appropriating** the processes of communication and shared decision making themselves. In English it was the processes of devising and supporting an interpretation, and of making connections across texts, that were modelled. An additional aim was to foster individual responses to the emerging shared understandings and analyses of language and its impact. Our analyses indicated (**English Episode 8.2**) – and the pupils’ own poems confirmed – that responses to the poetry were personal in some places and influenced in others by the representations jointly developed by teacher

and class using the IWB in partnership.¹ The latter were themselves a mixture of collections of individual responses, and composite interpretations that had been iteratively developed. In another example from **English, Episode 5.4** we saw above how Jackie modelled identification of linguistic devices in a text and annotation with ideas and themes.

In history Lloyd aspired to develop critical reading and analysis skills applicable in everyday life – when reading newspapers and so on. **History Episode 6.1** again offers an example (pupils annotated sources and justified the links they made).

Personalisation

IWB technology is seen here as an aid to affective and cognitive engagement through *encouraging pupils to visualise themselves in a particular scenario or role to relate a concept to themselves*. Chris felt that his approach to whole class teaching was subtly different from the traditional sense in which the teacher tries to get all pupils to come to the *same* understanding: it was ‘pupilcentric’ as described in Chapter 3. Asking pupils to construct their own *aides memoires*, and to annotate mini-diagrams for themselves (see ‘Recording’) were both elements of Chris’s approach and they helped learners to actively translate board work into books. Personal advances in learning were graphically represented on his own theme diagram (see Chapter 3) by having pupils located at different points as they moved along a ladder representing the ‘learning journey’.

Examples include **Science Episode 1.2** where Chris asked pupils to draw their own image to remind them that the plant cell wall protects and supports. In **Episode 3.1** mini-diagrams were provided to detail a practical method (testing what happens to plants kept in the dark). Pupils were encouraged to annotate these with humorous captions, as modelled on the IWB.

English activity was characterised by creative use and annotation of visual images by the teacher, to stimulate pupil thinking and ‘to elicit a deeper response’ (Tina). In particular, Jackie was encouraging *empathy* – ‘seeing oneself in the text in order to understand the text beyond oneself’ (Sue). She described the pictures as stimulating imagination and provoking pupils to come to a personal understanding of the underlying themes, characters, issues and motivations, using their prior experiences and knowledge. Jackie expressed the importance of choosing the right images for this.

EXAMPLE. English Episode 5.3 (see Chapter 4). Learners developed empathy with the persona of the hitchhiker during whole class and small group discussion. In **History Episode 1.2** once again, joint annotation of the portrait of the young Elizabeth required pupils to guess the thinking of others (historical empathy) and the teacher claimed that he learned new things about the paintings through exploring them with pupils.

INTERTWINING RESOURCES

ICT Resources

The case studies all employed a range of technology resources and blended their use to support learning and increase motivation and engagement. In English, provocative and informative visual images were employed in every lesson and an audio recording of a poet reading his own work aloud proved a powerful stimulus too. In history, images, texts, audio clips and simulations offered historical evidence for interaction and manipulation. Multiple resources in science included visual images and diagrams, texts, a quiz and a paired statements activity, an animation, a simulation and the iCam (**Science Episode 1.2**). Further illustrations from each subject are in the case study chapters and as follows.

EXAMPLE. English Episode 8.2. Composite text and image displays from poems studied were used to stimulate thinking before poem writing.

EXAMPLE. History Episode 1.2. ‘Do pictures tell us everything we need to know?’ Multiple sources were then drawn upon in subsequent lessons to consider factors affecting Elizabeth’s reign.

EXAMPLE. Science Episode 6.1. Chris used a matching pairs activity, the equation of photosynthesis with the spotlight feature and then an interactive 3-D diagram of the internal leaf structure.

ICT and non-ICT Resources

In each subject, other, non-ICT resources were used in conjunction with ICT tools; one teacher described this as the *intertwining of ICT and other resources*. In history and science these included ‘matched resources’ (see ‘Recording’) and texts. In English Lesson 7 a collage activity involved integration of various digital photographs / texts and non-digital images. In history there was concurrent use of a non-digital whiteboard, e.g. for instruction or reference, including key ideas to support processing of material on the main display screen. Worksheets were also used in history to provide information feeding into pair and whole-class discussion.

Rehearsing Ideas / Priming

Rehearsal of ideas (orally / on paper, with peers / individually) before voicing them to the whole class was a commonly observed strategy in every subject case. It was conceived as an important form of *priming* for subsequent use of technology and

as a method of supporting *confidence building*. Tina pointed out that some pupils have difficulty in immediately responding to a question, and benefit if they are able to step back briefly, with time to consider and discuss an idea. Engineering this into the teaching avoids any embarrassment, and trying things out on each other during paired discussion enables pupils to formulate and articulate their thinking. Hence, offering occasional opportunities for rehearsal of ideas ensures that everyone has made a decision of some kind and can justify their reasoning, making it easier to speak out in subsequent whole class discussion. In science and history, the backs of exercise books were used as a notepad tool for the formulation of individuals' ideas.

Some activity involving technology can also be construed as a form of *priming*. In English the IWB was sometimes used as a stimulus for talk and for ideas constituting a foundation for subsequent pupil writing or collage construction – a reverse form of priming.

EXAMPLE. In **English Episode 5.3** (see Chapter 4), class discussion of a bedraggled hitchhiker image in small groups helped pupils to formulate and rehearse their thoughts before voicing them with greater confidence during a whole class plenary.

EXAMPLE. In **English Episode 6.1** (see Chapter 4), assigning phrases relating to lifestyles of the personae to a briefcase and a rucksack in pupils' books during the previous lesson had primed pupils for this drag-and-drop activity on the IWB.

EXAMPLE. Before **History Episode 3.3**, pupils had worked in small groups to understand and categorise reasons for poverty, rehearsing ideas for the subsequent whole class IWB activity using the CD-ROM in this episode. The subject specialist attributed pupil enthusiasm partly to the 'micro-discussions in pairs': "Many teachers would ask for pupil opinions cold and not get much response. The pair work overcomes that effectively."

EXAMPLE. In **Science Episode 6.1** (Figure 3.1), all pupils matched plant cell features with their functions before Rita carried out the activity on the IWB and the class voted on its correctness.

RECORDING & REVISITING IWB ACTIVITY

Aides Memoires

Recording IWB-based activity is a theme running throughout the science lessons. The first form of recording was pupils generating their own notes or other

representations (including annotation of mini-diagrams). This kind of recording was encompassed in the term '*aide memoire*' and contrasted with copying directly from the board since pupils "translate what's going on with the board to what they produce in their books"; they are "thinking for themselves", "creating their own imagery" and "developing personal memory" (see wider theme of Personalisation).

Science Episode 1.2 is a classic example of this; as we saw above, the teacher had asked learners to draw an image on their diagram that reminded them that the cell wall *protects* and *supports* – generating their own personal *aides memoires* to indicate the functions to themselves. Several pupils shared their representations with the class.

Using Matched Resources

A second form of recording is the use of *mini-diagrams* in all science lessons – direct replication of images on the IWB (such as components of the equation of photosynthesis or instructions for a practical). This was used for *modelling / scaffolding / guiding pupils* through a process or for providing records for assessment. Chris used them to:

- provide a succinct, permanent record in pupils' books and assist recall and revision
- save copying time and provide more 'thinking time' (e.g. about the best way to annotate)
- draw pupils in to the activity by matching projected images
- offer more sophisticated images than pupils could produce themselves
- model high standards of presentation and accuracy, prompting pupils to take more care.

This pedagogical strategy was unusual; saving or printing IWB work for later use is an underdeveloped practice. Pupils themselves recognised the transience of ICT products and said they wanted records 'for reference' and as memory aids. Asking pupils to annotate their mini-diagrams or construct *aides memoires* were elements of Chris's approach that reflected the wider theme of *personalisation*.

EXAMPLE. In **Science Episode 3.1**, mini-diagrams matching the stages of an experiment carried out to investigate "Do plants need light to make food?" were stuck into pupils' books and annotated.

Revisiting and 'Reigniting' Prior Learning

Significant *added value* of using an IWB – above and beyond other forms of ICT – is provided by the powerful facility *to save and archive work, images and annotations and call these up again* in subsequent lessons, as described in Chapters 2 and 4. This is the third kind of recording.

Jackie considered that recording and *revisiting* ideas and discussion on the IWB develops learning when pupils see “something on the board that triggers off a thought.” It makes connections with their previous discussions and jointly constructed interpretations much more easily than reading their notes, which may be incomplete, or relying on their memories of previous lessons, which may be limited. Revisiting annotated slides and other stored materials in history likewise served to draw on shared experience and previously co-constructed knowledge, and to consolidate and synthesise these in the process of building up understanding of historical events.

This is “*reigniting*” prior learning, an evocative term coined by Chris. Sue felt that revisiting annotations transports pupils back immediately and fosters “shared ownership of the response to a poem,” as Jackie elaborated:

It’s really easy to... show them the images and poems again and... it’s all their ideas... ‘I remember us talking about that’... and it isn’t polished... this was done in our lesson... it’s real.

In science the equation of photosynthesis played a major role in reigniting prior learning for imminent use, as all pupil learning over the lesson sequence was “linked and referenced back to” it. Chris described this continual revisiting as “like seeing the same person but knowing them better each time – seeing new dimensions of the same thing”. Indeed he continually deconstructed and reconstructed the equation. For example, reconstructing it from scratch at the beginning of Lesson 2 was described by the teachers as combining continuity with familiarity, easing pupils into the lesson, and “reactivating the memory”.

EXAMPLE. English Episode 6.1 (see Chapter 4). Reviewing a previous lesson activity of listing columns of words relating to lifestyles of personae involved revisiting the slide, categorising through dragging and dropping, then adding annotations.

EXAMPLE. English Episode 8.2 (see Chapter 4) involved revisiting previous images (without annotations) and supplementing these with aural prompts as a form of *silent scaffolding* to stimulate thinking before poem writing; familiar photographs and quotations evoking key themes and characters, and examples of rhyme and alliteration, were displayed alongside the suggested techniques for beginning to write a poem.

“It’s all part of our shared experience that they could tap back into very quickly so I didn’t have to re-teach what those techniques were because they saw them, they remembered them and the links were quite instant...” (Jackie)

EXAMPLE. History Episode 3.1 (see Chapter 2). The class revisited and discussed a slide annotated by Oliver at the end of Lesson 2 where he ordered perceived problems for Elizabeth.

EXAMPLE. History Episode 6.1 (above). Lloyd revisited and built on an annotated slide of reasons for the Armada defeat from the previous lesson.

EXAMPLE. Science Episode 6.1. Chris reviewed the last lesson by revisiting the equation and used the spotlight feature to highlight its elements in turn, talking

through their functions and reminding the class of the experiments they had carried out and how they related to the equation.

Lesson Flow

Using the IWB efficiently was associated with supporting **smooth lesson flow** – maintaining continuity in terms of transition between sequential lesson phases, activities and arguments: “you have to become one with it” (Jackie). However, capitalising upon the revisiting facility in responding rapidly to pupils’ needs, reigniting earlier thinking, or making connections or comparisons between different contexts – requires considerable *flexibility*. This responsive activity can lead to what I have called **turbulence** (Bevan, 2006) in the lesson flow as the teacher and class travel back and forth, comparing and contrasting ideas:

In some lessons I’ve gone back to the image again, or gone back to the poem. It’s really easy just to flick between them. . . . In the lesson all kinds of things can happen: you can go off-track... so sometimes you’ve just got to go back: ‘I wanted you to notice this’. (Jackie)

In both cases, *familiarity with available resources* is deemed necessary for fluid and efficient use, and planning is crucial to ensure that extra resources are available if needed and can be rapidly accessed without disruption to lesson flow (that is, with physically smooth transitions).

CHAPTER SUMMARY

The central themes emerging across cases concerned exploiting IWB technology tools via: *creating a supportive environment for active learning (cognitive / physical participation)* during interactive whole class teaching; *supporting public sharing and co-construction of conceptual knowledge and interpretations*, e.g. through *collective annotation* by teachers and pupils on the board, *communicating and developing complex ideas, modelling thinking / writing processes, scaffolding and personalising* – pupils visualise themselves in a particular scenario or role or relate a concept to themselves – using projected images; *priming for ICT use*, and *intertwining of ICT and other resources*. A key affordance that use of the IWB harnessed was the ability to revisit stored resources and products of joint activity, including annotated

CHAPTER 5

slides, helping to *'reignite' prior learning*. Finally, *pupil recording of the outcomes of class activity* included use of *'matched resources'* or miniature replications of IWB images.

This chapter completes the summary of pedagogical themes emerging from the theory-building activities during the T-MEDIA case studies. Chapter 6 illustrates the process of collaboratively building intermediate theory in the three case studies of using the IWB to support classroom dialogue.

NOTE

- ¹ See examples in Lesson 8 Pupil Work in Downloadable Resources folder of English multimedia resource at <http://t-media.educ.cam.ac.uk>.

DEVELOPING THE METHODOLOGY: A STUDY OF DIALOGUE AND INTERACTIVE WHITEBOARD USE ACROSS THREE SUBJECT AREAS*

INTRODUCTION

The methodology developed in the T-MEDIA project was refined and extended to collaborative theory building about classroom dialogue and dialogic pedagogy through the “Dialogue and IWBs” project. This comprised three small-scale case studies of practice in English, history and personal, social, health and citizenship education. The participating practitioners already had a dialogic teaching approach. Our co-inquiry involved selectively drawing on elements of theory and practical guidelines derived from research on dialogue and synthesising these, both to recontextualise the theory and in contrast with T-MEDIA, to develop teaching strategies. For the teachers, the challenge provided by the goal of improving IWB use was an additional spur for detailed consideration of their own practice and an extension of their dialogic approach – using the IWB as a tool for its implementation (P. Warwick, et al., 2011).

The focus of the inquiry, the participants’ backgrounds, the five workshops we participated in and the other methods employed were detailed in Chapter 1. The development of the methodology was charted there and it is strongly recommended that you read that chapter before this one as the methodology is not repeated here. The present chapter illustrates the process of collaboratively building intermediate theory in this study and of representing it in tables of ideas about dialogue and dialogic strategies that were ultimately adapted for wider use. It includes a description of how we jointly developed criteria for critical lesson episodes.

CO-CONSTRUCTION OF INTERMEDIATE THEORY VIA THE DIALOGUE AND DIALOGIC STRATEGIES TABLES

A very important feature of the Dialogue and IWBs project work was again the collaborative development of a common theoretical framework, tailored to our needs and interests. Our two major tasks in the workshops were the iterative co-construction of (1) a conception of classroom dialogue in this new context and (2) teacher strategies for dialogic teaching and learning with the IWB. These were under continual development by the group throughout the workshop series.

* *With thanks to Rosemary Deaney for permitting re-use of our joint work.*

Three central, interrelated functions of classroom dialogue are portrayed as markers that could be associated with specific properties:

- dialogue should support the co-construction of knowledge and understanding;
- dialogue should make reasoning explicit;
- dialogue should be **cumulative**.

These properties became the column headings in our first dialogue table, exemplified in Table 6.1. The properties of dialogue we identified were arrived at through team discussions that (a) considered how classroom dialogue might differ in quality and intention from general classroom talk and (b) synthesised different viewpoints from the literature along with ideas arising from our classroom observations and experiences.

The team's conception of the notion of dialogue widened to include the use of multimodal forms of dialogue at the IWB (Jewitt, Moss, & Cardini, 2007) and non-verbal dialogue away from the IWB, thus extending beyond the scope of most of the literature available at the time. We identified and discussed lesson episodes where pupils were annotating, drawing, sorting, linking and manipulating IWB images to convey meaning or understanding. In sum, whilst the academic inputs in the workshop sessions undoubtedly influenced the language used in the table, the latter was the result of a genuine convergence of perspectives in the group. It drew as much on the teachers' reflections on effective practice as it did on the inputs from the university researchers within the group.

An illustration of how a university researcher and a teacher negotiated formulation of one idea in a review meeting is as follows. We discussed a requirement that we observed that Lloyd had made for learners to work in pairs to produce a joint storyboard for a video, unusually integrating their ideas (without prior notice) after creating individual storyboards on mini-whiteboards:

Lloyd: The '[are you] finding it hard to agree bit': I talked about that with Jim and Freddie [Learning Partners], and Jim quite rightly made the point that often the things that we are asked to discuss, we do agree on. So what do you then do? [...]

Sara: I think a storyboarding exercise, they had to do that completely independently and then reconcile their ideas so ... what they're doing is accommodating their views to each other. [...]

Lloyd: ... we were quite forthright about this weren't we? 'Willingness to change one's mind', it is important but also 'willingness to reconcile views'.

Sara: Yes, you're right because they don't necessarily change your mind, they just incorporate other ideas...? Yes I think that's a good point. [...]

Lloyd: It should go somewhere near there [indicating on dialogue table] to draw the distinction ... that some activities might be more about accommodating the views of others; some activities it's more about changing one's mind. [...]

Table 6.1. Team representation of "dialogue" in the IWB context

<i>DIALOGUE (T-P or P-P)</i>		<i>Cumulative</i>
<i>Supports co-construction of knowledge and understanding</i>	<i>Makes reasoning explicit</i>	
Awareness of shared purpose of talk (Ps & T)	Provokes thought & opens up opportunities for reasoning (<i>strategic/incidental</i>)	Shaped by building on / connecting with previous utterances
Mutual questioning	Justifying and referencing	Orienting oneself to others' perspectives / knowledge; appropriating words/ideas for own purposes
Protocol / framework / DT vocabulary / ground rules (protection from domination / over-channelling; mutual trust)	Speculative	Evaluating own ideas and solutions against others' solutions against others'
Sharing ideas & appreciating other perspectives (listening)	Becoming aware of what you do not know	Drawing on & extending existing knowledge & experiences
Grouping learners to encourage sharing of views	Willingness to accommodate others' views and to change one's mind; tentative (Ps & T)	Following a line of inquiry
Supportive environment for risk taking	Internal dialogue including comparing activity at board with own thought processes / ideas & experiences / outcomes of group discussion	Sustained over time (maybe across lessons)
Develops new shared understandings (greater than sum of parts) and personal understandings / meanings / knowledge	Nonverbal contribution to dialogue at IWB: P annotation, drawing, sorting, linking, manipulation etc.; other objects can convey meaning / understanding	
Aiming at common understanding but exploring different views	Nonverbal contribution to dialogue away from IWB: (group) outcomes in form of diagrams/ drawings/ordered elements, or on mini-whiteboards	
Collective reflection		
Critical but constructive		
Mix of exploratory and authoritative talk (Ts & Ps) to construct meaning		
Teaching approach that gives P responsibility for own learning and includes willingness to experiment		

T = teacher; P = pupil

Sara: Oh here it is, we have, look [indicating on table]: ‘Orienting oneself to others’ perspectives. Appropriating words and ideas for own purposes.’ It’s another step though, it’s slightly beyond that.

Lloyd: It’s more than that, isn’t it? Orienting oneself to others’ perspectives means an understanding.

Sara: Yes, it’s developing a joint outcome that actually accommodates the views of others, as you said.

Lloyd: Willingness to change one’s mind, or yes, willingness to work on the ideas of somebody else as well as your own.

Accommodate others’ views was subsequently added into the existing phrase *willingness to change one’s mind (pupils & teacher)* in the dialogue table.

A related, important example was the team’s debate and reconciliation of different perspectives in the literature on the notion of cumulative. We noted that the term ‘cumulative talk’ was used by Mercer (2000b) to mean passive, uncritical accumulation of utterances in which contextual references are left implicit and individual differences in perspective are minimised. Yet this definition differs from Alexander’s (2004) description of dialogue as cumulative. Alexander’s account describes chained lines of thinking and inquiry (with teachers offering learners individually tailored responses) and is more akin to Mercer’s ‘exploratory talk’ in which partners build critically and constructively on others’ utterances, actively offering suggestions and justified arguments for joint consideration (co-reasoning).

To construct our own representation of dialogue in Table 6.1, we adopted Alexander’s notion of cumulative; shared understanding of this term underpinned the above excerpt in which some of its nuances were negotiated. We recognised that it would, of course, be an unreasonable expectation that every utterance must cumulatively build on the previous one, extending and developing the concepts expressed (P. Warwick, et al., 2011). Rather, the teachers agreed that whole-class dialogue should allow the participants to evaluate their own ideas and solutions against others’ statements and propositions. As Diane stated in a video review meeting about her first lesson:

It has to be cumulative really, because you’ve got so much more to input if you take all those children and all the life experiences that they’ve got on all sorts of levels, the discussions that they’ve had with their families and their friends, and then bring all of that together.

We incorporated the principles of exploratory talk in other parts of the table, refining and merging them with ideas from Bahktin (1981) and others, as with ‘Orienting oneself to others’ perspectives’ (above). These examples illustrate the process of “jointly trying to articulate what we mean by dialogic teaching” as Lloyd described it.

Our whole-team workshops were the main forum for refining our understanding of dialogue. One contentious issue in the literature that provoked extensive discussion

on a couple of occasions was the question of whether participants in dialogue need to reach a consensus view, as is suggested, for example, by Mercer and Littleton (2007, pp. 72–73). The phrases ‘common understanding’ and ‘common knowledge’ are sometimes interpreted in terms of convergence, while Wegerif (2007, p. 282) conversely states that dialogue is characterised by “uncertainty, multiplicity and open-endedness”.

There is concurrence that disagreement offers an important stimulus for communication and change, creating contexts where propositions and explanations are more likely (Howe et al., 2007). Warwick, Hennessy and Mercer (2011) point out that this chimes with the Piagetian notion of ‘disequilibrium’, which “forces the subject to go beyond his current state and strike out in new directions” to develop a new understanding of the concept (Piaget 1985, cited in Daniels, 2005, p. 289). And in order for children to experience this disequilibrium it seems that they must be exposed to “someone else who sees things differently in a situation that calls for [striving towards] resolution of conflicting responses” (Mercer & Littleton, 2007, p 10). However Mercer and Littleton and Howe *et al.* also assert that working towards a carefully reasoned consensus viewpoint – weighing up the relative strengths of opinions to achieve a group view rather than acquiescence to another or majority view – keeps participants engaged with others’ ideas.

The following edited excerpt from Workshop 5 gives a flavour of our typically cumulative discussion around this issue, illustrating some of its ebb and flow; all participants initiated or sustained discussion at times, and grappling with ideas was often challenging and nonlinear, even cyclical or a struggle occasionally, although ultimately fruitful. Extended workshop time proved important in allowing us to come to (interim) decisions in most cases. The excerpt illustrates how we engaged in both reflective dialogue in which existing ideas and practices become more explicit and clear, and generative dialogue in which entirely new possibilities, insights, perspectives and levels of interaction are created (Isaacs, 1999, Chapter 1). This emerges only when participants let go of their positions, views and resistance. The interaction was as follows.

Diane initially linked the issue of consensus to a filmed episode, where a boy who typically did not work well in groups managed to work with a partner when asked to “come up with advice we would give people” in a potentially dangerous scenario.

Diane: They didn’t reach a common consensus at all, but they still worked really well together... and Jimmy, who obviously didn’t agree with Alex, had written ‘still wouldn’t trust the woman’ at the end! ... he was aware of his need to have his opinion acknowledged, but he did it in a way which for him was very sensitive and really supportive. But they didn’t reach a shared understanding, although they did reach a shared understanding of what they were being asked to do, which was to maybe explore the issues behind that scenario.

Lloyd: Do we have [in the table] this notion that discussion can lead to an understanding that there are any number of views? Do you see what I mean? Is that slightly different? Because that’s quite powerful, what you’ve said. [...]

We see things from a number of different perspectives and that might not lead to even a synthesis of those views, might it? [...]

Paul: A consensus allows you to move forward, I think that's why it's powerful, isn't it? ... The struggle to get to some kind of consensus gives you the basis for the discussion, doesn't it?

Sara: Yes, but that's in the process thing. You don't actually need to reach that consensus.

Lloyd: No, it could be both, can't it. It could be that, and it could be a number of different valid views, or appreciation that there are a number of different valid views and produce a synthesis or something. [...]

Paul: I think some tasks absolutely require some kind of cumulative, grounded understanding and a single perspective from which to move on, and others require an articulation of the fact that there isn't such a thing.

Sara: So, I think we need to change this in column 2, don't we? 'Aiming at a common understanding' sounds too wide ranging. [...]

Diane: 'Potential'?

Sara: Yes, it's 'potential', isn't it? Well I'll put that in for now. [...] Is that common understanding that you're sometimes working to, something that ... has taken forward the thinking that each of you as individuals had and together you've gone further than you would have done [alone]? Because Christine Howe's studies [in science] showed, didn't they, that if you make groups come to a consensus, sometimes that view is inferior to what some of them started with ... So, is actually the quality of the outcome as important as the quality of the dialogue in the sense that the understanding is not any old 'common understanding', but one that moves you forward?

Diane: So it's better to know of a range of things and to have considered them, than to have had to accept something which as you say is inferior or could be a step backwards, which could be incorrect...

Lloyd: Which is a slight issue with the notion of common understanding, isn't it?

Sara: Yes, it is. It's a problematic notion.

The discussion continued at length and ultimately we agreed that consensual agreement is not a prerequisite for learning through dialogue although the process of striving for it through challenging and exploring difference may be fruitful. (This was corroborated by one Learning Partner who told us in the review meeting "If you are [working] in a pair you've got the problem that if they don't have a different view, you don't really have anything to do.") 'Appreciation that there are a number of different valid views – sometimes a synthesis' was incorporated in the dialogue table, after the following continuation of our discussion.

Sara: Do we want to put anything in about synthesis? We've got 'appreciation that there are a number of valid views'... You appreciate that and then create a synthesis of it, or we've got 'new shared understandings.' Does that sum it up or do you want to go further?

Lloyd: No... I think Paul's point struck a chord with me... What is that [seminal report], 'Inside the black box'¹? The original stuff of that, is that a synthesis of a range of views? Or actually is that a description of a number of pieces of research? I think it comes to some conclusion in the end.

Paul: Well it does synthesise because it tries to produce consensus messages and that might be a definition of synthesis that you're looking for: the consensus messages from a range of different inputs. But then you come back to agreement, a bit.

Lloyd: Is '*Appreciation that there are a number of different valid views – sometimes leading to synthesis*'. Is that what we mean?

Sara: Yes, I think it's something like that. Did we have the word 'synthesis' in the teachers' strategies table, maybe?... But that's different though, isn't it? Because that's what the teacher is doing with the pupils' views, whereas here we are talking about what the pupils themselves might be doing. So even if it is there, we might need it here. So do we agree on this?

Paul: Yes, I think it's fine, on the basis of our 'synthesis' so far (laughter).

During this protracted discussion we also revisited and elaborated some earlier ideas, considering whether the phrases in the table "Evaluating own ideas and solutions against others" and "Giving reasons for agreement or disagreement" sufficiently described what we wanted to convey. We ultimately decided that they did but it was helpful to develop our underlying thinking in this area, as follows.

Lloyd: Picking up on what you said there, do we have anywhere in this [table] something about how people process whether or not they think what someone said is a good argument? You know, we've talked about willingness to change your mind. I was thinking as you were saying that, should we teach kids (and I'm sure we don't) how are you going to weigh the evidence?

Paul: Unfortunately I think that's where agreement comes in, because... in agreeing you're actually weighing the quality of the evidence and saying 'ok, yes' or 'no, that's absolute nonsense'.

Sara: But if you're disagreeing you're weighing the evidence too, the same way.

Paul: Yes, but that's what I think that Neil [Mercer] means when he says 'it's the attempt to agree which means that you get a decent quality discussion' because what you do is that in attempting to weigh that contribution, you're attempting to see whether that's got anything to say to you and whether you agree...

Sara: Yes, but in order to disagree you have to give a reason, you see. You could say 'Oh yes, I agree with you' without actually thinking it through. To disagree you've got to provide evidence, haven't you? So actually there's more onus on you when you're disagreeing.

Lloyd: You should, but I think the point I'm making is that if you say 'yes, I agree' should you not have been taught [and] gone through a process whereby you work out why it is that you're agreeing?

Sara: Exactly, but that's the justifying, isn't it, because we've got here 'justifying', that's part of it. Is it?!

Lloyd: It is and it isn't. Justifying suggests that the person who is doing the talking is justifying what they're saying. The point I'm making is. . . What we tend to think is, if we disagree with somebody, we need to come up with reasons, but actually, should we not also be coming up with reasons for agreeing? So we should provide kids with a reference for saying why this is good. So in history, we've all looked at three or four sources. Have they looked at these sources? Have they judged the value of the evidence?... So when you say 'I agree with that point', I should then say 'why?' But what we actually do is say 'I disagree with that point' and then someone says to you 'why do you disagree?' But we rarely say 'why do you agree?'

Sara: Yes. Ok. Well, we've got here 'evaluating own ideas and solutions against others.' Does that sum it up or do we need to elaborate that to capture what you're saying...? Is that clear enough or can we elaborate it somehow, Lloyd, that would sound better?

Lloyd: I'm just thinking for the benefit of kids' learning that we ought to not let them off with saying 'I agree with what John said.' . . . I think that's a skill that we ought to teach, and I don't think I do that really.

Sara: But you might model it. [. . .] Is it this? 'Giving reasons for agreement or disagreement.' Does that sum it up, do you think?

Lloyd: Yes, it goes with that. . . Because if we're looking to challenge in some way those kids who are quite happy just to say 'I agree', you know, how are we going to get to them to get them? As educators what are we going to do to move their thinking on?

Caroline expressed our final viewpoint about consensus and justification most eloquently, relating it to the teacher's role in developing learners' skills and structuring opportunities for dialogue:

For me it always comes back to the reasoning and justification and having a solid argument. So you don't need to agree, but you need to be able to justify why

you hold the opinion you do. It's having the structures as well to recognise other views and compare them to your own, and having the language to do it as well.

Diane's Representations of Dialogue

A significant milestone in development of intermediate theory occurred when Diane independently created her own organisation of our documented characteristics of dialogue, regrouping them under "Climate/Conditions", "Skills/Approaches" and "Outcomes". Her intention was to express the process of developing dialogic teaching and learning in her classroom in a way that could be directly applied to support professional development of her school colleagues, as elaborated in Chapter 10.

This partly came out of my colleagues asking what does dialogic teaching mean. I'm interested in identifying what will my colleagues need in order to be able to do some of these things.

Her choice of headings was intended to show the connections between a dialogic classroom ethos ('climate' in which learning can take place), possible observable features of a dialogic classroom (skills/approaches) and anticipated learning outcomes. In this table she particularly highlighted the cumulative intention of many of the features of classroom activity and emphasised "making reasoning explicit" and "supporting the co-construction of knowledge and understanding" as the core outcomes of the approach, linking back to the representation that I had originally initiated on behalf of the team.

After an extended period of refinement, we ultimately worked with an updated version of her representation (see Table 6.2) as we found it so useful, despite Diane's tentativeness about putting it forward (at Workshop 3), because of difficulties she experienced, as described in her follow-up questionnaire:

I found it quite difficult to separate my very practice-orientated approach from the academic concepts, and to identify nuances in the similarity or differences between related concepts ... Whilst I found it intellectually challenging, I also felt well supported by the group when exploring my own ideas, especially in relation to my version of the dialogue table.

Her table underwent a second major iteration when she devised "more accessible" terminology (illustrated in Table 6.3) in order to "explain to staff at school how dialogic teaching works". An excerpt from her certification report was:

[My first] table was briefly shared with staff at our IWB/dialogic teaching staff meeting. Following the critical episodes analysis, I developed this table further to make it more 'teacher-friendly', changing the headings to 'In my classroom, we:', 'You will see us:' and 'So that we can:'. Additionally, I added in some guidance to illustrate some of the ways teachers could address adopting a dialogic approach.

Table 6.2. Diane's reorganisation of the dialogue table

DIALOGUE (T-P or P-P)		3. Leading to . . .
1. Climate/conditions		
Protocol / framework / DT vocabulary / ground rules (<i>protection from domination / over-channelling</i>); <i>mutual trust</i>	Collective reflection Mutual questioning Sharing ideas & appreciating other perspectives (listening) Aiming at common understanding but exploring different views Mix of exploratory and authoritative talk (Ts & Ps) to construct meaning Cumulative: shaped by building on / connecting with previous utterances (<i>regardless of correctness</i>); orienting oneself to others' perspectives / knowledge; appropriating words/ideas for own purposes Evaluating own ideas and solutions against others' Following a line of inquiry Critical but constructive Justifying and referencing Speculative Provokes thought & opens up opportunities for explicit reasoning (<i>strategic/ incidental</i>) and making inferences Internal dialogue <i>including comparing activity at board with own thought processes / ideas & experiences / outcomes of group discussion</i> Nonverbal dialogue: <i>P annotation, drawing, sorting, linking, manipulation etc.; other objects can convey meaning / understanding</i> Nonverbal dialogue away from IWB: <i>(group) outcomes in form of diagrams/ drawings/ordered elements, or on mini-whiteboards</i>	Makes reasoning explicit Supports co-construction of knowledge-and-understanding Develops new shared understandings (> sum of parts) and personal understandings/ meanings/knowledge Appreciation that there are a number of different valid views – sometimes synthesis Improved dialogue skills
Supportive environment for risk taking Teaching approach that gives Ps responsibility for their own learning and includes willingness to experiment Level of T skill in working with Ps' contributions to facilitate dialogue (includes subject knowledge) Grouping learners to encourage sharing of views Awareness of shared purpose of talk (Ps & T) Willingness to accommodate others' views and to change one's mind; tentative (Ps & T) Opportunities to sustain dialogue over time (maybe across lessons) Familiarity with using range of IWB features and resource		

Note. Characteristics in bold font are our original table headings before Diane suggested those depicted (Table 6.1). Characteristics were originally color-coded to illustrate linked themes.

Table 6.3. Diane's rephrased table for colleagues: Using the IWB to support the development of dialogue in the primary classroom

<i>In my classroom, we ...</i>	<i>You will see us ...</i>	<i>So that we can ...</i>
<ul style="list-style-type: none"> - respect, trust and listen to each other <i>school and class rules; pupil management; classroom working practice</i> - take risks and experiment by trying out new teaching approaches <i>creative approaches; carefully chosen resources; groupings; pupil-led learning</i> - encourage children to be responsible for their own learning <i>children involved in setting success criteria; children selecting ways of working</i> - use good subject knowledge and awareness of our children's needs <i>to help us use children's contributions to advance the dialogue taking place teaching and planning founded on good subject knowledge; professional skill in adapting curriculum to meet particular needs of children</i> - support children in a range of ways to enable them to share their views and ideas <i>use of additional adults; range of teaching and learning styles used; clear expectations and appropriate support/resources available so that all children can access the learning</i> - value talk in our lessons and plan for it to take place <i>lessons are planned carefully to include opportunities to develop talk</i> - are willing to sometimes change our minds <i>teacher and other adults model this; children encouraged to articulate it also</i> - continue a dialogue over time, from lesson to lesson <i>planning takes account of this; teacher skill in maintaining continuity/recapping</i> - use a wide range of IWB features and resources to stimulate, enhance and record aspects of our learning <i>IWB is used confidently in a range of ways, with teacher and children able to select and use features most appropriate to need</i> 	<ul style="list-style-type: none"> - sharing, discussing, commenting on and exploring our views and ideas - asking each other questions - showing that we consider other people's views - sometimes trying to reach a shared understanding by building on what people say - giving feedback and responding in a helpful way - realising what we need or would like to learn and doing something about it! - using what we already know to help us - reasoning and thinking aloud - telling each other what we have learnt when we have been thinking by ourselves - using classroom resources, including the IWB, in different ways to help us in our learning - saying why we agree or disagree with an idea 	<ul style="list-style-type: none"> - realise what we still need or want to learn and how we might like to do it <i>children sometimes involved in setting agenda for future lessons; feedback from children on how they feel about their learning and what they still need; what questions has it raised?</i> - extend and refine what we already know <i>new knowledge linked to existing knowledge; links between are clearly made</i> - explain our reasoning clearly <i>improved speaking and listening skills; children are used to expectations of extended answers/explanations</i> - help each other to understand things in a new way <i>children summarise learning; working co-operatively</i> - come to agreement - express a range of views <i>this is seen in the way in which children express their views and in how they receive and respond to the views of others</i>

Text in italic font exemplifies the guidance Diane added in for her colleagues under each entry in Columns 1 and 3.

It is notable that the phrasing explicitly describes what *pupils* are doing (along with their teacher) from their own perspective within a dialogic learning community, for example “You will see us... asking each other questions.” Our previous version described the activity (e.g. “mutual questioning”) in a more objective way.

The guidance incorporated in italics in Table 6.3 comprised the next iteration, a checklist of dialogic classroom practice with some exemplification of ideas that appeared at Workshop 5. Diane devised this (and eventually, with the team’s input, Appendix 7) as a tool for use in whole staff development.

What I did do was, for my own information really, begin to put in italics after it, what are the actual things that I would expect to be involved in making sure that that thing happened. So in that first column, we’re looking at the climate, we respect, trust and listen to each other. So that rests on our school rules, our house rules, how our pupils are managed in terms of their behaviour and the classroom management, and the practice in the classroom is, we expect it to be a place where children are safe to be heard and that kind of thing. Do you see what I mean? . . . I’m thinking in terms of people understanding how it all links together really, so they realise how much they are already doing.

The value of a teacher establishing ‘ground rules for talk’ with a class is well documented (e.g. Dawes, et al., 2004; Mercer, 2000b) and the role of such rules is also specifically evident where pupils use ICT tools to mediate their learning (P. Warwick, Mercer, Kershner, & Kleine Staarman, 2010). Diane’s table was an attempt to put into practice some of our discussion and development of theory:

Paul: Really you’ve widened out from Neil’s ‘talk rules’ [in this table]? The idea that you have a set of practices which you start to integrate into your work.

Diane: Yes, because you can say, you know, ‘in our class we listen to each other.’ OK, how do you make sure that happens then?

The notion of auditing and celebrating dialogic aspects of teachers’ existing practice was central to Diane’s thinking as she prepared the table:

We could have a dialogue about: ‘In your classroom, do children talk freely? What do they do? What happens if somebody makes a mistake?’ And that could be a small point that could be there because that’s actually part of setting the context, isn’t it? And a lot of this other stuff, in terms of creating [the context], that’s something I’m going to be looking at. But also, the way people choose the resources and group their children. . . and what resources they provide to support children and how they manage their access for children with different kinds of needs, they’re doing all that already. So I would actually feel that to some extent there’s quite a lot of positive stuff that people could get from saying ‘Yes I do that. I know that I do that, that and that to good quality and I do that consistently’ and that’s what I want them to get the idea, that they

are really doing that, but that by sometimes making some changes, they might have a [positive] outcome that surprises them and has an outcome for children that was maybe not expected.

Unsurprisingly, this table (and Appendix 7) incorporates and modifies elements of Tables 6.1 and 6.2. As described in a case study report of her evolving thinking and practice by Warwick, Hennessy and Mercer (2011), Diane deliberately prepared these tables using “ordinary language” in order to make the ideas more readily accessible to her staff who had not been party to the thinking behind their development. This spontaneous action was in line with our stated project aim of working towards professional development materials for other teachers (and it was subsequently built upon by the team to create and publish a full set of such materials: Hennessy, et al., 2014).

Further Development of Diane’s Representations

Diane developed her representation over time with input from the team as well as through independently articulating her craft knowledge. Indeed the table acted as a communication device for the team, representing our collective thinking as it evolved. The next extract from Workshop 4 illustrates how we negotiated amendments to the table (i.e. intermediate theory in the making), drawing on the video footage we had viewed together and keeping our audience of other practitioners, including novices, in mind.

Paul: It does in a way all come back to the fact that, it’s scaffolded by the teacher in a whole range of different ways. The task setup, the group setup [. . .]

Diane: Well the level of teacher skill is important, isn’t it? In terms of a teacher being skilled to both have what information they take from people, how they react to it, how they are sensitive to it, the subject knowledge, their confidence in approaching it in, perhaps, a slightly different angle, perhaps in a way which will bring responses that they weren’t necessarily expecting. That is the other thing which is really crucial.

Paul: Willingness to experiment.

Diane: Absolutely. In a context that will allow you to experiment, that’s the thing, isn’t it?

Sara: Yes, maybe that actually goes into the climate conditions, the dialogue actually, what you’ve just said. But we don’t want to put off the NQTs [newly qualified teachers].

Diane: It says something about them and part of the mentoring process. In terms of the way we support teachers, and teachers as they are training, to be able to use and to develop skills in those areas. [. . .]

Lloyd: Trainee teachers have a lesson plan they are going to teach, quite rightly. And you don't want to veer off your lesson plan but you can see that an NQT or a trainee teacher would be able to do that. But if [an experienced teacher] did something similar with a different topic it would be much different in the sense that you would be able to respond to what the kids are saying.

Sara: It's the same when novice researchers interview people, they have their scripted questions but they don't actually process what the person is saying and reformulate the next question accordingly. They just ask the question. It's a case of working with the material coming at you on the spot, immediately and it's quite demanding. And it takes experience to be able to do it.

Lloyd: And you forget that, don't you?

Sara: Yes, it becomes second nature.

Paul: It isn't simply experience. [...] I know some trainee teachers who would now be able to try this approach. It's almost more to do with openness to ideas and the willingness to try. Experience does come in obviously and will make it easier for you.

Lloyd: No you are right; it's about the ability to respond. It's working with ideas, isn't it? What you're doing there, in all those three clips were people working with the ideas that were coming up from other people in the lesson. That's what it was really about. [...]

Paul: There are some teachers with whom we could have done the same process and not got the same results. It is interesting. Experience inevitably helps, to have the background to draw upon. And you have already tried things that you know don't work. You know what you are happy with and not happy with and you know the children well and you can assimilate well to different environments. All these things come with experience and are important but they're not crucial.

The exchange led us to add to the table: 'Level of teacher skill in working with learners' contributions to facilitate dialogue (includes subject knowledge)' and 'willingness to experiment.'

The following excerpt from Workshop 5 illustrates how another element of Diane's draft phrasing was challenged.

Paul: 'Being critical in a constructive way' is a bit tricky.

Diane: Yes, that is quite hard, isn't it? So then I was wondering about whether we use the word 'feedback'.

Paul: Do [pupils] understand 'feedback' and 'I want you to give some feedback to people'?

Diane: Well it's going to depend on [their] age, isn't it? But older children certainly are ... used to giving constructive feedback ...

Lloyd: ‘Giving feedback in a constructive way’?

Sara: ‘Giving feedback that helps people’?

Diane: Yes. [...] So what I was thinking that would refer to was when they want to disagree but they do it in a way which is kind of considered. It’s in keeping with the ground rules, isn’t it? Of respect for each other ...

Paul: ‘Saying what we think in a way that helps’ might be helpful.

Diane: Mm...

Sara: Well, it’s giving feedback, isn’t it? ‘Giving feedback in a way that helps’, how about that?

Caroline: It’s ‘responding’, isn’t it, in this sense?

Paul: So we’ve got ‘giving feedback/responding in a way that helps’ or ‘in a constructive way that is helpful.’

The discussion moved on to the final column of Diane’s table and how she had interpreted our original phrasing “Develops new shared understandings (greater than sum of parts) and personal understandings/meanings/knowledge”. Diane explained:

I’ve got ‘help each other to understand things in a new way.’ I wanted it to be the idea that there was a new understanding of some sort. . . . So it could be that we know just a few more things, or that we’ve all looked at something from a completely new perspective or tried to apply it to a new situation.

It was collectively decided not to elaborate the phrase further in the table, but that examples could include: ‘summarise learning,’ ‘work cooperatively, come to an agreement, express a range of views.’

This exchange and those preceding illustrate how amicable our negotiations were as we articulated and debated the nuances of the emerging framework. A respectful, non-judgmental atmosphere characterised all of our exchanges and disagreements; this was essential for fostering confidence in all of us (as genuine co-inquirers) to voice our ideas and to acknowledge a lack of knowledge or understanding (Feito, 2007). We also built on each other’s ideas, not just directly but through voicing or extrapolating from what may have been unspoken in a previous speaker’s utterance. Agreed phrasing often incorporated a subset of suggestions made by several participants, as above (itself embodying the notion of consensus). However, our team discussions and the tables as external representations of our thinking also encompassed a view of knowledge as fluid and constantly renegotiated.

Drawing on Bakhtin (1986) and others², we perceive the development of our own thinking in the same way as we view classroom dialogue – as a dynamic, situated and ongoing process whose individual and collective dimensions are interdependent. In this view, new meanings are never final or fixed but emerge between intentions and responses of participants as they put forward what they see as significant to the

group and they arise out of (rather than overcoming) difference (Wegerif, 2007). Thus, our tables were only ‘finalised’ in the sense that the funded project inevitably ended, but individual participants will no doubt continue to encounter or develop further examples of classroom dialogue and internal dialogue at least will continue. Moreover different representations can usefully continue to serve different purposes, as Caroline’s comments in her diary entry about Workshop 3 indicated:

Looking at the two sorted versions of the dialogue column of the table was really interesting. Both versions allowed for a clearer interpretation of the ideas that had been generated. Sara’s version, with the idea of supporting co-construction at the top was very useful in bringing together the various discussions that have taken place so far, and I feel that this ‘top’ element does still seem to be central to the work in this project. Diane’s version, aimed at presenting the information for staff development, was similar to my thoughts in the last journal entry and would certainly be something I would consider using in that situation myself. The headings (Climate/Culture/Skills and Approaches/Leading to...) allowed for another very clear route through the thinking to be visible.

Representing Classroom Strategies for Supporting Dialogue

We sought to derive pedagogic strategies from the understandings explored above: see the resulting extensive list in Appendix 7, which addresses teachers directly. It focuses on strategies for exploiting the general affordances of the IWB, although many of them are also applicable in contexts without technology use. The strategies are not usually directly related in the list to specific functional features of the IWB (such as the ability to cut and paste on-screen objects), though some suggestions appear as a guide in places. The pedagogical value of these functional features has been noted in other research (H. J. Smith, Higgins, Wall, & Miller, 2005). Many strategies were linked to the dialogue table (Table 6.1) itself, describing how the teacher might set up the climactic conditions or support development of the dialogue elements listed. An example of such a link is ‘Willingness to accommodate others’ views and to change one’s mind’ (Table 6.1) and ‘Helping children to learn that ideas often change as we learn – model open-mindedness and tolerance of uncertainty’ (Appendix 7).

We all agreed that for dialogue to thrive, the climate within the classroom needs to be a safe, stimulating and nurturing place where the teacher’s intention is to make learning accessible to all children. Inclusive teaching approaches, based on a sound knowledge of pupils’ strengths and needs, and which can be adapted between and within lessons, create the climate for dialogic teaching to take place. Central strategies related to creating a learning community were thus: ‘Creating a safe environment for risk taking and working out / testing out ideas’ and ‘Acknowledging that not all learners will want to speak.’ The wording followed Diane’s comment that reticent children could still contribute meaningfully to a discussion through using the multimodal affordances of the IWB:

Anne finds it really hard to talk sensibly... she actually almost seems to struggle in getting the words out of her mouth ... and Oliver also really struggles. I don't want to put pressure on these children to talk. I think we were talking before, weren't we, about making sure that everybody says something, and that that isn't always necessary [i.e. provided that they have another means by which they can contribute to the ongoing dialogue]. (Diane, Interview 1)

All three teachers made a significant contribution to the content of Appendix 7. Below we consider more systematically how its elements relate to the analysis of one critical episode in Diane's classroom, whilst illustrating the importance and complexity of the scaffolding role of the teacher in developing the cumulative nature of dialogue in her classroom (the analysis in this section is an expanded version of a section in the paper by P. Warwick, et al., 2011). The episode was (mutually) chosen from Diane's second lesson of three (a video clip of the episode is viewable at <http://sms.cam.ac.uk/media/1098026>). The lesson objective was to "explore concepts of secrets/loyalty in relation to personal safety." We report on a section of the lesson in which Diane asked pupils to examine what she termed a "more serious type of scenario" as a means of stimulating pupil dialogue. The task was to engage in group dialogue and decision making about the appropriate advice that might be given to the child in the scenario presented on the IWB.

At the mid-point of the lesson Diane introduced a problem scenario to the class, in which the theme of divided loyalties was evident. In her pre-lesson diary Diane noted the influence of the workshop input on her choice of IWB strategy:

Will use a recording of my voice to present a piece of text – as Chris [Chris Tooley, IWB expert] suggested on the workshop day – I can then observe children as they listen. Most important point of learning in this lesson is that children really begin to see the links between making good decisions and their personal safety. This is where changes to their thinking can really begin.

The decision to record her voice reading the scenario and to play this through the IWB whilst the children read the screen was an important strategy for Diane, freeing her to observe and gauge the children's responses in order to orchestrate the subsequent dialogue more effectively. One child was then asked to highlight sections of the text that the children felt were "really important". *Diverse ideas were gathered from a number of learners* and the children were asked to *explain their reasons* (italic font in this section denotes links to strategies in Appendix 7) for their text selections. The same child then annotated around the text to represent her peers' understandings of the characters' feelings. In this second stage, pupils were evidently stimulated to go beyond the printed text, generating and explaining their own ideas and illustrating empathy in their explanations and chosen words (e.g. "beaten", "confused"). Their accumulated record from this activity appears in Figure 6.1.

In discussion about the episode Diane said that the sound recording created a resource with the potential for individuals and groups to listen again. She had

My friend Sam asked to tell me something in secret, and then showed me bruises on her arm and back. She said her Dad hits her quite often; he hits her Mum and sister too. Last night her Dad walloped her across the head, and now she can't see properly. Her sister says she must keep quiet and stay loyal to the family, because if she tells, her Dad will go to prison and the family will be split up. But her head hurts, and she's scared to go home, and she needs to talk to someone. She says that she chose me because I am her best friend and I can be trusted to keep her secret.

Needs to talk to someone
Crushing
Worried
Beaten
Confused
frightened




Figure 6.1. Scenario screen with annotation.

deliberately avoided making her recorded voice too expressive, so that the children would not be led in their identification of significant words and phrases. This is one example of the IWB as a potential repository of resources for children to use (which includes web pages, vocabulary and images), enabling the *development of dialogue over time* to be linked to easy and repeated resource access. This potential of the IWB to offer a constantly accessible bank of tailored resources (including for other classes) seems to have particular value in the context of developing a dialogic pedagogy, where collective understanding of key ideas can be supported by *referring back to resources used earlier*. This has the potential to support further dialogue and children's learning, provided that the classroom ethos values the *building of a learning community*.

Diane had a clear role in orchestrating the talk, as this short section of lesson transcript from the more extended critical episode illustrates:

Emily [choosing peer]: Emma?

Emma: 'She can't see properly'. [. . .]

Emily: Lily.

Lily: 'Her Dad hits her quite often'.

Diane: What does that show us Lily? Why did you think that was important there?

Lily: She's hurt because her Dad (*inaudible*)

Diane: Is it the first time that they've done it? No. That's right. That's a good point Lily. Someone else Emily.

Emily: Matt?

Matt: Um, ‘the family will be split up’.

Diane: And why do you think that’s an important piece of information there? Why did you choose that?

Matt: Because she probably loves her family and it’s not very nice when your family splits up.

Diane: Absolutely. Toby, are you alright? Good. What part do you think is important? Oliver. You might need to move.

Toby: ‘Her Dad will go to prison’.

Diane: Why did you choose that bit, do you think?

Toby: Because she loves her Dad. She doesn’t want him to go away.

Diane: Now remember this is about thinking ‘what are we going to need to talk about in our groups?’ So these are some of the things, aren’t they? Are there any more we should have? What about Harry? [. . .]

Harry: ‘Trusted’.

This brief excerpt illustrates that Diane successfully maintained the direction of the discussion, included a range of children, subtly managed behaviour within a whole class (containing a large proportion of children with behavioural difficulties and other special needs), and so on. She maximised participation through selecting volunteers carefully, continually monitoring engagement, and asking a child to record her peers’ ideas at the IWB. The over-riding dialogic intention is clear – the class was cumulatively building a collective understanding of the scenario as it related to their personal experiences and understandings of the situation, and to those of their own peer group. Diane reminded the children (see her last utterance above) that the outcomes of this activity were the basis for the group work to follow, thus *making the purpose clear*. Ultimately Diane was very impressed with the words the pupils generated (Figure 6.1), commenting that it was rewarding to see individuals who were “shy, quiet, easily confused and not very confident, producing input which was really relevant”.

Yet Diane was not entirely happy with her role, feeling that she had intervened too much, as expressed in a post-lesson interview:

I deliberately asked Emily (to lead the discussion)...so then I just butt in... Maybe it would be a good point to say to somebody, ‘I’m actually going to want you to do this, but ...what I’d like you to do would be to ask other people for their input and ask them why they’ve done that.’ And then what I’d do is get myself out of the way.

More positively with respect to her role, Diane also noted at another point in the same interview that “I don’t repeat back what they say...and I ask them to comment

on each other’s comments more...so helping the children learn to listen by not doing all of the work for them.” Diane thus deliberately refrained from revoicing their contributions, to encourage children to develop confidence and skill in expressing their own ideas. These observations chime strikingly with what Alexander (2004) and others have noted about classrooms where there is a clear dialogic pedagogy – that observable teaching strategies include *increasing thinking time*, *withholding evaluations* and *encouraging extended turns*. It is interesting to note that, by the end of the project, all of the teachers felt that they had encouraged extended turns, which helped to *elicit a diverse range of views* from the children. They had tried to avoid evaluating, thus facilitating a dialogic space for discussion. With respect to the use of the IWB, Diane felt that this lesson section would have been “really unsatisfactory” without it. She concurred with our project team that it is not the technical complexity of what happens on the screen that has most significance for learning (as illustrated in her remarks at the end of the transcript in the next section of this chapter).

Let us look at what happened subsequently in the same lesson, where we identified another critical episode of whole class dialogue in the context of IWB use. In this example, groups are coming up to the IWB in turn and presenting to the class the (recorded) outcomes of their group discussions (“as a team working for Childline”) about the domestic violence scenario outlined above; they write their suggestions next to the photographs they have selected and arranged from a set provided by Diane. A video clip from this activity can be seen at <http://sms.cam.ac.uk/media/1085308>. Figure 6.2 captures one of the resulting IWB screens and it is followed by a transcript of associated dialogue. The teacher helped the children to be responsive and to build on each other’s ideas through her open-ended,

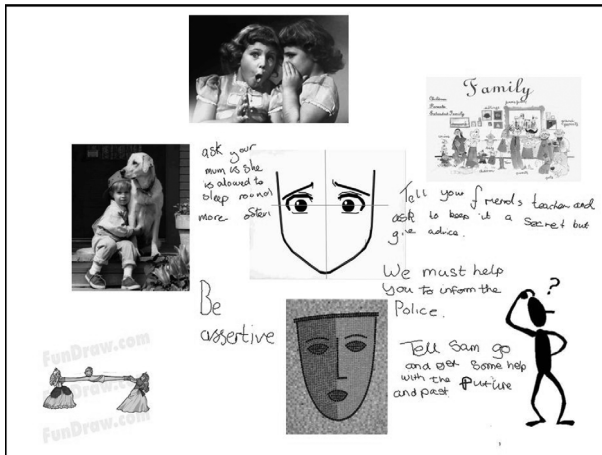


Figure 6.2. Group representation of scenario discussion.

Note. Image of “divided loyalties” mask is reproduced by kind permission of the originator Wendy Morrell.

probing questions such as “Why did Mohammed write “be assertive”?” “Why are you [suggesting she calls the] police?” “Does anyone agree that’s a good step to take?” As before, she managed the dialogue while pupils were interacting with images and annotations at the IWB, allowing it to be led by the pupils’ own contributions rather than her own agenda. At the end she concluded by drawing together the learners’ views while, again, *not repeating or reformulating their contributions*. Her sensitive mediation spawned a number of thoughtful ideas, reasoned arguments and mature insights into the characters’ mindsets as the class together explored some complex issues and ethical dilemmas (e.g. the worry that a family would be split up if a domestic violence situation was reported).

Diane (reading out what Charlotte has written on the IWB): ‘We must help you to inform the police. ‘Now why are you [suggesting she calls the] police? What is it about that information that made you think ‘my advice is police’? Amita.

Amita (group member): Well we were thinking if we don’t do anything it’s just gonna keep on happening so we’ve got to do something about it. So we came up with an idea with calling the police.

Diane: And that would be some advice that you could give to that girl. Telling the girl she should call the police and tell them don’t be afraid and tell them about what’s happening to her friend Sam. That’s a really big step, isn’t it? Does anybody agree that that’s a good step to take? What do you think Ruth?

Ruth: I think that’s good advice because if you inform the police then they could help, like in the future.

[...] Leo did you want to say something... Was there a piece of advice that your group thought was important?

Leo: If she’s naughty, um, maybe that could be one of the reasons or if he’s drinking too much or if he’s a bit stressed, try not to go near him.

Diane: So some of those are the practical things, that’s right. Did your group say anything about perhaps talking to a grown-up? Someone that you know, someone that you trust. Perhaps talking to somebody at school... Did your group say anything like that at all Sharlene?

Sharlene: Um, yeah... You could love your family very much but try not to get too much involved because if you do and your friend’s dad might do...

Diane: Yeah, you see, you’re a child as well, aren’t you, so maybe that’s when you’re saying that you’d go on and talk to adults. So what’s Ruth [written]? ‘Tell Sam go and get some help with the future and past bad things that have been happening.’ Where do you think she might go for help? Where were you thinking when you wrote that?

Ruth: Like, the police and the family.

Diane: Ok and Amita is going to write something on behalf of her group. Did you want to say something?

Robin: This is one of those ones that Ruth said, she said that these can help you for the future but if the police do arrest Sam's dad and if he gets out he can just hurt them more, if he gets near them.

Diane: Did you hear that? What do you think about that?

Jamal: This is what you could do, you could have the police arrest your dad and sort of maybe give him some counselling, something's happened in the past that sort of made him violent or maybe sort of he has a drinking or drug problem.

Diane: So I suppose there is potential for something, might not necessarily be negative but it's not easy, is it. My goodness it's a horribly difficult thing. And what have you written? 'Ask your mum is she allowed to sleep round more often'? And that's a way of perhaps saying, let me try and make something nice happen and maybe perhaps spend a bit more time around. I see some hands up... Go on then.

Amita: But Sam says she doesn't want her family split up and if her dad gets arrested then they will split up.

Diane: Are you saying then that we should say and do nothing?

Amita: We should do something but...

Diane: Also it's not our decision anyway, is it? It's not our decision on what happens to Sam's dad but it is our decision about whether we do something. So generally then as a team of people working for Childline would you be telling Sam to or telling the friend rather. Tell Sam to contact somebody else, to tell somebody else. We're giving information like that. We're saying to be assertive and that it might get serious. Oh, this was a tough one wasn't it?

These critical episodes (of which the transcribed sections above are parts) link in some additional ways with our accumulated list of strategies presented in Appendix 7. It is clear that there was *recognition of effort and progress*, together with a concern to use the IWB to *make the learning pathway over three lessons clear* to the children. The scenario was used to *draw on the children's experiences* and emotional responses and to *create a basis for the co-construction of understanding*. Diane continued mediating the discussion during the interim small group activity, engaging with the detail of learners' contributions. Then in the second episode, she was *drawing on what children had said and done in small group work, using their contributions to structure further discussion and activity*. The uses of the IWB in both episodes *gave status to their contributions* and *collated these for future reference*, either by the children's groups, individuals or the teacher. The use of the IWB sound recorder was a simple yet effective

way to engage the children and to support subsequent dialogue. The presentation of the text and then the children's own arrangements and annotations of the related images guided and sustained discussion and, partly because the scenario was used with the whole class, allowed thinking time for individuals. All of these digital resources were carefully prepared in advance, illustrating Diane's strategic *planning for IWB use*, and her *use of a sequence of (multimodal) resources to follow a line of inquiry*.

This was undoubtedly a safe environment for risk taking, partly because Diane was so supportive of individual contributions, really listening to pupil responses to fully understand what they are trying to convey, and because she encouraged children to listen and speak to each other respectfully. In addition the provisional nature of contributions on the IWB encouraged pupils to generate their own provisional ideas and meant that children were willing to change their minds or modify their responses. Diane encouraged and modelled productive dialogue and the supportive role of her strategic questioning is very clear in the short transcribed examples presented above.

Her attempts at *relinquishing teacher control* of contributions through the children's control of the IWB were variable, but Diane's awareness of this as an issue has also been highlighted as, to some extent, has the cumulative effect of the three-lesson sequence on her thinking and practice. We can see in these episodes a reflection of arguments about the nature of interactivity with the IWB. Important for learning is not physical interactivity with the IWB but the ways it can be used to increase children's participation in whole-class interactions or to improve the quality of those interactions (H. J. Smith, et al., 2005). Teachers can use the IWB, as Diane did, to create a genuine dialogic space for interaction between children and ideas.

DEVELOPMENT OF CRITERIA FOR CRITICAL LESSON EPISODES

This section outlines our development of criteria for critical lesson episodes during Phase 3 (collective and paired video review), with a view to illustrating further the process of research collaboration.

Discussion during Workshop 4 led to our ultimate definition of critical episodes as follows:

- (a) collectively illustrating a range of IWB uses;
- (b) including dialogue that is: stimulated by well-selected resources that are engaging and/or meaningful to learners; linked with any level of IWB use but including some pupil ownership of the board; arising from opportunities for focused, cumulative, open-ended discussion in whole class, pairs, or groups; moving forward pupils' learning.

To illustrate how this definition was developed, again grounded in the teachers' current practice, and how we both took up and directly challenged each other's ideas, we can look to the following excerpt from Workshop 4. (Phrases in italics directly informed our definition.) This culminated in a unique research tool that can be of practical use in future when analysing practice in IWB-supported settings:

Lloyd: I think it's quite *focused pair discussion* which was important in all this ... Is there something as well ... about moving on in terms of either teacher intervention that helps the dialogue, perhaps this isn't cognitive necessarily but a way of *moving on the learning through dialogue*. The reason is I thought there was one at least where I connected what two kids had said with another two kids. [...]

Sara: *Cumulative* is an important characteristic then. What about the use of the IWB, what do we want to say about that as a criterion? ...

Caroline: It would be quite nice to see *a range of uses* across all three lessons.

Diane: So whatever is on the IWB, it needs to be *engaging or meaningful* to the children. [For example] they could be recording their views by themselves or with the teacher. And it could be playing a few that they've had, if it's engaging.

Sara: OK, anything else about the IWB use?

Paul: I think not necessarily whizzy.

Diane: That's what I mean about being engaging. It can be a fantastic visual, an intriguing sound clip, one of those Flash files, one of those PowerPoints with animation or a statement that makes them look on the board [others agree]. [But] it has to be well-chosen, things being *well-selected* [to support their learning] [...]

Lloyd: Why do we need the word engaging, if it's just meaningful?

Diane: When you were saying sometimes children are turned off from listening to the teacher, and in terms of the fact that sometimes the whiteboard can offer a way of engaging their attention ... and sparking their interests... And *it can be very simple indeed, or it can be whizzy*. Whereas meaningful, if something is engaging, it is not necessarily meaningful to the children because they have *no ownership*, no involvement.

A little later in the workshop we grappled with the issue of having to choose short episodes that may not show the fuller context of IWB use – other preceding or following activity within the lesson, and the cumulative nature of dialogue across activities. This led to the following exchange.

Paul: The sense of the cumulative use of the IWB during the course of the lesson can only be done by saying this leads to this, which lead to this...the context is in terms of the use of the IWB for dialogue through the lesson, 'I want the children to get to the end and have something that they could look back on as a record of their developing thoughts through this lesson'. And those individual uses are nicely illustrative sometimes but they almost don't make any sense as individual... 'across 3 lessons the use of the IWB allowed

me to do that' and I am beginning to think the critical episodes only make sense in that context, because you can stage your own understanding based on the ways in which the IWB was used and how cumulative...

Lloyd: You can use critical episodes of anything to reflect something that has happened as part of a wider picture that we've all either participated in as a teacher or observed. That's reasonable.

Paul: Is all we're saying that in any analysis of a critical episode we have to keep saying 'and how did that relate to the overall use of the whiteboard in the lesson and over the course of the three lessons'? 'And this little bit here, how did that relate to the use of the whiteboard in that lesson and in three lessons as a whole?' So you are constantly referring back to that picture. That is the problem.

Caroline: Then doesn't that include making sure the critical episodes are showing a variety of uses? [group agreement]

Paul: But, that [clip just watched from Caroline's classroom] doesn't. And yet it is a critical episode because it embodies so much about what you want to say about that group working dialogically. So we would have some critical episodes that show different uses of the IWB. I think we've got to have that.

Hence we agreed that evaluation of any critical episode needed to be mindful of the longer sequence and context of lesson activity, and that an episode in itself need not show a range of uses, although some may do: a set of episodes should be *collectively illustrating a range of IWB uses*.

CONCLUSION

In this study intermediate theory was embodied within (a) a collaboratively generated table summarising the conditions, typical activities and goals of dialogic classrooms in which the IWB was used, and (b) a further table listing teacher strategies for supporting dialogue (including multimodal forms) in this context. Along with our illustrative video-based exemplars of teacher practices, these materials form a springboard for further critique and modification in other settings, subject areas, and with different pupil groups. (Some of the materials and a hyperlink to our collection of digital video clips appear on a dedicated website at <http://tinyurl.com/OUPIWB/>.)

The discussion has illuminated how we as university researchers engaged in and benefited equally from wrestling with dialogic theories and their relationships to practice. Our own understandings of dialogue per se and in the context of activity supported by whole-class technology became much clearer as we worked with our practitioner colleagues to synthesise elements of the various theoretical perspectives, drawing closely on what we learned from their classroom practices and practical theories.

CHAPTER SUMMARY

This chapter has illustrated the process by which the T-MEDIA research methodology evolved further during the Dialogue and IWBs project, following the description of that methodology in Chapter 1. A team of university researchers and practitioners worked to develop as well as to analyse and document practice – in this case new uses of the interactive whiteboard to develop dialogic classroom interaction in English, history and personal, social, health and citizenship education. Joint review of literature and digital video exemplars, teachers' own lesson videos and post-lesson interviews subsequently served to identify effective pedagogical strategies for supporting dialogue in this new context. The process of continually integrating researcher and practitioner perspectives along with insights from the data ultimately culminated in co-construction of enriched understandings of dialogue and dialogic pedagogy, again framed in accessible language for practitioner use. This involved jointly developing criteria for critical lesson episodes. The process of co-inquiry itself is scrutinised in Chapter 7, which reflects on the methodological approach to intermediate theory building through collaborative review of lesson videos in the case studies described in Chapters 2–6. Influences of the process upon thinking and dialogic classroom practice of the teachers participating in the Dialogue and IWBs case study reported in this chapter are followed up in Chapter 10.

NOTES

- ¹ Black, P., Harrison, C., Lee, C., Marshall, B., & William, D. (2002). *Working Inside the Black Box: Assessment for Learning in the Classroom*. London: King's College, London (Department of Education & Professional Studies).
- ² Theoretical issues concerning different perspectives on dialogue were again beyond the scope of this paper, however they are elaborated in the paper by Hennessy concerning the nature of dialogue in the multimodal context of IWB use, and the role of digital artifacts as interim records of dialogic activity: Hennessy, S. (2011). The role of digital artefacts on the interactive whiteboard in mediating dialogic teaching and learning. *Journal of Computer Assisted Learning*, 27(6), 463–586 The paper draws particularly on the work of Wells, Jewitt, Wegerif, Bakhtin and Hakkarainen.

This chapter was based on two co-authored articles, posted by permission of the publisher:

Hennessy, S., Warwick, P. & Mercer, N. A dialogic inquiry approach to working with teachers in developing classroom dialogue. Teachers College Record, 2011, 113 (9), 1906–1959. Available online at <http://www.tcrecord.org/content.asp?contentid=16178>

Warwick, P., Hennessy, S., & Mercer, N. (2011). Promoting teaching and school development through co-inquiry: Developing interactive whiteboard use in a 'dialogic classroom'. Teachers and Teaching: Theory and Practice, 17(3), 303–324. doi:10.1080/13540602.2011.554704.

REFLECTIONS ON THE METHODOLOGICAL APPROACH: THEORY BUILDING THROUGH COLLABORATIVE VIDEO ANALYSIS*

Researchers can expand the viability and validity of the video records by sharing viewings and interpretations within discourse communities that include the participants who were videotaped (Goldman, 2007, p. 16).

INTRODUCTION

The preceding chapters have been building up a picture of how university researchers and in-service school teachers can work together to interrogate and refine theory through analysing and critically reflecting on classroom practices. They illustrate how classroom observations and collaborative analysis can begin to bridge the gap between theory and practice through developing new understandings of practice that are mutually helpful. Chapter 1 described the process by which we developed grounded *intermediate theory* via an intensive and equitable collaboration with practitioners during two research projects. This included carefully planned introduction of aspects of scholarly theory and other external stimuli, especially video exemplars of relevant classroom practice. The following five chapters have illustrated the process in action through describing a series of case studies and outlining the outcomes. Those comprised detailed narrative accounts of how we jointly recontextualised and refined certain constructs from sociocultural theory by applying them to specific classroom practices involving IWB technology. The accounts are illustrated through descriptions of videoed episodes of classroom practice and the interpretive frameworks encompassing multiple sources of evidence that we devised as researchers. However those frameworks need to avoid technical and complex language and to address issues of practical relevance if they are to be meaningful to practitioners as well as academic researchers (Vanderlinde & van Braak, 2010). Hence the narrative accounts are framed using mutually accessible language.

This chapter attempts to step back and reflect further on the methodological approach to collaboratively reviewing lesson videos that has been iteratively developed. It highlights preconditions and key characteristics of the approach,

* *With thanks to Rosemary Deaney for permitting re-use of our joint work.*

explores the respective roles of the research team members, and links back to relevant methodological literature. This includes addressing some of the questions that all models for closing the gap between research and practice tend to gloss over (Broekkamp & van Hout-Wolters, 2007), including: Which themes and problems are investigated? To what extent is the collaboration between researchers and practitioners equal? What are their respective roles and contributions?

MUTUAL INTERESTS, GOALS AND BENEFITS OF BRIDGING BETWEEN RESEARCH AND PRACTICE

Our co-inquiry offered a vehicle for simultaneously (a) exploring in new practical contexts theoretical ideas about teaching and (b) further exploiting a technological tool that teachers valued and already used on a daily basis. This is consistent with the following inter-related critical pre-conditions for success, as explained below:

- framing the project “in such a way as to pose questions that were of mutual interest to all participants and where there was sufficient uncertainty or ambiguity to instigate the need to exchange ideas and interpretations” (Baumfield & Butterworth, 2007, p. 421);
- a vested interest by the teachers in the research goals, namely evolving and adaptable explicit representations of pedagogy and dialogue that were grounded in observable practice, aligned with curricular and pedagogical goals, and both classroom-specific and generalisable to other classes, teachers, schools and even subjects;
- a strong mutual interest in research inquiry and in exchange across our community boundaries, and shared perceptions of the benefits for our own professional learning.

While the university research team conceptualised the general aims of the research, as expanded below, the specific focus of the lesson sequence in each case study and the pedagogical strategies employed were determined by the teacher. The research was naturalistic in that sense. The teachers’ evident interest in developing their practices with IWB technology through planning their own lessons within the national curriculum framework and their existing schemes of work meant that we avoided the marked tension experienced by Goodchild’s (2007) teachers between the imposed inquiry teaching approaches (with “tasks” devised by the project director) and curriculum demands. That tension resulted in requests for a stronger focus on lesson planning with peers (that were not satisfactorily met), and a lack of evidence of innovation and internalisation. By contrast, focusing on observing (or developing) strategies already (or to be) embedded in ongoing practice means that the practice is attuned to the complex realities of the classroom and therefore has higher external credibility (McIntyre, 2005, p. 378); this undoubtedly contributed towards success here.

In the Dialogue and IWBs project, not only lesson planning but also design of the teachers’ personal research projects was conceptualised and managed entirely by individuals and driven by their particular interests in exploring dialogue within their

own settings. They thus enjoyed a significant amount of influence within the larger shared inquiry. They undertook independent research in their own right under its umbrella, stimulated and continually informed by discussions within that arena. Two projects (by Caroline and Lloyd) surveyed pupil perspectives on the more dialogic approach to teaching and learning that was developed, and solicited some positive feedback and thoughtful pupil reflections. Recurring themes were the importance of considering and comparing a wide range of diverse viewpoints, taking all of them seriously and learning from others through talk. Diane's project charted development of our dialogue table and how her own thinking and phrasing had strongly influenced its formulation, producing a generic professional development tool.

Certification was voluntary and offered after recruitment of participants, so unanimous take-up confirmed our prior belief in these teachers' desire to participate in continuing professional development and self-reflection. Their own research and writing provided an additional motivation for engaging with the literature and other stimuli, and for making personal sense of the ideas encountered. While the certification process ultimately required feedback and evaluation from university researchers, potentially creating a power imbalance, commentary was not given until reports were submitted some months after the end of the workshop series. The process was not perceived by any of us to impede equitable working. Commenting on our practitioner colleagues' writing for an academic purpose was simply another way in which our scholarly expertise was shared with them. In turn their reports held an important status as data in their own right (for all of us), as their use in this book and in joint outputs confirms.

The research focus was explicitly and unapologetically directed by the university team towards understanding and sharing the pedagogy underlying existing practice in the specific context. In the Dialogue and IWBs project, the focus was also towards developing dialogic teaching with the IWB. However, teachers were enthusiastic about pursuing these goals with us, so that they almost immediately became shared. (Where researchers and practitioners have dissimilar goals and values, extensive effort is required to maintain a close collaboration: Bauer & Fischer, 2007). Together we highlighted those aspects of practice collectively deemed to be most effective for pupil learning with technology. Critiquing and reformulating educational theory was part of the agenda for that process, in line with Gordon's (2007b, p.xii) subsequent assertion that theories should be viewed as "guides to thought and instruments of interpretation" rather than established facts. Once again, a theory cannot simply be applied wholesale to practice in a particular classroom. The open-endedness of our research questions and the collaborative endeavour to answer them by drawing on all team members' contributions, perspectives and expertise as appropriate, however, meant that the focus continued to develop throughout in response to authentic, joint concerns. Our research helped to bridge the cultural gap between research and practice through reshaping all team members' understandings of both. Indeed, we all perceived mutual benefits, particularly for our own professional learning through interacting across our various cultures and through theorising about classroom practice.

Inevitably, competing demands in the school environment were occasionally disruptive of the process, but a fundamentally positive disposition towards the research (elaborated further in a later section) meant that it was highly prioritised by the vast majority of the participating teachers. In the case of one T-MEDIA pair, it was followed through with interest, but disruption by contingencies (including illness, accidents, extensive other commitments, and a series of power failures in the school) proved more frequent. Their grid comments were somewhat brief as the two teachers felt unable to spend much time on written commentary, however the video review process helped to fill in the gaps in our understanding. The work of Fisler and Firestone (2006) on teacher learning over 3 years within a school-university partnership confirms that individual teacher factors can mediate the influence of such partnerships on pedagogical change, and again are often overlooked. Variation in social trust – determining whether one engages in action with others that incorporates some degree of risk – is a key factor. Fisler and Firestone point out that collaboration, observation and feedback all involve risk for teachers, and here the balance between risk and benefits of the research may also have been perceived differently by this pair.

There were three (equally) significant aspects of the research design that were closely related to the overarching focus on understanding classroom practice and theory building, as follows.

SUPPORTIVE FEATURES OF THE VIDEO REVIEW PROCESS

Observation and Data Review Sustained Over Time

Classroom observation and lesson video review were sustained over a series of lessons, enabling us to progressively construct a picture of the pedagogic processes involved in planning and implementing a technology-based lesson sequence, to capture cumulative dialogue between lessons, to generate themes and test interpretations for robustness.

Firstly, some of the examples in Chapters 2–6 of how we developed the analytic schemes in each case study implicitly assume a progressive development over time. For instance in the T-MEDIA history teaching case, the global theme of *Increasing learner participation, interdependence and responsibility* was created through discussion and then later (in Meeting 3) we honed our focus towards finer distinctions between codes. These included characterising the teacher’s mediating role in *dialogic class* and *peer discussion*. In science, the development of Chris’s learning journey diagram after its initial presentation in Meeting 2 was iterative over time. In each case study new codes and representations were tentatively applied to the next set of data under consideration, assessed for fit and tweaked accordingly. This highlighted the importance of both classroom observation and lesson video review continuing

over a series of lessons – usually six consecutive ones. This in turn enabled us to build up a picture of the pedagogic processes involved in planning, implementing and assessing a technology-based lesson sequence, to generate overarching themes and test interpretations for robustness.

In the Dialogue and IWBs study (Chapter 6), fewer lessons (three in each case) were filmed and analysed as the scope of the project was smaller, but more time was spent in workshops. The process of deconstructing existing ideas about dialogue and exemplars of practice, and identifying critical episodes of IWB-supported dialogue, was ongoing throughout the five workshops and the analysis of episodes by one university researcher and the teacher in each case. The dialogue tables went through numerous iterations as a result of this prolonged process, which strengthened their validity and could not really have been shortcutted. Moreover, analysing a sequence of lessons was critically important in order to capture the cumulative nature of dialogue over time: across as well as within lessons.

In these studies, video was useful in capturing key elements of each lesson sequence and the broad patterns of interaction within the given contexts, over the course of weeks. It allowed us to move between the micro and macro levels of analysis and to understand the contexts – pedagogical and curricular contexts and preceding or following interactions – in which interactions took place (Haw & Hadfield, 2011). This movement between micro and macro aspects of an interaction is “the key to unlocking the ‘non-visible’ meanings within the video record” (*ibid.*, p. 28).

Multiphase Video Review Process

Independent review of video, screenshots, teacher interview and diary data followed by team discussion of critical episodes elicited the underlying pedagogical reasoning, allowed us to compare interpretations and supported our negotiation of a shared analytical framework. Teacher availability and release from teaching was supportive.

The structure of the video review process itself (see Chapter 1 for details) was the second key element. Wood (1999) points out that for deep engagement, teachers need to develop their skills in making observations and reflecting on the videotaped classroom events. Recording reflections in pre-and post-lesson diaries was one key part of this process. The independent review of lesson videos and collation of written commentary by the collaborating teachers and university researchers was another. In both cases, written reflections were required and these can encourage teachers to reflect more deeply and to organize their thoughts more carefully than simply speaking (Ruthven, 2001). This was followed by joint, in-depth discussion of provisionally identified critical episodes.

Variation in our perspectives and interpretations was anticipated here and it shaped our viewing of raw footage and provisional choice of episodes. The discussions

offered opportunities for university researchers to formulate questions at their leisure and for teachers to articulate the reasoning behind their planning and decision making during lessons. This allowed all involved to compare impressions, debate interpretations of the events observed and reflect at length on our complementary accounts of the pedagogic strategies, styles of classroom interaction (between teachers, learners and technology) and levels of learner participation emerging. We were thereby able to negotiate a joint account of the underlying rationale and effectiveness of the pedagogical approach portrayed in each episode. (The structure of the review process in the Dialogue and IWBs project was a little different to T-MEDIA as subject colleagues and additional subject experts were not involved but the basic approach was similar.)

Video records were clearly the lynchpin, as intimated in Chapter 1 where the advantages in capturing and revisiting the important elements of an approach were outlined. Video-stimulated recall is believed to provoke reflective, dispassionate and considered responses and to help overcome working memory limitations on introspective reasoning (Lyle, 2003). It is ideal when provoking further evaluation and rethinking of what teachers normally take for granted, rather than pure recall, is desirable. In our case the data obtained from video recordings acted as a springboard and a scaffold for development of further interpretation; it both constituted and stimulated a source of evidence. Unlike the study by Lyle, teachers were thus not confined to accessing cognitive recollection of aims and events but encouraged to create explanations where those were not immediately salient. The former goal is unattainable in any case; Lyle found that a degree of reflection and order crept into the accounts.

Indeed the term ‘stimulated recall’ is now outdated as there has been a shift from reconstructing past thinking towards constructive, shared reflections on present and future actions (Tochon, 2007). Teachers can both articulate and manipulate their viewpoints; Haw and Hadfield (2011, p. 61) found that responses to questions about how typical experiences were related to general analytical frameworks used within various models of professional knowledge. In our own studies we concentrated on the rationale – however logical or routine or disruptive of the established routine – for the strategies underlying the specific actions and communicative acts observed in the lesson videos, and especially in the critical incidents once provisionally identified. Rather than soliciting participants’ typical, ‘tried and tested’ or idealised strategies, the approach is inherently reflexive, allowing the researcher and teacher to go back and forth through an incident (*ibid.*). Consequently, the rationale may often have been reconstructed, articulated for the first time, and/or related to our own developing analytical framework or to others operating in the professional contexts. Involving teachers in identifying critical incidents and then in narrowing down the final selection for presentation to other practitioners increased their levels of responsibility and contribution and generated new insights. Note that despite the stimulus that video footage helpfully provided for recall, we attempted to minimise the time lag before video review so that rationale was at least more salient.

The preceding data processing was very time consuming, however, so there was a minimum gap of a few weeks.

It must be acknowledged that the captured data itself and the perspectives captured were inevitably shaped to some extent by decisions taken about who, what, when, where and how to film – in the first place and as the research progressed. Video can never be a truly ‘objective’ source of data. It will always be subject to misinterpretation and bias, so that data from video are always subject to some degree of personal framing of what the researcher experiences (Goldman, 2007).

In T-MEDIA studies, we had two cameras (which is preferable if resources permit) – one that was fixed on a tripod to capture the pupils’ faces from the front of the class, and was only occasionally monitored. A second, mobile (main) camera whose default position was at the back or side of the room on a tripod, focused on the teacher and the IWB, but generally followed the teacher’s movements and zoomed in to interactions with individual or groups of pupils where appropriate. As the classroom researcher in two of the case studies, my main preoccupation was with deciding when to direct the cameraman to shift his focus, for example from following the teacher (default strategy) to a group of students elsewhere who were acting or speaking in an interesting way. Such a shift usually involved removing the camera from its tripod and changing positions so as to capture the audio too; shifting into this hand-held and more intrusive mode was only worthwhile for a sustained interaction, while the length of an interaction was of course tricky to predict in advance. Even the two-camera set-up could not always capture everything we wanted to record.

The following introspective account by co-researcher Rosemary Deaney of her personal experience of conducting classroom observations, penned after the study for this book, illustrates her similar concern to maximise quality of the data.

I was present in all the history lessons, so observed in situ, rather than just what was presented through the necessarily restricted view of the camera lens. Even so, my view was partial as there were distractions during lessons such as note-taking and monitoring activity, [being] ready to point out to the cameraman where it might be useful to zoom in on particular activity. Unforeseen practical issues arose as well. For example, the classroom was separated from a busy corridor by a wall with high internal windows, some of which were permanently open, so I was continually alert to extraneous noise and how that might affect the quality of our recording.

These accounts remind us that video (and other forms of) data must be looked at critically to ascertain the extent to which it is technically, theoretically and culturally laden (Haw & Hadfield, 2011, p. 29). While video records underpinned the whole process of lesson review, we drew not just on video and transcripts, looked at in conjunction with interim screen shots from the IWB, but also on extracts from teacher interview and diary data. Soliciting this information from teachers supplemented, and overcame the potential limitations of, the indirect and inevitably selective method

of obtaining accurate evidence for teacher thinking through video-stimulated recall (outlined by Lyle, 2003; Powell, et al., 2003; Roschelle, 2000). This helped us to obtain as rounded a picture as possible and yielded further insights; these documented reflections upon the episodes had already taken us a step beyond the observational data and that in turn provided a solid basis for further, joint analysis. The team review document (grid or notes) was refined after the review meeting to incorporate different reviewers' reflections and the outcomes of the verbal negotiations.

In both studies, initial commentary documents prepared by the university researchers were interspersed with direct quotes about the episode or lesson from teacher interviews and diaries. Pre-framed questions to the teacher (from university researchers, and in T-MEDIA, from colleagues and subject specialists too) were intended to solicit the rationale for a particular action or interaction or views about the unique contribution of the technology. Along with the team's attempts to clarify terminology and its meaning within each analytic scheme under development, these questions proved invaluable in triggering reflection and deeper analysis. For example, the T-MEDIA history teacher's stated aims were phrased mainly in terms of specific historical knowledge, but what actually emerged from his own grid comments and our classroom observations was the intention to develop a set of more generic, or 'transferable' skills, such as prioritisation and linking of causes. The review and discussion processes served to tease out these implicit goals and to highlight them as central components for incorporation in the thematic overview of the lesson sequence. These processes were also helpful on a few occasions where prior written comments alone were somewhat brief owing to time constraints on teachers. Critical episodes had a useful disclosing function here, acting as windows through which the team could view the phenomena of interest. This resonates with the description of Sheard and Harrison (2005) concerning how *video quotations*, or teacher extraction of video clips for discussion (using the Interactive Classroom Explorer software), act as a powerful methodological and cognitive tool to support constructive learning.

The review process yielded a bank of information about teacher strategies for integrating IWB use to support learning – and in the second project, dialogue – as well as the nature of any “added value” over other tools and approaches. It culminated in a final agreed set of critical episodes from each classroom, a rationale for their selection, and an increased understanding of pedagogy in the context of IWB use. It also helped teachers to refine their approaches later on, in light of the insights they had gained.

Having enough uninterrupted time for the kinds of informal discussions reported in the preceding case study chapters proved critical, since intensive collaboration with practitioners involves a sustained, long-term process (ideally of the order of 5 years!: Vanderlinde & van Braak, 2010). Substantial funding was built into the project budget to release practitioners from their teaching and other commitments and payment was made for every hour spent in project meetings and data analysis. The review meetings complemented the post-lesson interviews; the latter served

to access immediate thoughts while they were still fresh, but were relatively short (1 hour) and took place too soon after the lesson to allow in-depth reflection on it by interviewer or teacher.

Integration of Multiple Participant Viewpoints

Teachers, subject colleagues or teachers in other settings, university researchers and academic subject specialists contributed complementary perspectives on practice and insightful critique.

The third feature of our approach that was absolutely critical to its success was the bringing together of multiple, unique perspectives. The benefits we perceived resonated with Goldman's 'perspectivity' framework which acknowledges that "negotiating the meaning of events from multiple points of viewing enables a layering of diversity producing a clearer understanding of the complexity involved in knowing what happened in a given time and place" (Goldman, 2007, pp. 15–16). Soliciting multiple perspectives also helped to ameliorate the research finding that teachers are more motivated but less self-reflective when watching their own lessons (Seidel, et al., 2011), as referred to in Chapter 1.

In T-MEDIA a *teacher colleague* acted as a critical friend to each case study participant and as an equal partner in the analysis process. The colleague complemented the teacher's articulation of rationale by offering a different, more detached perspective on the teaching and learning processes under scrutiny, informed by specialist knowledge of the subject, the syllabus, the technological resources and the pupils. For example, in English we saw how Jackie's use of an animated Clipart image in a brainstorming and collective annotation activity was interpreted by Tina in her detailed grid comments as a mix of *dialogic interaction* and subtly *reshaping pupils' thinking* (Chapter 4, Episode 5.1). Later on (Lesson 8) we saw how Tina introduced the notions of *drip feeding* and *silent scaffolding*.

The two *university researchers* offered a complementary theoretical perspective to that of the two teachers in each T-MEDIA case. This increased validity of critical episodes or teacher strategies through triangulation and gave equal weight to the four researcher voices during the process of reciprocal exchange. The process yielded verbatim records of dialogue between teachers and researchers as well as between teachers and learners within the classroom. The custom-designed review grid with time-coded, segmented summary of the practices captured, and colour-coded columns for each of the four perspectives and for extracts from additional data, was an invaluable tool in recording and integrating our perspectives. Reviewing video extracts together was also powerful. While the approach to analysing video within a particular research tradition is not so different from other kinds of data in many ways, it lends itself much more easily to collaborative analysis and this sets it apart (Haw & Hadfield, 2011).

Critical commentary from an *academic colleague with specialist subject knowledge* and extensive experience of teacher education and development offered additional detailed insights. It served to relate the observations pertaining to use of a relatively new technology to a wider context of subject teaching using technology, and to suggest alternative potential approaches. Significantly, this colleague was an impartial observer and thus able to pose probing questions indirectly (usually in writing) to the teachers for their subsequent response and clarification (the form and degree of specialist input was flexible and varied). Teachers' rationales were thus further elaborated through follow-up (and thus reconciliation) of the specialist's provocative comments.

History Episode 3.1, for example, portrayed how Dan came to the board and prioritised three issues that were problematic in Elizabethan times (poverty, crime and unemployment), stimulating a class discussion (see Chapter 2). The external subject specialist Arthur reviewed Lesson 3 as a whole (during a discussion with the university researchers after the standard review meetings had been completed) and highlighted the dangers of conflating evidential thinking with causal reasoning, or reliability with authenticity, and the need to treat bias constructively. His comments were fed back to Lloyd who perceived the two strands of evaluating sources and causal reasoning as intertwined and as developing the skills of critical analysis. This included the potential for different reasons and their status. He explained that Dan's comments on bias gave a way in to talk about the status of sources, raising questions about reliability and evidence and usefulness of sources. "Implicit in deriving the causes is the need to organise (classifying, linking) them and use the evidence to the best effect. That's what was happening in this activity. It was more about making links than prioritising."

In science (Chapter 3), we saw how a question posed by the subject specialist Elaine in her written comments about the purpose of pupils confirming correctness of a peer's ideas during a matching activity (Fate of Glucose) in Episode 3.2 elicited a detailed rationale from Chris concerning the benefits of involving all pupils and diagnosing misconceptions in a safe forum. Likewise, Chapter 4 reported how English teacher Jackie responded to subject specialist Sue's suggestion that pupils might write on the IWB themselves, explaining the constraints operating (lack of time and physical space) and her fear of pupils losing concentration through the disruption of coming up to the board during a brainstorm activity.

In the Dialogue and IWBs project, initial video review was carried out on a smaller scale (researcher-teacher pairs). However the three teachers from different subject disciplines and different schools – also spanning primary, middle and secondary phases – convened together (with two university researchers) during workshops, contrasting with the subject focus we had employed during T-MEDIA. The perspectives they held were thus rather more diverse and the conversation less oriented towards subject pedagogy, yet the group gelled quickly and was able to critique both lesson episodes and the dialogic theory very fruitfully. This combination of collaborators drew in a number of impartial observers this time. They were able to reflect on the exemplars

from others' classrooms (each other's and unknown teachers' practices) from a wider context of teaching using IWB technology that transcended subject boundaries. This did not diminish the subject culture differences that we know are important, but enabled us to focus on the elements of dialogic pedagogy related to IWB use that might offer messages for other school and subject settings. The broad range of expertise in the room enriched the analysis for all of us. Chapter 6 provides some extended examples of such oral reflection so they are not repeated here.

Reviewing clips from each other's lessons was a minor part of the process in the Dialogue and IWBs project owing to the time and budgetary constraints of a shorter project. There was no systematic coding of transcripts by the whole team as in T-MEDIA. Nevertheless such review occasionally enabled us collectively to make explicit the dialogic intentions that underpinned each of these (already dialogic) teachers' practices, as in the excerpt below from the team's comments in Workshop 4 after we viewed a clip chosen by Caroline from her filmed lessons. This kind of articulation fed into or reinforced our evolving characterisation of classroom dialogue.

Lloyd [to Caroline]: I thought you were scaffolding really well. When they needed a bit of help you prompted them.

Diane: And really non-committally but also sensing when they might need a little hint. Also about encouraging participation, they weren't reluctant, they were just struggling a bit, and therefore it was appropriate to give them that.

Lloyd: I thought that bit because you were suggesting [to the pupils] there in your body language, 'you found out something that I haven't thought of'.

Diane: You were very much giving them the impression that you were working alongside them.

Lloyd: I think that's really interesting more generally whether kids believe us when we do that or not? Does Miss really know the answer and is just playing up to it or not? ... The sense there was you really didn't know, 'we've come up with something'.

It must be acknowledged that in the few instances where teacher participants in this project viewed clips from each other's practices, their comments were unanimously positive (as in the excerpt above). They did not question the practices portrayed or suggest alternative approaches. That was probably due mainly to the lack of time spent on this activity and on the foci of the workshops in question, first on familiarising participants with each other's existing practices, and then on determining the criteria for critical episodes – rather than in-depth critique as expected in T-MEDIA.

It may also have been that teachers did not feel themselves qualified to critique practices of colleagues from different schools, phases and subject areas, and as Lloyd reported, they found it "hard to contextualise" without more information

(see Chapter 10). By contrast, in T-MEDIA the participants were subject colleagues teaching similar age groups in the same school. In each project the structure of the video review process served the purpose at the time, but the issue of willingness to critique colleagues' – versus strangers' – practices needs to be addressed in any future applications using knowledge of the particular setting. This is discussed further in Chapter 11.

RELATIVE ROLES AND RELATIONSHIPS WITHIN THE RESEARCH TEAM

This section unpacks the integration of perspectives by looking back upon our experiences of the research collaboration to examine in a bit more detail how our respective roles evolved. It shows how

The research focus, design and methods of data collection and video review were conceived largely by the university team; teachers designed the lesson sequences and some conducted their own related research. Co-inquiry spanned the workshops, data analysis and development of the analytic frameworks.

The optimal degree of practitioner involvement in collaborative research with university researchers is the subject of some debate. Biesta (2007, p. 299) warns that the ways in which practitioners or policy-makers present practical problems – and hence articulate an alleged “research need” – may not necessarily be the best way in which the problem should be understood. The range of variables affecting pupil achievement may be underestimated, for instance. A particular problem may arise when researchers produce insights that are troubling for practitioners and policy-makers to hear. Biesta (2007, p. 300) argues that

Researchers. . . have a particular role to play in communities of inquiry and other forms of collaboration with educational practitioners. Whereas attempts to bridge gaps between research and practice are therefore generally laudable, it is also important to remain aware of differences in expertise and responsibility between the stakeholders.

Wenger (1998) likewise maintained that different communities of practice need to maintain a careful balance between separation, so that they can develop deep expertise, and collaboration, and so that they can grow and change to adapt to a variety of situations. Collapsing the two roles – so that “practitioners may act as researchers” and “scientists may act as designers of educational environments” (Bauer & Fischer, 2007, p. 231) – is deemed undesirable since it completely blurs the distinction. The two parties bring different expertise to the collaboration and should have different responsibilities and roles.

In this view, maintaining a critical distance between research and educational practice is recommended. Failing to address the problems of practitioners could be considered equally problematic, however, depending on how we understand the

“gap between research and practice”. As mentioned in the Introduction chapter, there are in fact different kinds of gap perceived. An analysis by Bauer and Fischer (2007) of the various, typical scripts for the gap included representing it as a lack of communication channels from research to practice, the unidirectional nature of which has already been questioned in the introductory sections of this book. In the less linear “loop” script, research draws its inspiration from practice and feeds the results back; practitioners and researchers may work together to identify the research need. The design-based research approach (Design-Based Research Collective, 2003) is an iterative incarnation of this.

Another, the “highly interactive script,” is concerned with practitioner involvement and close collaboration throughout all the stages of the research process (Bauer & Fischer, 2007). In our study, practitioner involvement was intensive but not fully pervasive. It was therefore not as restrictive as it may be in other research settings, including teacher-led learning communities that can be limited by parochial pictures of teaching and learning that privilege certain voices and epistemologies (J. W. Little, Gearhart, Curry, & Kafka, 2003). Bauer and Fischer identified separate cooperative and collaborative variants of the highly interactive script. Our methodology in fact blends some elements of both since, as described below, university researchers and teacher volunteers possessed complementary expertise, and responsibilities were divided to some extent.

In line with Biesta’s (2007) assertions, the boundary between researcher and practitioner was kept somewhat distinct. As in other co-inquiry partnerships (e.g. Goodchild, 2007), the broad research focus, design and methods in each project were mutually considered as the responsibility of the university team who had specified these – and of course recruited the collaborating practitioners – when securing funding for the work. The research focus was, however, progressively refined through our interactions with the practitioners. In the Dialogue and IWBs project, teachers additionally carried out their own research projects within the umbrella of the main project and attained certification for these, as elaborated earlier in the section ‘Mutual interests, goals and benefits of bridging between research and practice.’ Thus each person’s particular role as an individual and/or collaborating “researcher” remained clear to all of us, even where those roles overlapped.

Only very occasionally were teacher suggestions made concerning design and methods of the overall project; minor alterations were made in response. For instance, the T-MEDIA science teacher’s suggestion that two older pupils who had previously engaged in some other research in the school might interview the pupils in the target class, was taken up and proved successful. In the Dialogue and IWBs project, teachers requested a fifth workshop (after the four planned ones had taken place), which we willingly scheduled.

The process of co-inquiry properly began during the pilot filming and continued throughout the workshops, data collection, data analysis, development and refinement of the analytic frameworks. All of us interacted (individually and collectively) with – and formulated responses to – the literature, video and other resources. We drew

heavily on these and on our own personal experiences in synthesising ideas about using the IWB to support learning in general and learning through dialogue. Our responsibilities also diverged in some key ways. Teachers devised lesson plans while we structured the video review process. During data collection each teacher was occupied with teaching and we directed the video camera, thereby rendering our focus, perspectives and mental selections transparent to the viewers (Goldman-Segall, 1995; Roschelle, 2000). The research focus on interactive pedagogical strategies and uses of technology clearly framed what we captured. Unique roles were also assigned to peer teachers and subject specialist academics in T-MEDIA. In between meetings, the teachers wrote their reflective diaries and sometimes generated suggested updates to our evolving analytic schemes. The university researchers sourced and prepared workshop materials, processed the data, and updated (and circulated) versions of the coding schemes or dialogue tables, incorporating each round of democratically agreed changes. Likewise we integrated diary, interview and other data into provisional documents for discussion during meetings. Despite some division of labour, then, there were iterative cycles of interaction between the closely related – and sometimes joint – activities of researchers and teachers.

Capitalising on Complementary Expertise, Balancing Perspectives and Increasing Participation in Developing Intermediate Theory

Throughout the project, we strove to remain aware of the need for maintaining equilibrium between teacher and university researcher perspectives. Perceived success factors were

- equally valuing, deliberately exploiting and purposefully integrating differing forms of prior professional expertise that each individual brings to the table; teachers’ comments on video clips formed a starting point for the discussion facilitated by university researchers;
- the teachers’ receptiveness to scholarly theory and willingness to make explicit (and alter) their beliefs and practical theories; some individual teachers’ proactive representations of intermediate theory for the team;
- university researchers facilitating the video review and workshop discussions
 - highlighting, recording and synthesising the evolving ideas.

Awareness of the potential danger of teachers being ‘polite’ and acquiescing to their perceptions of our expectations, resulting in superficial interaction, led us to offer constant encouragement and reinforcement of the need for teacher input in the T-MEDIA project collaboration. This characterised the pattern of communication right from the start and meant that security to share perspectives was gradually built up. Collaboration became our mode of working, although this is perhaps more accurately described as equitable than equal. The balance between university researcher and practitioner perspectives within our project context shifted back and

forth constantly. This was attributed to the differing nature of our prior professional expertise and responsibilities.¹

Specifically, the university researchers possessed extensive experience of the methodology of educational research and made fluid use of sociocultural theory (much of this was previously unfamiliar to the teachers). The T-MEDIA teachers adopted more of our suggested coding terms than vice versa simply because we made more suggestions and had more scholarly theory available to draw on. In contrast teachers were the recognised experts in terms of situated pedagogical knowledge for using IWB technology in their subject area and designing activity to optimise its day-to-day use. In the second project teachers were expert in supporting dialogue too. They were also keepers of rich, contextual knowledge about the pupils, the school and the subject curriculum. As Green, Skukauskaite, Dixon and Cordova (2007) point out, life in the classroom is “socially constructed, local and often invisible to outsiders who do not share the history, meanings and language that members have in common” (p. 130). Both bodies of knowledge were equally valued and deliberately exploited as we set about integrating them and learning from (and about) each other in the process. For example, there was an observable shift over time within teachers’ written and verbal commentary towards (a) a broader range of characteristics of practice including more emphasis on classroom interactions, (b) more analytical interpretation (as characterised by the increased “noticing” observed by van Es and Sherin (2008) rather than straightforward description, (c) articulation of tacit intentions and practices executed automatically or initially taken for granted and (d) more spontaneous rather than prompted contributions of these kinds as teachers developed self-confidence in their own interpretations.

In sum, teachers developed an “analytic mindset” (Sherin, 2007, p. 13). This resonates with the description by Borko, Jacobs, Eiteljorg and Pittman (2008) of teachers’ conversations around video becoming more productive – more focused, in-depth and analytical (over a 2-year period). Whereas facilitators in those studies by van Es and Sherin (2008) and Borko *et al.* themselves selected clips for discussion and carefully framed the meeting conversations around these, we shared the responsibility for this to some extent. In those studies and our own, however, the researcher(s) used teachers’ ideas about what they found noteworthy upon viewing a clip as the starting point for at least some of the discussions. In each case, though, the shifts observed are partly attributed to a researcher orchestrating the team discussions and structuring the activities in some key ways. In particular we recognised central ideas in participants’ comments, as described in Carroll’s (2005) study of mentor teacher study group discourse; we were

- “picking up larger patterns of ideas lurking in the details of ongoing conversation and rebroadcasting them in ways that [highlight] new perspectives or apparent underlying principles” (p. 472);
- demonstrating “a tactful command of language to present thoughts in respectful but clear terms” (p. 471);

- recording the evolving ideas and circulating them back into the interchange, both (verbally) during and (in writing) between our review meetings;
- hence responsively facilitating the discussions and the alignment and repositioning of participants with respect to each other and to key ideas.

The teachers appreciated our efforts here. Tina reported that her initial fears about moving into an unfamiliar environment and losing control were dispelled during the first meeting “because the environment was very safe and secure”:

As practitioners in our own right, that was what we were bringing to the group so therefore. . . we were actually talking about things that we had a secure knowledge and understanding of, and. . . I felt that our contribution was as valued as anybody else’s. It was completely equal in that respect and. . . I think the whole process, the dynamic of this group has been really positive.

The teachers in turn rose to the challenge – perceived as a “luxury” – of grappling with educational theory, as two of them described after the T-MEDIA project:

Being able to discuss a particular topic at a high level is something that you don’t get a chance to do in school. You have odd learning conversations but you don’t really get the chance to analyse teaching practice in any depth. So for me that was quite exciting. (Tina)

[One] thing that certainly helped me was your patience and helping us understand those terms initially. . . to feel equal and not feel intimidated at all was really helpful. . . Towards the end I. . . got used to that language. (Tina)

You don’t [usually] put labels on these things. . . that was initially quite scary . . . Actually it wasn’t about getting it wrong, it was just about somebody else’s interpretation, looking at it through a different pair of eyes. (Jackie)

The process through which the four researchers informed each other’s perspectives was cumulative as we tuned in to the new priorities encountered and features of classroom practice highlighted by our co-inquirers. Co-construction of the analytical account became tightly consolidated towards the end; we noticed that in every case we appeared to be working more in harmony – and creating a shared discourse – during the final two review meetings. That was not to say, of course, that our perspectives converged in every case on some kind of consensual ‘truth.’ Instead the diversity yielded increased richness and criticality in the account, broadened the range of codes well beyond what any one of us would have generated alone, and rendered their definitions more specific. We ultimately converged on a set of ‘critical episodes’ through negotiation; the goal of doing so in itself served to focus our analyses. The final set was not an exact match with any single participant’s original selection.

In the Dialogue and IWBs project, the co-inquiry process got off the ground more rapidly and on a more equal footing from the start since the project spotlight on dialogue resonated strongly with the teachers’ preferred pedagogical approach; from the start there was a shared desire to increase understanding, prevalence and effectiveness of

dialogic pedagogy. Moreover, our experience of maintaining equilibrium between teacher and university-researcher perspectives during the T-MEDIA video review process made it easier to maintain one the second time around, while the receptiveness to theory served to reduce the need for constant encouragement and reinforcement of the need for teacher input in the project collaboration. A collaborative mode of working and confidence to share perspectives were evident from the start, as this excerpt from Lloyd's diary written after Workshop 1 indicates:

I felt a real sense of the group collaborating very well. I learned plenty from everybody ... Challenging each other too in a very supportive way. Plenty of opportunity to re-shape one's own thinking. Sense of teachers and researchers with a common purpose. ... Particularly important is that while the IWB is a key tool, it has to serve learning purposes.

The final sentence describes a view that clearly emerged as being shared by the whole team.

Moreover, Lloyd had already encountered and debated Alexander's and Mortimer and Scott's ideas about dialogue during T-MEDIA and enthusiastically incorporated our final representation of them into a whole school lesson observation schedule – before taking part in the Dialogue and IWBs project. As the only teacher in that project who had previously participated in our earlier research, Lloyd had an advantage in terms of familiarity not only with some of the theoretical constructs but also with the process of joint theory building, thus increasing his confidence.

In each project the teachers increasingly made suggestions that shaped the detailed analytic schemes and characterisation of global themes, as illustrated in case study chapters. In one case (T-MEDIA science) we saw how the teacher, Chris, undertook to devise complex graphical representations of the intermediate theory under development, one diagram helpfully portraying and linking the emerging affordances of the IWB and the other centred around the learning journey, a construct also adopted by the whole team. In Chapter 6 we saw how one teacher in the Dialogue and IWBs project, Diane, undertook to devise her own framework for representing dialogue for her school colleagues; this experimental characterisation was ultimately adopted by the whole team.

In sum, the teachers' applied practical theories played a valuable role in our operationalisation of scholarly knowledge through jointly analysing pedagogical strategies. This process entailed deliberately drawing on a broad range of theoretical (sociocultural / dialogic) perspectives as applicable, and treating the grand theory as somewhat pliable, using selected classroom contexts as its testbed. This involved critically scrutinising a series of videoed examples from the participants' own lessons and other sources. After validating or reconceptualising certain constructs (e.g. the nature and applicability of the term *dialogic interaction* to multiple episodes in three T-MEDIA cases, and the notion of consensus underpinning dialogue in the other project, were debated at length), we recast the theory where needed so as to achieve the best fit with practice and to integrate practical theory.

A SUPPORTIVE CLIMATE FOR TRUST AND DIALOGUE WITHIN
THE RESEARCH TEAM

The dynamics of interaction between the practitioner and university researcher communities were perceived by all participants as harmonious and respectful. Although the university researchers organised and facilitated the workshops and meetings (so there was a power differential in that sense), opportunities for contributions by all participants were perceived as genuinely equal. This contributed to rapid formation of a single, productive team of co-learners with common aims and language, and shared ownership of ultimate outcomes. Indeed, while we looked for evidence of constructive criticism or negative reactions to any of our techniques, there were very few instances noted; instead the teachers demonstrated a noticeable ease in working with us.

Upon reflection, two interrelated features of the research team are believed to have facilitated the smooth evolution of our complementary roles and the teachers' marked confidence in laying their practice open to scrutiny:

- our previous relationship derived from working together, which contributed towards an atmosphere of mutual trust and respect for each other's unique strengths, experiences, expertise and ways of working;
- ironically, the fact that we were neither specialists in the particular subjects nor teacher mentors and thus disinclined to participate in or evaluate the design and implementation of classroom activities.

The latter constituted a further precondition for success of the co-inquiry. Our roles were distinctly not those of teachers, coaches or mentors and we deliberately kept our identities distinct; indeed we were the only non-subject specialists participating in the T-MEDIA project. The lack of subject expertise potentially had some disadvantages there in terms of our ability to engage with the subject matter in depth. However we relied on our expert academic colleagues here, and it did mean that each category of participant had a unique form of established expertise that was valued by the others. We believe that this made for a more equitable relationship than research partnerships where university-based participants have themselves taught the subject at school level and they plan lessons, co-teach or exchange roles with the teacher. In such cases tensions can arise as diverging perspectives conflict or teachers feel that they are being negatively evaluated (as reported by Wiske, 1995). This occurred only in one of our cases and was soon resolved with reassurance, so that the evolving collaborations on the whole proved very amicable and productive, culminating in shared ownership of outcomes.

Rosemary's post-project reflective account (below) fleshes out the university researcher perspective on the collaboration a bit.

I had familiarised myself to some extent with the topic and with current national curriculum documents beforehand, but as a non-specialist, there was a sense in which I became a learner too, both in terms of engagement with the

topic and appreciating the curricular expectations and objectives associated with teaching the subject.

Being present in the [history] lessons, then viewing them again on video, I shared Lloyd's interest in how students were experiencing these lessons. Was the pace too fast, or too slow for different individuals? Sometimes there seemed to be little space for pupils to reflect. To what extent were they able to process material productively to develop their personal frameworks of historical understanding? How did they feel about coming out to the front to write on the board? How much were they able to contribute to discussions within the small groups? What opportunities were missed for making links with other contexts? These questions, along with the wider educational debates in which they were located, were discussed within our meetings when we shared perspectives on the data. Far from being exhaustively explored, such questions could form the basis for deeper inquiry in future studies of this type.

The account illustrates the kinds of thinking that we engaged in as we shaped our relationships with not only the teacher participants but also the emerging data. This thinking and speculation generated the questions we posed in the review meetings, but as Rosemary implies, there is rarely enough time to explore every question in a great deal of depth.

In the Dialogue and IWBs project, the discussions involved additional input from the other practitioners who spanned different school subjects and phases. This allowed us to work together towards a non-specialist perspective on both classroom dialogue and researcher-practitioner collaboration. At the same time we acknowledged that certain aspects of our theoretical framework of dialogue and certain dialogic strategies probably remained more salient for individuals because of their subject orientations (or personal approaches; the small sample made it impossible to explore differences systematically but it would be interesting to do so in a larger study). We observed that the teachers transcended the subject divisions with ease, often exemplifying their ideas using their own subject practice (Diane as a primary teacher taught multiple subjects anyway) yet working as part of our team in constructing a generic representation of dialogue, as the transcribed data in Chapter 6 confirm.

The process of establishing a framework of trust is a time-consuming but critical one (Edwards & Jones, 2003). In both projects, and as in Baumfield and Butterworth's (2007) study of research partnership, the teachers appeared to value access to research experience, making links with other practitioners and the prestige of working with a university. In a sense, this was, however, just a starting point. The interpersonal relationship between participants developed through regular dialogue – building upon the foundations laid during previous work of various kinds with five of the eight T-MEDIA teachers and two of the three Dialogue and IWBs teachers. It particularly built upon the time and energy already invested in creating a “channel for open and honest debate” about the benefits and frustrations of working

within our schools-university partnership (Baumfield & McLaughlin, 2006, p. 140). Mello (2005) points out that such relationships are under-explored but can have a major impact on the evolution of educational programmes under evaluation; critical factors include informal and social interactions. (Her study focused on university researchers but has implications for partnerships with teachers too.) Note that the fact that we had not previously worked with some of the participating colleagues and yet those teachers engaged in the process with us indicates that a pre-existing working relationship was not a precondition for success, but where it was present, it was perhaps an enabling factor for interaction.

The nature of our working relationship was supportive as well as equitable and respectful. For example, university researchers provided gradual induction and assuaged teacher concerns about grappling with theory, and teachers provided patient explanations about subject practices for nonspecialist researchers. This meant that all participants were willing to articulate, justify, be challenged about and re-negotiate their perspectives (Edwards & Jones, 2003). One illustrative comment comes from an interview after the Dialogue and IWBs project with Diane for an Open University podcast²:

It's really valuable for teachers to work alongside researchers in universities... being challenged... from that kind of different perspective made me question what I was saying, why did I believe in [those ideas], why were they important?

Finally, teachers were observed to be respectful and supportive of each other's views and practices, and this contributed to their apparent engagement in self-critique and reflection when viewing their own lessons. The potential for fear of criticism and difficulties in defending intuitive practice inhibiting articulation of the reasons for and consequences of critical events (Seidel, et al., 2011) fortunately remained unrealised. Borko et al. (2008) found that having a facilitator take a lead role in determining the analytic focus of the workshop, selecting the clips to stimulate discussion, and framing the conversations served to enhance the success of professional development using video from teachers' own lessons.

All of the above self-evidently set the scene for dialogic interaction between ourselves as co-inquirers sharing some common goals. The process of developing a collective perspective on classroom learning or on dialogue supported by technology was itself cumulative over time during the processes of video review and workshop discussions as we responded to and progressively incorporated each other's viewpoints and selected perspectives from the literature. The final factor perceived as significant – probably the most significant as everything above hinges upon it – in the success of our collaborations was thus

a supportive environment for team dialogue and debate and a willingness to justify, probe, be challenged, suspend judgment and accommodate others' perspectives in co-creating a new framework.

The reflections in this chapter indicate that we were willing to raise and consider assumptions and perceptions without being bound by or committed to them; this is the ‘suspension’ component of dialogue as identified by Isaacs (1999, Chapter 6) in the MIT-based Dialogue Project.³ The excerpts of team dialogue in Chapters 2–4 and Chapter 6 of this book (and the quote above from Diane’s podcast) corroborate the assertion. Suspension as exemplified in those excerpts, means that our views were not suppressed but externalised and displayed – with willingness to see things through new eyes, i.e. with uncertainty rather than conviction or compulsion to act.

Dialogue is characterized by people who surprise themselves by what they say. They do not have all of their thoughts worked out in advance but are willing to be influenced by the conversation itself. They come with questions to which they do not yet have answers (Isaacs, 1999, p. 136).

Suspension also means mining for the pivotal questions and unresolved issues. We posed new questions and challenges to each other (as illustrated earlier) and made our own reasoning explicit as we continually renegotiated and refined our ideas and their expression. In sum we created a supportive and ultimately fruitful environment for dialogue about learning from a sociocultural perspective and for dialogue about dialogue itself.

CONCLUSIONS

The research set out to illuminate and ultimately disseminate a shared theoretical perspective on pedagogical strategies for using technology in subject teaching. In the Dialogue and IWBs project, the aims were also to develop dialogic pedagogy related to IWB use and to reconceptualise the notion of dialogue in this context. Participation of carefully selected teachers whose technology-integrated practice and thinking were well developed, articulated and documented over a period of several years proved crucial to achieving these goals. The involvement of like-minded colleagues and subject experts (teacher educators) also played a major role in the joint lesson video review process of T-MEDIA.

Our aims were served by an in-depth, small-scale case study design underpinned by triangulation (within each case) between the multiple perspectives of teachers and university researchers across multiple data sources. These included data obtained via mixed methods and over time in the same setting. The theme of “interdependence” arising during the T-MEDIA analyses (in the history case in particular) likewise described the relationship between the research participants. Each played a unique, and mutually respected, contributory role in the definition and identification of critical episodes and their categorisation during the iterative co-construction of a theoretically informed and empirically grounded analytic account. This account is thus considered to be significantly more than the sum of its parts. The process by which it was achieved was not merely one of “video-stimulated recall” (e.g. Lyle,

2003). It could more accurately be described as one of *video-stimulated reframing*, as individuals' perceptions and experiences were made explicit, scrutinised, elaborated, contrasted and reconciled – through intensive engagement with, and retrospective reflection upon, the digital video and other data over a substantial period of research time.

Another emerging theme, namely that of “dialogic interaction,” described the process of communication between the team members or co-inquirers. The video review and workshop processes developed a collective perspective on classroom learning (and on dialogue) supported by IWB technology – cumulatively over time. Through these processes we shared, evaluated, challenged and accommodated both each other's perspectives and those from the literature.

In sum, teachers' and university researchers' initial theories were modified through deconstructing and reconstructing practice. Our understandings were enriched as we applied unifying theoretical concepts to concrete examples, and reconceptualised teacher actions and strategies more broadly and in new terms. This process, like the co-teaching process described by Tobin and Roth (2007), has thus suggested that strategies used by individual teachers can be considered as cases of more generalised strategies – here employed across subject, school and pupil contexts. Moreover our final analysis of this process might now also yield new instructional goals (as some of our subject specialists suggested), reformulation of existing goals, or new measures of success (e.g. in terms of learner participation in whole class activity), as described by diSessa and Cobb (2004).

The collaboration in each project culminated in development of *intermediate theory* that brings together scholarly knowledge and applied practical theory, and the ways of working and languages of academic and practitioner discourses. This theory is characterised at the levels of both fine categorisation of teacher mediation strategies in relation to emerging affordances of IWB technology and the specific settings investigated, and overarching themes across lessons (and subject cases in some instances). That is, we are developing theoretical constructs that “empower us to see order, pattern, and regularity in the complex settings” of our studies, as the design-based research paradigm aspires to do too (diSessa & Cobb, 2004, p. 84). Here, fundamental theoretical assumptions are retained, but reframing incorporates a strong element of recontextualising *a priori* theory through a process of continually adapting to emerging issues, values and context-specific practices. We ultimately captured the pedagogic rationale underlying seven lesson sequences over a fixed time period. And yet, the emerging strategies themselves remain fluid and subject to further adaptation as other practitioners may engage with them (de Freitas, et al., 2008), or as the same individuals employ them with new pupil groups and topics. Extensive research into ‘adaptive teaching’ informs us that teachers continually re-evaluate and dynamically modify their practices – including during lessons – in light of their informal assessments of pupils' motivation, participation, learning needs and progress (Randi & Corno, 2005).

The teachers' comments about their experience as co-inquirers in the T-MEDIA project indicated that they appreciated having the time and opportunity to step back and view their own practices as observers, to participate in academic discourse relating to strategies for supporting technology use, and to consider how these might be adapted to different contexts. Likewise, Armstrong and Curran (2006, p. 11) concluded that through the joint analysis of data from digital video, "teachers are able to develop new ways of thinking. . . which can immediately feed back into actual teaching situations". We explored the impacts of that process of analytical and critical reflection – and in this case, of individual and joint theorising – on knowledge creation and on the thinking and everyday practice of teachers, departments and schools. The results of a series of follow-up interviews with T-MEDIA teachers, undertaken 1 year on, are reported in Chapter 8. The report shows how the teachers' open-minded outlook and engagement with the theory-building process led to increased reflectiveness, critical analysis, raised metacognitive awareness of routine practices, questioning of underlying values and assumptions and in some cases, even a significant re-evaluation of teaching objectives and learning processes. Chapter 10 describes how our collective representation of dialogue also became a valuable tool that was used purposively by the Dialogue and IWBs teacher participants for deeper analysis and improvement of practice in other teaching contexts within both their own and colleagues' classrooms. The work also culminated in co-authorship and publication of extensive continuing professional development materials (Hennessy, et al., 2013).

Finally, the *intermediate theory building script* may provide guidance to others through scaffolding and describing continued collaborative and cooperative interaction between teachers, their colleagues, researchers and subject specialists. As Bauer and Fischer (2007) likewise described, the process of aligning our perspectives required significant effort and input by all participants. It also needed dedicated time to be set aside for the process, and recognition of the distinct roles and responsibilities of university researchers and practitioners.

CHAPTER SUMMARY

This chapter reflected back upon the methodological approach to collaborative lesson video review that underpinned the work reported in the previous six chapters and synthesises the emerging insights. The discussion covered the relationships and complementary roles within the research team plus teachers' development of a more analytical outlook over time. It touched on issues of mutual trust, interests and goals, and some implications for bridging between research and practice. It identified preconditions of the approach and key characteristics as it developed in practice, as summarised in Table 7.1.

The resulting 'script' for intermediate theory building describes the process of aligning our perspectives in a way that may offer guidance to others.

Table 7.1. *Preconditions and key characteristics of the co-inquiry*

<i>Preconditions</i>	<i>Key characteristics</i>
<ul style="list-style-type: none"> – initially posing questions of mutual interest to all participants; sufficient uncertainty or ambiguity to underpin exchange of ideas and interpretations; – a vested interest by the teachers in the research goals <ul style="list-style-type: none"> – evolving and adaptable explicit representations of pedagogy and dialogue that were grounded in observable practice, aligned with curricular and pedagogical goals, and both classroom-specific and generalisable to other settings; – a strong mutual interest in research inquiry and in exchange across our community boundaries; – university researchers being neither specialists in the particular subjects nor teacher mentors and thus maintaining a boundary between roles. 	<ul style="list-style-type: none"> – filming and analysis of lesson sequences and progressive development of analytic schemes over time through the multiphase process of video review, comparing interpretations and reframing theory; – dedicated time for teacher participation; – integration of complementary perspectives from the teachers filmed, their colleagues or teachers in other settings, the university researchers and academic subject specialists; – both shared and distinct roles and responsibilities of the university team and the teachers in the inquiry process and development of analytic frameworks; – teachers’ receptiveness to scholarly theory, selection of and commentary on video clips, and proactive representations of intermediate theory; – university researchers facilitating the video review and workshop discussions – highlighting, recording and synthesising the evolving ideas; – an atmosphere of mutual trust and respect for each other’s unique strengths, experiences, expertise and ways of working, enhanced by previous working relationships; – a supportive climate for team dialogue and open-minded debate; a willingness to probe, be challenged, suspend opinion and accommodate others’ perspectives in co-creating new frameworks.

NOTES

- ¹ It was also notable that those present in the classroom during filming and participating in interviews (teacher + Researcher 1) enjoyed an advantage over the other two participants (colleague + Researcher 2) in terms of familiarity with the material during review; they consequently tended to spend less time looking at the videos. Thus the distinction in approach was not purely a teacher-researcher one, but was confounded by the insider and outsider roles too.
- ² The podcast “Exploring teaching and learning in real and virtual worlds” is posted on the OpenLearn site at <http://podcast.open.ac.uk/podcast.php?id=490#>.
- ³ The Dialogue Project and specifically, its focus on reflective dialogue between teachers, underpinned the Professional Learning Community movement within education: Hord, S. M. (1997a). *Professional Learning Communities: Communities of Continuous Inquiry and Improvement*. Austin, Texas: Southwest Educational Development Laboratory.

This chapter was based on two co-authored articles, posted by permission of the publisher (Teachers College, Columbia University):

Hennessy, S. and Deaney, R. (2009) Integrating multiple teacher and researcher perspectives through video analysis of pedagogic approaches to using projection technologies. Teachers College Record, 111 (7), 1753–1795. Available online at <http://www.tcrecord.org/Content.asp?ContentId=15305>.

Hennessy, S., Warwick, P., & Mercer, N. (2011). A dialogic inquiry approach to working with teachers in developing classroom dialogue. Teachers College Record, 113(9), 1906–1959. Retrieved from <http://www.tcrecord.org/content.asp?contentid=16178>.

SECTION TWO

DESIGNING A FRAMEWORK FOR TEACHERS’ PROFESSIONAL LEARNING: USING INTERMEDIATE THEORY TO DEVELOP CLASSROOM PRACTICE

INTRODUCTION

This section contains four chapters after this Introduction. It examines the impact of the intermediate theory-building process upon participating teachers’ professional development and subsequent practice. The evolving approach to research partnership between classroom teachers and university educators is also extended by exploring how research outcomes may be used to support other teachers’ professional learning, both within schools and externally. An emerging, scalable, school-based, research-informed professional development approach that supports teachers in developing pedagogical insights is proposed. This introductory chapter explicates some underlying principles of the approach and grounds them in supporting literature.

CONTEMPORARY MODELS OF TEACHER PROFESSIONAL DEVELOPMENT

Research suggests that the typical provision of one-off professional development workshops tends to be of limited value in sustaining transformation of practice and may not help teachers in tackling the specific pedagogical issues associated with their own students’ needs (Glazer & Hannafin, 2006; Jaworski & Wood, 1999; Muijs & Lindsay, 2008). It often takes “a top-down approach to disseminating knowledge, in which teachers are provided with information and resources that they are expected to translate into action” (Butler, et al., 2004, p. 436). Even longer courses or workshops where teachers successfully develop awareness and confidence in alternative conceptualisations of teaching can lead to little actual change in practice without ongoing support, because turning new knowledge and ideas into practice is highly challenging (Goldstein, et al., 1999). Real change is uncomfortable and unpredictable, and potential can remain unrealised (Carter & Richards, 1999; Jaworski & Wood, 1999) as teachers try to cope alone when back in their classrooms. The potential for new approaches can remain unrealised unless teachers can conceptualise and generalise the implications of their new visions to the classroom.

Recent work indicates a more promising approach to be one that draws on teachers’ local networks, encourages peer learning and supports ongoing reflection

on and reconceptualisation of one's own classroom practice and development of new insights into pedagogy (J. G. Wells, 2007; Zwart, et al., 2007). An EPPi review noted that key features of effective continuing professional development (CPD) programmes included: building on teachers' knowledge bases; teachers identifying their own starting points; collaboration with peers and experts; sustained, intensive programmes; and opportunities to engage in reflection and dialogue (Cordingley, Rundell, Temperey, & McGregor, 2004). Reflective dialogue as a deliberate professional learning strategy is a significant catalyst for improved classroom practice (Nehring, et al., 2010). Wells (2007) and OECD (1998) add some further defining features: engaging teachers in concrete, experiential tasks that illuminate the learning process and are rooted in inquiry that is participant-driven and attends to the teaching context. This necessitates providing structured time for teachers to work together in planning forthcoming lessons, observing each other's classrooms, and sharing feedback (Hord, 1997a).

Small **communities of practice** (Wenger, 1998), formed when people come together to develop practices that work for their specific situation, may provide stronger support for teacher learning than is conventionally possible through off-site professional development. Such communities – including the various teacher groupings in the schools participating in the work reported in this book – support practitioners to deal with complex situations that defy algorithmic solutions, through, for example, sharing stories (Seely Brown & Duguid, 1996) informally or in department meetings. In particular, teachers looking to introduce technology into their classrooms face a myriad of situated issues, including: what hardware and software is available and desirable; how to introduce it to students and to create differentiated exercises; what teaching style to use; how to manage technology failure. The professional community of practice therefore has a potential role in helping individuals resolve these issues. Such communities may have very different constitutions. In our work one kind of community is the departmental grouping of same-subject secondary teachers – as in the T-MEDIA case studies (Chapters 2–5) and the subsequent mathematics study reported in Chapter 9 – i.e. colleagues that work closely together on a daily basis. A second kind is the uniting of teachers from different schools, phases and subject areas in the common cause of exploring IWB use to support dialogue (Chapters 6 and 10).

There is now a growing body of research on 'professional learning communities' (PLCs) that highlights the importance of creating a collaborative and collegial learning environment to support opportunities to develop teachers' practices, knowledge and effectiveness, and for reflecting critically on their practices (e.g. Hord, 1997b). PLC members share leadership, values and vision, work and learn collaboratively, observe and review other classrooms and participate in decision making (Hord, 1997a). Synthesising the literature in this area (especially Bolam, McMahon, Stoll, Thomas, & Wallace, 2005; J. W. Little, 2003; Vescio, Ross, & Adams, 2008), a school PLC can be defined as

- A community with the capacity to promote, sustain and empower the learning of all professionals in the school community;
- through collaborative and individual inquiry, problem solving and reflection with others who share the same day-to-day experiences;
- that deconstructs teaching practice, makes it public and critical, including problematising the learning environment and taking the risks necessary to change;
- and through structured, reflective dialogue that leads to extensive and continuing conversations about curriculum, teaching and pupil development;
- with the collective and persistent purpose of enhancing pupil learning.

When these elements are present, significant student learning gains take place (Vescio, et al., 2008), teacher knowledge (practical theory) develops and morale improves. This requires a fundamental cultural shift in the way that many teachers approach their work – currently isolationist, insular, teacher-centred – but it also requires a degree of teacher authority (described as the ability of teachers to make decisions within their communities and in school governance) and ownership, e.g. over curriculum development.

Reviews of research into the impact of teacher professional development and professional learning communities respectively by Vescio et al. (2008) and Avalos (2011) published in the esteemed journal *Teaching and Teacher Education* highlight the importance of teacher co-learning as being a powerful mediating factor in changing practices as well as in improving student learning; change was related to the extent to which teachers had engaged in collaborative and reflective inquiry. The benefits of professional development founded on peer collaboration can additionally extend beyond the areas it targets (Cordingley, Bell, Rundell, & Evans, 2003), and can in fact be very wide-ranging. Teacher benefits include enthusiasm about professional learning; increases in confidence and self efficacy (beliefs about one's capability to perform a given task); a greater commitment to changing practice and willingness to try new things; activities to generate more effective and targeted dialogue between students; and a conscious effort by teachers to use computers more for both instruction and to increase the range of teaching and learning strategies targeted at specific student needs. CPD also strengthens teachers' status and career prospects. Student benefits include: a demonstrable enhancement of student motivation; improvements in performance on tests; more positive responses to specific subjects; an increased sophistication in response to higher order questions; the development of a wider range of learning activities in class and strategies for students. They can also include increased confidence in explaining to the rest of the class and greater understanding of discussion techniques such as listening and waiting (Sebba, et al., 2012).

Collectively these benefits could be said to increase 'professional capital' – improving the quality of teaching in the wider profession through continuous inquiry, and individual and collective development and responsibility (A. Hargreaves & Fullan, 2012). Professionalism includes the judgment to make effective decisions

in complex situations, the capacity to improvise, and openness to feedback and learning from mistakes.

However potential pitfalls of professional learning communities that clearly need to be avoided were identified by Annenberg Institute for School Reform (2004) at Brown University, as follows.

- Reluctance to make work public limits more rigorous feedback;
- Deep-seated issues of trust and equity are often not addressed;
- Leadership capacity often remains underdeveloped;
- Effects of changes in practice and improved student learning are often poorly documented.

The quality of change triggered through any CPD is of course subject to the motivations of those involved. Manouchehri (2001) noted that two teachers engaged in peer coaching, who held that teaching was largely a matter for individual teachers to define, limited their comments to brief ‘tips’ to each other and . This contrasted with another pair who were keen to debate and to learn and who consequently challenged their own preconceptions and engaged with underlying theories. Thus collegiality does not, *per se*, ensure quality; a critical stance also seems to be needed.

Likewise, while fellow practitioners may provide helpful stories, Jaworski (2006) argues that where innovation is required, a community of practice is not sufficient in itself. Two additional elements are needed: reflective practice and peer learning, which together form the basis of what Jaworski calls a ‘community of inquiry’. This notion builds on the sustained ‘inquiry stance’ described in the review by Cochran-Smith and Lytle (1999), whereby teachers generate local knowledge, envision and theorise their practice, and interpret and interrogate the theory and research of others. A community of inquiry encourages individuals to look critically at their own practices and to modify these through their own empirical ‘learning-in-practice’ (Jaworski, 2006, p. 204), namely where two or more colleagues work together to address a problematic issue. Community of inquiry ranges from large-scale, formal, systematic research through to the almost unrecognised practical day-to-day inquiries that teachers undertake whilst teaching; there is always a reflexive relationship between inquiry and development. Through appraising the context, focus of change and realistic possibilities, teachers become ‘**critically aligned**’ (*ibid.*, p. 190) in addressing the problem and conducting their inquiry. This means that they consciously align with aspects of practice while stepping back from and critically questioning roles, beliefs, purposes and routine practices – as a part of their participation for ongoing regeneration of the practice. They engage in public reflective practice (Handscomb & MacBeath, 2004) and rigorous debate with colleagues (Wallace 2003). Ultimately critical alignment leads to “a development of [metacognitive] awareness of states of practice, a recognition that actions and their consequences are not always easy to rationalize, and a position of inquiring into relationships between action and outcome” (Jaworski, 2006, p. 194). In turn, an explicit inquiry discourse – as a part of community – can provide opportunity for

critical alignment (*ibid.*, p. 200) and continuous reassessment and development of practices.

In the work reported here, two studies specifically employed a community of inquiry approach to using theory derived from research to *develop* (rather than just analyse and understand) classroom practice. In both studies the intermediate theory that had been developed and refined along the way was then made available and accessible to other practitioners, so that they could in turn use it to guide development of their practice. Chapter 9 outlines how the analytical framework and video exemplars derived from the T-MEDIA mathematics case were used to stimulate critique, debate, reflection and new learning-in-practice (Jaworski, 2006). The study reported in Chapter 10 also demonstrated teachers' 'critical alignment' as they developed IWB use to support their dialogic teaching and generated and shared the dialogue tables. The final chapter broadens the account in proposing a community of inquiry approach to using scholarly or intermediate theory to understand and develop classroom practice in other settings. Using theory to inform practice, and the role of video, not only underpinned the collaborative research process described throughout Section One, but they are introduced in the next two sections as key tenets of an evolving professional development approach.

TEACHER LEARNING THROUGH EXPOSURE TO PEDAGOGICAL MODELS AND PRINCIPLES

There has been little prior work investigating how scholarly knowledge might usefully be integrated with teachers' own informal theories and classroom experience and what the outcomes might be. Relevant research includes the work by de Freitas *et al.* (2008), already mentioned in Chapter 1, in which practitioners critically evaluated given pedagogical models for technology use, and adapted the models to suit their own contexts. A professional development model tested by Butler *et al.* (2004) exposed teachers to principles concerning self-regulated pupil learning, through modelling, workshops, intensive classroom support, feedback and reflection. Teachers consequently shifted their questioning techniques and interaction patterns with learners. They considered the new theoretical concepts and language they adopted and personalised to be crucial in effecting change. The researchers described the framework as a 'guiding light' (*ibid.*, p. 451) but stressed the danger of dependence on 'outsiders' for sustaining an innovation. They also linked teacher learning with emerging 'reconstructed conceptual frameworks' but no details of reconstruction or adaptation were presented. However, personal ownership and adaptation of new ideas seem to be the key to teacher engagement with those ideas.

Section One Introduction proposed the notion of 'applied practical theory' that is situated in local, authentic pedagogical practices, perhaps related to specific learner groups, too, and evolving through adaptation to particular settings of use. Through our research collaborations, as charted in Section One, this practical theory interacted

with grand theory and culminated in intermediate theory. This is, nevertheless, just the first stage in bridging between research and practice. The studies in this section now go on to ask, what are the benefits and professional learning outcomes of participation in this process, and how can practitioner colleagues also benefit? How can we reach the important second stage of supporting professional development for others that both builds on the outcomes of such research collaborations and no longer depends on ‘outsiders’ but is teacher-led?

Traditional professional development has been designed to help teachers transfer knowledge and skills learned in workshops to classroom settings (Randi & Corno, 2007). It has left teachers to abstract relevant principles by themselves and to make links between specific research findings and practical problems in their own teaching situations. Even where design of specific interventions that embody a favoured theory derives from experimental research (rather than policymakers’ whims), namely “research-based proposals” for practice (McIntyre, 2005), any number of interventions might be developed to embody any given theory (Randi & Corno, 2007). Intensive coaching of teachers to practise components of particular instructional interventions is intended to facilitate implementation, and this may provoke similar disempowerment, resentment or resistant reactions from teachers as typical reactions to “dissemination” of “what works” or “models of best practice” that are popular with the UK government in particular; these are sometimes illustrated with video exemplars distributed to teachers. The incipient difficulties with the best practice approach were summarised in Chapter 1 when the contrasting approach underlying the T-MEDIA multimedia professional development tools was described.

Randi and Corno (2007) argue that by contrast, understanding and using multiple examples may ultimately help teachers to inductively abstract the general principles underlying the theory and transfer them to new teaching situations more easily. “In this new model of theory validation, practice serves theory as much as theory serves practice” (*ibid.*, p. 338). Moreover, “when teachers adopt and adapt applications of theory-based principles that fit their students’ needs as they arise, they provide a new context for research to examine how broadly their theory maps out across domains” (*ibid.*, p. 336).

My concern is likewise not with one-way transfer of theory into practice in the abstract, or design of theory-based instructional interventions. It is with encouraging practitioners themselves to develop and adapt theoretically principled pedagogy and practice. The approach in this work embodies an iterative cycle of research-informed theory – research on practice – refinement of theory – refinement of practice and changes in pedagogical thinking – identifying what is subject- or context-specific and what is generalisable – sharing pedagogical approaches and principles with others – and further application by participants, colleagues and practitioners further afield to their own specific settings. The approach assumes a predilection for all participants to reflect and generalise. It also assumes that a synthesis of strategic and specialised domain knowledge is needed (Perkins & Salomon, 1989). It focuses on mindfully

(in advance or in retrospect: *ibid.*) abstracting, understanding and decontextualising underlying theoretical principles, causes and relationships for use in other contexts.

The approach is a general one and may be applied to aspects of classroom teaching and learning that do not involve technology use or dialogic interaction, for instance. However, the substantive outcomes of our research collaboration are also available for those who want to explore these domains. Chapter 11 suggests that teachers might use selected case studies of classroom practice (ours or their own) along with analytical tools – such as the coding frameworks and dialogue tables we developed – as stimuli for discussion and reflection upon their own practices.

Teachers' exposure to new ideas and appropriation of those ideas relevant for their settings may stimulate them to reassess pedagogical practice and thinking and trialling of new approaches, as in the Dialogue and IWBs project. Their involvement in research collaboration of the kind described in the previous chapters or in a related form of co-learning with colleagues may even nurture an inquiry outlook extending into the long term. In our own teams the university researchers hoped that teachers would have the capacity, agency and inclination to continue developing and adapting the ideas and tools after involvement with the research came to an end. That was investigated in the studies reported in the next three chapters.

SUBSEQUENT USE OF VIDEO IN PROFESSIONAL DEVELOPMENT

We have begun to explore how the research outcomes might be used with other practitioners, again non-prescriptively and using multiple examples and instantiations of theory. Key elements of the approach to wider professional development are the complementary strengths of grounding reflection in everyday practice but also in vicarious encounters with other teachers' very different classroom settings and comparison between them. This affords reflection from a distance and a degree of critical analysis that is not possible when acting in the setting, as observed in the case-based teaching described by Putnam and Borko (2000). Cases can provide rich, shared experiences of authentic settings and complex problems for (in-service or pre-service) teachers to examine and critique together, using multiple perspectives and frameworks. In our case studies, the complexity of the settings and pedagogical issues is depicted through sequences of lesson video clips.

Both of the projects described in this book produced video exemplars of classroom practice and accompanying materials designed to be used with teachers who have not participated in the research, and some pilot trials were conducted. As mentioned above, Chapter 9 in particular reports how we trialled a process of collaborative, practitioner-led professional development using the T-MEDIA mathematics multimedia resource as the key stimulus for discussion, reflection and classroom trialling. Before describing the studies, the powerful role of video for this purpose is briefly elaborated.

Juxtaposing videoed practices from different classroom contexts is particularly effective because it allows teachers to encounter contrasting examples from other

settings, in order to reflect on and see their own practice more clearly (Hiebert, cited in NRC, 2001, p. 10). Viewing such videos exposes teachers to a variety of new ideas and to alternative strategies in a way that is otherwise impossible, and it transforms teaching into a practice-based profession (Lampert, cited in NRC, 2001). More specifically, the Learning from Mentors study by Paine and Wang (1996) illustrated how the chance to examine practices concretely, but at a distance from one's own practice, affords both participants and other viewers valuable insights into unexamined assumptions about learning to teach.

However, overgeneralising from what are essentially snapshot and selective views, or attributing causality without a full grasp of other contextual factors, must obviously be avoided. Likewise, unfounded inferences may be made about the lessons depicted, the teachers, the students and what they learned, the schools, etc. (NRC, 2001). Drawing out similarities between the experiences of the video subjects and one's own is inevitable and productive (as in Lampert & Loewenberg Ball's 1998 study of a class of student teachers interacting with a dedicated hypermedia learning environment) Ironically, though, clearly distinguishing between them may also be important in interpreting what is depicted. Pre-service teachers in particular tend to lack curiosity about context and an appreciation of it as an aspect of pedagogical knowledge (*ibid.*, chapter 5). The multimedia environment was specifically designed to help develop this, through an open-ended investigation assignment framed in language intended to develop a stance of inquiry and conjecture. It may be necessary to provide more guidance of this kind for novice teachers than for in-service teachers, but in both cases, carefully phrased stimulus questions can act as useful prompts when viewing videos and these are employed throughout our own professional development materials.

In the same vein, the description by Frederiksen, Sipusic, Sherin and Wolfe (1998) of teachers viewing and interpreting video data collaboratively in 'video clubs' reports that teachers need to be encouraged to recognise when subjects of filming are achieving their own teaching goals in the particular teaching situations shown, rather than making judgments about appropriateness *per se*. Frederiksen *et al.* claim that teachers eventually develop a shared set of criteria for evaluating teacher effectiveness in accomplishing instructional goals, such as "mathematical thinking is going on" or "participants in the class are showing mutual respect." Changes in thinking and practice are documented in the study. For example, one video club member gave a video presentation on her use of collaborative groups in mathematics. Her approach was very different from the rest of the group's teacher-centred classrooms. As a result of this meeting, three members took the initiative to change their teaching styles to incorporate more group work and then shared videotapes of themselves using this approach in subsequent meetings. "These club members were in essence carrying out design experiments . . . in their classrooms, using the video club as a research group to help them interpret the outcomes of their experiments" (Frederiksen, et al., 1998, p. 277).

The videoed lessons and clips featured in our own professional development materials offer a mixture of different approaches, portraying the complexity of teaching practice. Many teachers will see familiar practice, while also being challenged by new ideas. Some will be encouraged to investigate how far the teachers featured are achieving their own goals, for example dialogic intentions, and to consider the influencing factors and challenges with the approach. Others will be motivated by wanting to trial aspects of – or improve on – the practice depicted.

The next chapter (8) examines the impact of the intermediate theory-building process upon T-MEDIA teachers' professional development and subsequent practice, and looks at wider benefits too. A follow-up study of mathematics teachers' professional development is presented in Chapter 9. The outcomes of working with teachers to analyse dialogic teaching with the IWB are then reported in Chapter 10, before drawing conclusions and implications from the account in Chapter 11.

THE IMPACT OF RESEARCH COLLABORATION ON PROFESSIONAL LEARNING AND PRACTICE*

INTRODUCTION

This chapter reports on a follow-up study carried out by Hennessy and Deaney 1 year after the T-MEDIA project collaborative analyses. Its aim was to assess the subsequent impacts of the process of critical reflection and theory building. The study elicited structured and personalised accounts from the eight teachers of impact on pedagogical thinking and practice and the supporting or constraining factors. It also investigated the extent to which the ideas and practices they had developed were subsequently shared with, taken up or adapted by their colleagues and schools. The study was prompted by T-MEDIA teachers' comments indicating that they strongly appreciated having the (uninterrupted) time to step back and view their own practices as observers, to participate in academic discourse relating to strategies for supporting technology use and how these might be adapted to different contexts. The opportunities to discuss topics 'at a high level' and 'to analyse teaching practice in depth' as co-inquirers were perceived as novel and 'exciting'. The follow-up study investigated whether these perspectives and experiences were sustained over the longer term.

TEACHERS' PROFESSIONAL LEARNING: FRAMING OUR ANALYSIS

The Section Two Introduction mentions the handful of prior studies on teacher learning where scholarly knowledge or pedagogical models are introduced to, critiqued, adapted and integrated with teachers' own thinking and classroom practice, with a view to increasing understanding and improving practice (Butler, et al., 2004; de Freitas, et al., 2008). The findings have some implications for the follow-up study presented here, although we did not originally set out to improve practice in this way nor was classroom support provided as it was in those studies; instead we examined whether the sociocultural theory introduced had any subsequent use as a tool for characterising teacher thinking about pedagogy.

In framing our analysis of the data reported here, we drew primarily on an in-depth study reported by Zwart *et al.* (2007) of teachers' ongoing professional learning through 'reciprocal peer coaching': experimentation, live lesson observation, reflection and exchange of ideas. That work adapted the seminal 'Interconnected

* *With thanks to Rosemary Deaney for permitting re-use of our joint work.*

Model of Teacher Professional Growth' proposed by Clarke and Hollingsworth (2002) which describes change in four domains: *personal* (including beliefs and attitudes), *practice* (experimentation), *consequence* (pupil learning & motivation) and *external* (stimuli, support, in-service sessions, conversations with colleagues). Our own analysis focuses on versions of the personal, practice and external domains.¹ We define the personal domain here in terms of *pedagogical approaches and thinking* (integrating both theoretical and practical insights as did Zwart *et al.*), and scrutinise *practice* in terms of planned and reported teaching and learning activities that developed the original pedagogical practices observed. These domains are examined in relation to impact upon them ('ending points' in the terms of Zwart *et al.*) up to that moment in time, 1 year later. They are also linked since change in thinking is often associated with change in practice.

There are three inter-related components of the collaborative video analysis with both researchers and peers – viewing and reflecting on recorded lessons, discussing what teachers did, why they did it and how successful it was for learners, and introducing sociocultural learning theory as an analytical tool. We construe these as the chief *external stimuli* and original sources of *external support*. The video analysis offered a potential trigger for change in both pedagogical thinking and practice (i.e. it was the main 'entry point' of interest here). Subsequent interaction with colleagues and/or school leaders over the year, initiated by T-MEDIA participants, constituted a further potential area of impact of the collaboration process ('ending points' in the *external domain*). We thus distinguish impact within classrooms, subject departments and schools (see 'Focus' section); at the classroom level we include teachers filmed plus their colleagues who reviewed the data (a non-reciprocal relationship in our case).

Finally, the intrinsic and contextual factors that might facilitate or constrain the processes of applying or disseminating new knowledge were an important part of our teacher questioning. Our own and other research indicates that external constraints in particular (concerns about delivering the curriculum, maintaining lesson pace and teacher control) can hinder even very enthusiastic teachers from fully integrating new technology into their classrooms and from allowing pupils to use it (Hennessy, *et al.*, 2007). Likewise the pace and demands of school life seem to hinder opportunities for teachers to observe, discuss, develop and reflect on practice (Glazer & Hannafin, 2006). Importantly, conditions for sustainability, evolution and dissemination of technology-integrated practice include adequate access to reliable resources, a supportive organisational culture and a collegial environment (Deaney & Hennessy, 2007).

Focus

The follow-up study explored the impacts of the process of critical reflection during TMEDIA on professional knowledge creation by the participating teachers and on dissemination within their subject departments and schools. A distinctive departure from previous studies of researcher-practitioner collaboration and 'peer coaching'

was evaluation of our individual and joint theorising about lesson events at a micro-analytic level. The research questions were deliberately wide-ranging so as to capture all potential forms of impact anticipated:

1. What was the impact of involvement in the project upon participating teachers' pedagogical practice and thinking?
 - 1a. To what extent and how has engagement in the collaborative video analysis influenced participants' teaching of the topics investigated and of other topics? Have they developed or modified their practice? Have participating colleagues adopted the practices observed in other teaching contexts?
 - 1b. Has the analysis had any general impact on pedagogical thinking?
2. Did the constructs introduced from sociocultural theory influence teacher thinking or understanding of practice in any way?
3. To what extent have the approaches and practices identified been taken up and adapted by (a) other subject colleagues or (b) more widely within the school? What mechanisms operated here?

And permeating all of the above, what were the supporting or constraining factors affecting adoption, development and dissemination?

Data Collection and Analysis

The eight T-MEDIA teachers were interviewed approximately 1 year after the original cycle of review meetings in each case. Semi-structured interview questions were distributed beforehand in order to give participants time to refresh their memories and prepare responses. Corroborating documentary evidence of dissemination to colleagues or wider impact was gathered where available². Interviews lasted 60–90 minutes. Transcripts were validated by interviewees, who made no amendments (except to add text where audio recordings had been undecipherable).

The analysis drew upon rich contextual information derived from the T-MEDIA research. The analytic tradition in the case study literature (Yin, 1998) advocates analysis across multiple case studies plus complementary analysis within cases, and across multiple data sources. We thereby aimed to capture both similarity and situated variation of practitioner response. A simple coding framework comprised eight broad (non-exclusive) *a priori* categories linked directly to the research questions (*dissemination to subject colleagues, wider dissemination, impact on teaching same topic, impact on wider practice, impact on teacher thinking, impact of joint theorising, modification of practice, contextual factors of influence*).³ Relevant data in the 16 video review meeting transcripts were also trawled and 35 excerpts were ultimately coded using the same categories. Systematic coding of interview and meeting transcripts was assisted by use of HyperResearch™ 2.6, a software tool for qualitative data analysis. Data from each case were independently coded (where relevant to target themes), then cross-case links were identified using the reduced dataset.

Findings

Some general *contextual factors* influenced the development of practice outlined in the following sections. Teacher mobility proved the most significant obstacle to subsequent discussion between pairs and more widely within their schools. Half of the participants (two teachers and two colleagues) left their schools after the analyses. Hilary was studying, thus teaching very part-time. Chris had become Deputy Principal in a new school; he struggled to balance a very demanding job (and limited teaching time) with putting into practice the ‘many opportunities and thought processes opened up by the project’. Rolf likewise was a Deputy Principal who continued to have limited teaching opportunities. By contrast Ruth had taken over Chris’s role in IWB development in the school after his departure, partly as a result of her work with him on T-MEDIA, and was developing her colleagues’ practice.

Further key constraints on the desired development of practice were competing demands on teacher time and lack of IWB access for some individuals. The 14–16 science curriculum had radically altered too since filming, reducing the photosynthesis topic profile. Finally, technical issues intervened in the mathematics case, where both teachers wanted to trial a graphing activity involving photograph overlay but the school’s non-standard office software precluded transfer of the pictures.

More positively, the three schools each had a supportive leadership team and conducive ethos for both research and professional development initiatives; these are known success factors, impacting upon motivation and sustainability of change (e.g. Guskey, 2000). Two schools were members of our Faculty’s established schools-university research partnership (described by C. McLaughlin, et al., 2006).

The findings related to each specific research question are now summarised.

1. Impact of project involvement upon teachers’ own pedagogical practice and thinking

1a. Impact on participants’ practice in the original and other topic areas

This section describes how the teachers filmed had sustained their practices over time and they and their colleagues had adapted them according to the needs of particular classes. This first level of professional learning and change is routine practice to some extent but here it was additionally associated with critique of the observed lessons.

Jackie had successfully taught the English topic again, with a weaker group, this time using the whiteboard only as a prompt and introducing role play in order to facilitate understanding of what the poems revealed about society.

I’ve made it more interactive. . . because they are those kind of learners. They are not so content at speaking their points of view and watching the development of ideas on the board. They like to trial things a little bit more physically.

The approach included revisiting images and phrases from the poems studied on the IWB (‘silent scaffolding’), and ‘drip feeding’ suggested techniques for starting

the writing. Jackie planned to extend IWB use by comparing poems displayed simultaneously. She had introduced similar strategies across a range of topics including studying *Romeo and Juliet*.

Colleague Tina had moved schools and although she had ideas for modifying the approach developed by Jackie, she no longer had access to an interactive whiteboard. Having 'all these locked up resources' proved very frustrating.

Lloyd had modified his approach for his subsequent history class, shifting the focus and balance of activities slightly, retaining many images but making the module shorter.

Sarah had used many of the same resources the following year in teaching the mathematics topic, but modified their phasing within the sequence and included 'real life' examples as discussed in the project (Deaney & Hennessy, 2011). Colleague Hilary had adjusted her approach to teaching straight line graphs as a direct outcome of early discussions of how Sarah was going to teach. She reported "starting with a *problem* point of view" and working towards the equation by building up from plotting points by hand, using online co-ordinates games or graphing software with a greater degree of adaptation, as portrayed by Sarah, "breaking it down into those smaller chunks" and "playing around" with the sequencing, depending on the group.

In common with most other participants, analysing the video at a micro-analytical level had made her "more conscious of my thinking when teaching other topics too" and led to some change in her wider practice as well as increased reflectiveness.

You can get a bit wrapped up in the day-to-day teaching. ... So having a chance to reflect and actually think about what you were actually doing ... even though some of those things just happen subconsciously, actually trying to put it into words and thinking about it, is useful.

Chris had recently taught the topic of photosynthesis to a new group using selected parts of his original sequence, but as a single lesson only, as appropriate for the new curriculum. However, there were other more general areas of development for him, exemplifying the many instances of teachers' increased awareness of their own pedagogy as a result of the in-depth review process. Chris noted the research team commentary about the notion of narrative (being told a realistic story) as a method of moving learners on; although he had not used this technique consciously, he subsequently planned to do so.

His colleague Ruth had explicitly drawn on the approaches that Chris had modelled, such as visualising techniques, and wanted to develop them further. She had also become more confident in allowing children to write more on the IWB rather than just "moving things from one place to another". Pupils had become more comfortable with this too. Ruth now used the IWB to build up a picture of "what's going on" during a lesson or over several lessons, through revisiting learner contributions for revision purposes (an extension to Chris's original approach). She had become more conscious of her questioning and much more responsive to pupils as well.

Drawing things out ... had become intuitive through experience of years, but I hadn't actually thought what I was actually doing by asking that question. ... Now I can find myself, without planning it, going on certain routes, depending on what the response is from some of the kids. Or just not giving in and telling them the answer.

When revising the department's schemes of work, Ruth had inserted suggestions related to the materials and approach that Chris had used. Watching him teach had helped her to realise that adaptation to individual teachers' ways of working was important. When sharing IWB files she told colleagues "they are not tablets of stone, they are not lesson plans. You are going to have to adapt them to fit [with] how you want it to flow."

To conclude, the unique role of the teacher colleagues was a key element of the TMEDIA methodology. Colleagues were not co-teachers in the same classroom nor did they assume the same role as the teachers filmed, who were required to scrutinise their *own* practice. Nevertheless there were clearly increased resources and new directions available to them and these were enthusiastically exploited.

Note that subject colleagues were chosen by the teachers themselves. It was evident that the pairs enjoyed good personal relationships, had similar pedagogical beliefs and approaches, were motivated to interact with peers to improve teaching and learning in their classrooms, and were used to discussing practices informally and respectfully. These are all factors underlying successful sharing of ideas between teachers (Glazer & Hannafin, 2006; Manouchehri, 2001).

Ib. Impact of involvement upon pedagogical thinking and professional development practices

Here we describe change at a second, deeper level. The process of reflecting critically upon practice and making explicit and justifying underlying rationale becomes both pervasive across an individual's wider pedagogical approach (i.e. thinking and planning) and embedded in ongoing professional development practices. Half of the teachers reported some form of "profound impact" of the collaborative video analysis on development and broadening of their own thinking. Their reports are similar to Rathgen's (2006) descriptions of "professionally life-changing" outcomes that were in daily use by teachers, including increased reflectiveness, critical analysis and a significant re-evaluation of teaching objectives and learning processes. Lloyd reported:

Thinking about the lessons has made me go back to some fundamental questions: who makes the history in the classroom? Where does the dialogue start from, where does it end? And who owns what we take as most important out of the discussion?

In this case the process of collegial interaction had extended beyond learning at the individual teacher level and yielded subsequent "benefits for the [department] in

terms of creating conversation about ways of doing things, and about working with colleagues on doing things”.

For others too, the deeper insights gained reached far beyond the strategies for using technology that were our original research focus, and offered implications for teachers’ professional learning and metacognitive development.

It was really good INSET [in-service training] ... that has had a very very significant impact; it’s moving to this level of metacognition ... standing back and thinking ‘why I am I thinking that?’ ... so much of it has now become ingrained. ... So the process was very useful, not just in planning for teaching, but in preparation for being a Deputy Head ... it’s had a broad impact upon [my] general level of thinking. ... [Instead of simply reacting] everything is treated as provisional while you stand back and consider all the aspects first. It has ... helped me to help other teachers I’m working with and line managing about how to think about situations themselves. (Chris)

It makes you rethink completely the whole approach that you take to teaching. [...] I learned loads of things; it was really good for me to see [the videos]. Jackie and I were talking about it being part of learning conversation and for observing lessons, which we have to do this term ... we can feed all of this back to our Faculty. So it has extended our practice. (Tina)

These impacts at the deeper level underlie changes in thinking and pedagogic values that are implicitly linked with some of the changes in practice outlined in the previous section, for example Hilary’s increased reflectiveness and varied sequencing of activity. Likewise Ruth’s strategic questioning and responsiveness to pupils were based on a reported shift towards valuing and building on pupils’ contributions.

Finally, Lloyd suggested carrying out some analysis of video with *pupils*:

See what kind of learning is going on. . . .almost, with some framework, getting them to comment in the way that we’ve commented, in some sort of ‘kid speak’ way. . . . What are your views on how the lesson’s been structured, are we engaging everybody’s ideas here? Who’s in charge of the lesson?

Rolf felt that this was more critical than the interaction with the technology itself: “Novelty can wear off – but collaboration, pupils as learners in that shared culture, that’s what’s timeless.” Sarah had in fact shown parts of the mathematics video to participant pupils. They had enjoyed it and had responded by spontaneously volunteering or discussing answers while viewing some episodes.

2. Impact of collaborative theory building upon thinking and practice

A unique feature of the T-MEDIA methodology was the co-construction and refinement of theory, within the supportive context of a ‘genuine partnership’ between teachers and university researchers (Rathgen, 2006). The perceived impact of the collaborative theory building was multidimensional. First, it was seen as

rendering ‘hidden’ practice more visible as an invaluable precondition for critical reflection. There was a strongly emerging feeling that the new terms “‘just reinforced things that you were doing before’ or reflected a teacher’s relationship with children. Nevertheless ‘having a coding scheme that values those things that you might not necessarily recognise or value yourself ... was useful’” (Jackie). Likewise Hilary found that some terms helped her to think more consciously about everyday actions, for example ‘reigniting’ ideas from the last lesson. Related to the first facet then, the process raised metacognitive awareness of routine practices and led to questioning of underlying values and assumptions. Lloyd elaborated this eloquently:

[The coding] helped me to ... clarify some of my own thinking about what I saw happening in lessons that I was teaching and in other people’s lessons that I observe ... It’s almost like the codes were becoming used by me, for my own purpose, to try and look at aspects of my teaching that I found interesting. ... *Funnelling*^A and *dialogic interaction* are good descriptions of what I do, but hadn’t identified in that way before ... it brought my thinking on about what those things were ... particularly it’s helped me re-think ... what the start point and the end point of learning is and where it should come from.

The use of the codes helped me to think about what I was seeing with a particular vocabulary, a particular language to do it with ... it helped me articulate those things rather more effectively ... [the codes] have made my understanding perhaps a bit more complex.

Colleague Rolf also believed that the project would have been impoverished without the new vocabulary introduced to shape lesson commentary; his remarks would then have “‘very much focused on the use of IT [with] very limited things to say’”. He described how the video review and coding had offered an unanticipated, much broader focus on ‘how we look at interaction between teacher and pupils and pupils and pupils. What is good teaching?’ He greatly appreciated the chance to analyse in depth that the collaborative video review process had offered [imposed?!]:

Being forced, and I use that word deliberately, to watch these videos of these lessons and to use words and phrases I’ve never used before – what a learning experience that is as well, I mean that was extraordinary. And to know that you are accountable because you are going to meet up and discuss these, I think has been also a very important, useful aspect of the work. Analysing something to that level as well. Not just looking at a lesson once, but maybe looking at it three times and then discussing it with colleagues and realising you’ve actually missed some things but sometimes you may have seen some things that others hadn’t. It’s all very very useful actually. It’s had quite a profound impact on me. (Rolf)

Being forced to look at practice and theory *in depth* was clearly not always a comfortable process, but rather a mixed experience for most. It was variously reported to be challenging, unnerving, exciting and enjoyable. Teachers reported that they had “‘benefited both personally and professionally’” and felt “‘blessed to have

been involved... [it was] the best INSET of my career.” Yet the process evoked some vulnerability too as teachers were forced to explain their strategies and actions and to confront their own possible shortcomings, making it impossible to carry on with complacency.

Part of the motivation to actually take part in the project was an example of the most intensive personal reflection that I’ve been through for a long time and actually being forced into a situation whereby it’s really good INSET to reflect at great depth and have to justify the reasons you were doing things. So it meant sometimes having to be painfully honest as well about looking at shortcomings. (Chris)

It was challenging in that you had to be brutally honest with yourself and you couldn’t just rest on your laurels. I guess it alters your perspective on things. Do you look for the things that are going well, or do you pick out things that are not going as well as you would like? That tends to be my predominant attitude, that you see the black spot rather than the white paper and then I guess you struggle over that point and it is always in the back of your mind about how you actually move forward with it. So I guess that was quite a hard process, to not be just able to skim over what was happening but to have to address those issues but I think that is what brought the real growth. I have not been able to just go on regardless. And it was hard, challenging in terms of the time required to stop and think at that level and start planning at that level which was very useful, but in the normal teacher’s week the time for that sort of degree of reflection is hard to find unless you eat into your own time in the evenings. (Chris)

Use of theory evidently helped the teachers to identify, make sense of and articulate facets of complex classroom practice and offered them a new terminology to support this. Jackie’s colleague Tina described her experience of the process thus:

Once you got used to those terms it was actually then quite easy to look at the videos ... It’s just a whole new meta-language for us to be dealing in really; it’s a research language rather than the language of the classroom, and also really a language of education.

Jackie herself pointed out that

it’s very very difficult to suddenly think of a word for a concept or an idea that you are putting into practice. The *scaffolding* was easy because we are used to that and we do that all time, but some of the other terms would have been quite difficult for us to think of.

I think also some of the terms themselves helped. Like *funnelling* [is] a fantastic word for a very complex, long-winded, rambling description of something that happened . . .

Chris's colleague Ruth elaborated her perceptions along similar lines:

The idea of *scaffolding* is something that sticks in my mind quite a lot, which the actual process I had done bits of but not really understood what I was actually trying to build up . . .

She described the biggest effect upon her pedagogical thinking as “actually understanding the impact of a particular activity on students' learning” and was therefore able to plan more cogently. For example

Am I dragging them through or am I going to let them discover it, or am I going to set up a *scaffold*? . . . now I can understand why it does work or how to take it the next step.

Hence the process of developing collaborative theorising offered teachers a means of arriving at not just new descriptions, but also explanatory understandings of context and practice.

During the review process, we introduced teachers to wider literature including Robin Alexander's (2004) treatise on 'dialogic teaching'. Lloyd subsequently shared these ideas within the history department, and with pupils too. We received the following feedback from him via e-mail:

The pamphlet has created quite a flurry of excitement! . . . Discussed some of the ideas today with an able group after we had discussed whether the Holocaust was a unique experience. Where writing occurred, it was in response to student contributions. Teacher faded and actually became a contributor and learner. We then talked about the different roles people including me had taken in the lesson. Some consensus that some students, NOT the teacher had provided the main points for others to reflect on/challenge/shape thinking. Hugely rewarding!!

Lloyd had found it enjoyable and productive to explore the notion of dialogic teaching and to tease out the differences between types of interaction during development of the codes.

It's something I can reflect on and use . . . to think, 'Let's try and really take some of those codes, even where the differences seem quite subtle, and actually try and put them into lesson planning and see . . . whether you can do that successfully'.

This resonates with the conclusion of de Freitas *et al.* (2008, p. 37) that “teachers learn to talk the talk of educationalists by making sense of the artefacts [they] provide”. It demonstrates too that the theories were not accepted unquestioningly by our reflective practitioners but put on trial for their applicability and value within practical contexts. The most surprising application of this trialling to practice emerged as a lesson observation schedule (Appendix 8) formulated by the history teachers for use across the whole school. This comprised eight selected themes from

our jointly developed coding scheme. Lesson observation was already a means of sharing practice and of performance management, but the teachers were dissatisfied with the existing generic proforma.

It's a fairly standard [inspection]-style observation sheet. It has things like 'relations with pupils: tick outstanding, good or satisfactory' . . . [but] there are one hundred different things that we might be doing. . . we need to be able to tease that out more and make that more effective, what we mean by that and what we are observing, which of course partly comes from this work. (Lloyd)

The pair saw the language of our collaborative intermediate theory as “exciting” and offering a sharpened focus for observing teaching and learning and as above, *analysing* it:

Having that vocabulary actually helps you think about this because without it you tend to describe things in very vague terms and I think the more analytical you can be, the more helpful it is in terms of working out what is going on . . . something that focused on some aspect of teaching, for example the dialogic aspect, would be extremely informative to [both teacher and] observer. (Rolf, Deputy Principal)

Rolf suggested that different observation sheets could be generated, depending on the focus. Lloyd agreed that developing a descriptive language that teachers were happy using could encourage a more analytic view of lessons and capture aspects such as pupil-teacher interactions or developing co-operative learning. He saw the scheme they had formulated as a starting point and a stimulus for collective questioning and subsequent development of practice:

There's a lot of debate that needs to happen there about whether or not these things are good, how people would adapt these ideas, whether they'd reject them, and is there something better that goes in their place or are we just happy with 'relationships with pupils are good', or your questioning is 'good'?

At the time of writing, the schedule had been trialled successfully by three teachers in eight lessons and was expected to be more widely adopted. Related to this was the “very powerful” idea of “Pupils as Learning Partners” (PLP) arising from Lloyd's discussions with Humanities colleagues about the T-MEDIA research. This involved two pupils (incognito to peers) commenting on lessons using the new lesson observation sheet. They also wrote sections of a diary during the lesson, discussed this with the teacher afterwards, and helped with subsequent lesson planning. Lloyd perceived this as “a logical step from collaborative knowledge building” that incorporated “a large element of trust”. PLP had been trialled with four teachers and was expected to spread to other faculties; the school had procured external funding for the initiative.

In sum, engagement with the research process clearly stimulated critical analysis and creative development of practice in this case. The mutually developed

scheme was adapted to provide a valuable, practical tool for both teacher and pupil feedback about classroom teaching and learning processes and a catalyst for further pedagogical development.

In the same vein Chris suggested that the complexity of teaching and learning processes had become much more apparent through creating his diagram that knitted together the constructs in our coding framework:

One thing that struck me when I was doing this was that you can have this notion that teaching is simple and that planning lessons is actually a simple task to do, because you started off doing it at university, you know, in a very simplistic form, and you haven't really perceived the changes that have occurred as you go through. But this has really shown me how much more of an art form it actually is in terms of preparing things, and this whole thing has just given me a brilliant starting framework for actually doing observations of other people, and actually being much clearer about what's going on, and more able to respond effectively to what you see.

For all of the teachers involved, intermediate theory provided an *analytical lens upon existing and emerging practices*, including those not incorporating technology. However the specific constructs were not necessarily applied to practice after the analyses ended. A *more general impact on strategic pedagogical thinking* was sometimes evident, adding further examples to the accumulating impact of the video critique on analytical thinking. For Chris, like the others, the theory building had offered "another view into the intricacies of what you're doing".

It allowed me to rethink, to re-sort my tool kit, to realise I had these individual tools and I could use them to different respects rather than just using them all to hammer.

Sarah explained how encountering the new terminology had influenced her pedagogical thinking by making her reflect upon her natural questioning techniques and structuring of learners' responses and discussions.

Do I want a single answer? Do I want a discussion? Do I want them to come up with as many alternative answers as possible?

Finally, one of the history subject specialists, Arthur, spontaneously described how the glossary of terms we provided and the intermediate theory built up during our discussions, had helped to increase his own knowledge and had subsequently proved useful in his practice as a teacher educator:

One of the particularly valuable aspects of my involvement was my own increased understanding and appreciation of sociocultural approaches that resulted from it. As a teacher educator, I was very used to thinking about teacher actions in terms of processes such as 'scaffolding' and 'modelling' (DfES, 2004 Key Stage 3 National Strategy – Pedagogy and practice). I was

not aware of the provenance of many of these terms and the process of writing commentaries on the lessons was an opportunity to think about particular teacher actions in much greater depth than I might have done otherwise or had had the opportunity to do before. I found the categorisations of teacher activity developed by the T-MEDIA team (see Glossary in Appendix 6) fascinating and very helpful in helping me to enhance my vocabulary for thinking about teaching and I drew on the terminology extensively with my students subsequently.

3a. Sharing of pedagogical approaches with other subject colleagues

Participants were generously funded during their project for time for reflection and discussion but other departmental colleagues were not, thus opportunities to review their own practice or thinking were expected to be limited. Indeed it was unclear whether expecting any change among colleagues who had not participated in T-MEDIA was realistic. In practice, Department/Faculty meetings provided one helpful forum for sharing approaches (to teaching and learning generally, or to using technology). Jackie's scheme of work had generated a discussion about teaching techniques for poetry. Ruth planned to share her T-MEDIA experiences in relation to specification of the new 11–14 curriculum, however most of her dissemination to colleagues related to training them on technological features of the IWB.

Mathematics colleague Hilary likewise viewed increasing technology use as the first step, describing how this had occurred in her department as a result of T-MEDIA. There was also apparently “quite a lot of discussion going on about the approach Sarah took, and then breaking that down, because obviously you teach it to different year groups using different approaches. I think that's where it's had the most impact.” Her colleagues had adopted Sarah's approach of using graphing software and online games for line graphs.

In some cases impact was viewed as longer term. Sarah was encouraging one colleague to use more technology: “She's getting a tablet and she can then watch the [T-MEDIA] video and see how I used it.”

Lloyd reported positive effects in terms of “awareness-raising and also people's interest in [ongoing] whiteboard training ... there's a reference point from this project, I think, for people who ... perhaps feel more confident now, having seen somebody like me use [that sort of technology], to go forward and to be trained in using it”. The approach to teaching the history lesson sequence itself had been disseminated to two other colleagues, who had “pretty much followed the line of those lessons” and had discussed with him how those lessons had worked. However, he considered the technology a subsidiary focus to his Faculty using and formalising the pedagogical approaches through developing other lessons.

Finally, Rolf was enthusiastic yet realistic about the prospect of extending the process to bigger groups of colleagues in his school and to transcending subject boundaries, although he was not convinced that circumstances would allow this.

Another part of the process that you've employed in this research is to have a lesson videoed and analysed by different people, and that is something I think would be great to do as well. I can't necessarily see it happening, but in some ways it would be nice to do that. To have a whole faculty look at a lesson, discuss it, maybe go away and look at it independently and then come back and discuss it, or of course, maybe better still, people from different faculties looking at a lesson. What a powerful resource that would be and what useful discussions we would have. That as a tool for discussing teaching and learning, I think that would be really really helpful and even maybe it's something I should think about in terms of the heads of faculty, that we set ourselves a task like that because we haven't done that sort of thing [. . .] But I'm now talking about possible ideas rather than things that are actually going to happen.

3b. Wider dissemination of approaches

There was some limited evidence of sharing ideas with colleagues beyond the participants' subject departments. Sarah had written a short article about the T-MEDIA research in a Teaching and Learning Group magazine whose purpose was 'to share good practice amongst staff' across the school. Hilary confirmed the wider impact the project had had on the school's research culture a year later.

I think there is a definite move to teacher action research ... there are other staff picking their own subject that they are interested in and doing some research ... [T-MEDIA] was definitely one of the first things in the school and then suddenly it all mushroomed ... [I don't know] whether or not things were going to go in that direction anyway, but I think having something solid to talk about helped.

Chris described a strong impact on his new school and its practice as a result of devising a staff training programme that models classroom use of IWBs: "I use that basis to deliver some of what has come from the project ... suggesting how they can start using it [to intervene] in the way in which [pupils] think." Likewise Ruth drew on T-MEDIA video footage from mathematics and history lessons to develop her own knowledge of IWB use as a basis for training staff in different subjects.

There was strongest evidence of wider dissemination in history. This offered an example of change at a third, institutional level: here the teachers recognised the value for broader professional development of collaborative video or live lesson analysis that draws on relevant theoretical concepts using the language of intermediate theory, and they sought to introduce and embed these approaches into school-wide practice. The whole school lesson observation schedule already mentioned was a powerful example of this; it offered a new frame for evaluation, hence illustrating change in another facet of (organisational) practice. Lloyd had begun discussions with teachers in other departments and schools about this version of our coding scheme and the pedagogy it captured. The English department was particularly receptive; lesson

activities were, like history ones, characterised by “a fairly open style of learning”. Lloyd had viewed and discussed a history video clip with the Head of English and planned to do more of this. Most significantly, Rolf reported that the English faculty were interested in the actual *process* of analysing practice during TMEDIA and in conducting another research project as a spin-off:

It would be along the lines of establishing if the whole notion of dialogic teaching, if the work that we did, particularly looking at creating concepts and vocabulary and tools to help us recognise what happens in the classroom and develop that, whether that can realistically be spread across different curriculum areas, even to teachers who are not particularly engaged in research.

Related to this was an increased realisation – expressed by both Lloyd and Chris – of how complex the teaching process is and how much is happening in a lesson. Chris and Ruth had both developed a more critical approach to observation of trainees’ science lessons. The experience of lesson analysis had also given Chris “a great framework for observing other teachers” with a clearer focus and more ability to respond to what he saw.

Lloyd felt that there were other potentially fruitful cross-curricular applications in the context of a new national peer coaching initiative: ‘the idea of coaching colleagues, or co-coaching, where you try and improve your practice in something, and an aspect of this kind of work would be an obvious thing where we could then use the videos. So it might be about questioning, it might be about how to frame a discussion . . . that’d be really exciting.’

Rolf highlighted links with his current leadership of the Spotlight Programme, based on the notion of “a self-reflecting, self-evaluating school”: involvement with T-MEDIA had “helped make it a pretty rigorous and valid exercise” and “sensitised me to some of the issues there.” These included the role of the observer, what was observed, and whether a consistent approach was appropriate across faculties and levels of experience.

There was a “wider angle” too. Lloyd had contributed to two external conferences associated with his school’s status as a research-oriented training school and there were plans for further dissemination at a forthcoming Training and Development Agency national conference. The focus in each case was on our research collaboration itself, its growth from exploring IWB use to “more generally looking at different teaching styles and ways to do things with kids”, and the emerging theme of dialogic teaching.

We tried to show how a partnership with other colleagues from [outside] school . . . presents other possible questions for you to think about. So is there a research question there for us in the school about classroom talk? . . . And . . . we used some of the ideas from that pamphlet (Alexander, 2004) that you gave us. People were very interested in that.

Finally, both Lloyd and Jackie were co-presenters with the university researchers 2 years after the analyses at a national seminar on pedagogies for interactive technologies; their presentations tangibly illustrated the theory building process and highlighting the long-term impact upon their practices and thinking. Even further down the line, sending Chris (in 2010) the first draft of the science case study chapter of this book elicited the following response via email:

It actually brought back to me the excitement of the project and reminded me of why I went to become a deputy head – must try to redirect more of my time to considering best practice rather than systems next year!

And Lloyd's reaction at the same point was

It was fascinating to re-visit this work which I enjoyed so much... I learned an enormous amount. Interesting for me how the ideas underpinning the lessons are similar to those used [now] by many teachers at our school, and an increasing number. My colleague who is about to lead a Teaching and Learning group in school has a huge interest in interdependent learning and dialogue. The Chesterton understanding of these ideas is well developed and continues to broaden and deepen and this can only be a good thing. It is particularly interesting to reflect again on the research process and Arthur's comments show just how important his role in the project was.

Jackie had two children after the study ended and is now juggling motherhood with part-time work. Her response to the first full draft was rather wistful:

I'm so glad I took part in this research as it really was a unique experience and something I just wouldn't have time to do now ... It's lovely to read the draft and remember all that we talked about. Maybe one day I'll be able to sit back and think about my teaching in such a reflective way again.

CONCLUSIONS

While the original aims of the T-MEDIA research project focused on understanding rather than improving practice, the nature and outcomes of the collaboration process shared a close affinity with the 'co-learning' and similar partnerships between researchers and practitioners documented by Wagner (1997), Baumfield and Butterworth (2007) and others. That line of work showed that professional development based on peer observation, collegial interaction and reflection on both self and peer practice can promote substantive change and deeper reflective practice, and the capacity for such shared learning can itself be learned (Glazer & Hannafin, 2006). Teachers involved in the T-MEDIA research benefited from engaging in reflexive inquiry within the supportive framework of research collaboration with both university and school colleagues. They actively participated in systematic joint analysis of lesson videos and negotiation of an interpretative account, within a carefully orchestrated forum for discussion, reflection and critique.

A unique feature was the use of sociocultural theory as an analytical tool, providing new constructs and language with which to understand, describe and disseminate emerging, situated practice with technology in more sophisticated and detailed ways. The theory constituted the pivotal stimulus underlying the reflective activity, and was itself the subject of development over time. Professional learning took place here through the inter-related processes of scrutinising practice (and postulating alternative approaches), articulating and codifying tacit craft knowledge, and contextualising and reformulating scholarly knowledge (Ruthven, 2002). Ultimately we co-constructed accounts of pedagogy that reconciled, extended and transcended multiple individual perspectives. Shared ownership over these accounts and selection by consensus of key approaches (and exemplars of practice) on which they were based may have conferred increased status and confidence in those approaches. Of paramount importance here too was relevance of emerging ideas to teachers' own classroom contexts.

This follow-up study demonstrates that the collaboration process had an unanticipated, significant impact on evolution of participants' pedagogical thinking and practices relating to the topic areas originally observed and to other areas too. Specific subject practices developed by the teachers filmed were adopted and modified by their participating colleagues; this included closer attention to levels of learners' involvement and teacher responsiveness to their needs. A key mechanism here was the common view that the analysis process allowed teachers "to break down what the strategies are and to build up from the component parts different ways of doing things rather than just wandering through" [Chris]. It also appears that the benefits to individuals of their reflection and theorising were extended more widely to other subject colleagues within the schools. As our earlier study (Deaney & Hennessy, 2007) found, take-up of specific practices outside of subject departments was inevitably more limited, although the profiles of technology use and classroom research were increased in two schools. There was one very significant exception, however: the direct application of outcomes to practice through development of a whole school lesson observation schedule based closely on our jointly constructed thematic coding scheme (focusing on classroom interactions rather than technology use).

In sum, the outcomes included a range of changes in both pedagogical thinking and practice, along with some examples of increased metacognitive awareness of underlying pedagogical aims and rationale; these various facets of change were often inter-related. They were sustained over a year after the collaboration, without interaction with ourselves (Butler, et al., 2004). Zwart *et al.* (2007) found that "ending points" of "reciprocal peer coaching" were more often in the cognitive, personal domain rather than in the behavioural, practice domain. They speculated that this may be attributed to teachers' tendency to associate learning with knowledge and thinking and thus to report these explicitly. However, changes in practice may simply have not yet been enacted. In our study several plans for further development of practice were articulated but as yet unrealised after 1 year, as illustrated above. In

the study by Zwart *et al.*, coaching was in fact ongoing during the 1-year period and could thus be expected to continue to provoke change afterwards.

To conclude, we have shown that under conditions of sensitive support, teachers readily accommodate theoretical constructs into specific contexts of professional thinking and practice. This accommodation appears to involve teachers in adapting and using such constructs as a cognitive resource that helps them to describe, make sense of, critique and learn from observed classroom practice. Collaborative video analysis provides a rich context in which teachers can develop such an approach to scrutiny of practice – through rendering implicit rationale, values and routine practices more explicit. The opportunities it affords for engagement in professional dialogue and scholarly analysis are highly valued by practitioners. Building a relationship of trust between researchers and teachers is essential here. The UK government’s e-learning strategy (DfES, 2003) emphasises creative teaching with technology and endorses the notion of collaborative partnerships between research and teaching communities. Feedback from our participants concerning their experience of one such initiative will hopefully prove a valuable resource in developing further fruitful partnerships in future. Collaborative projects like this are inevitably time-limited, however, and it must be acknowledged that their success depends upon dedicated and funded teacher release time – posing a key ethical concern. Likewise our study was located in a small number of sites, but it is argued that the video-supported collaborative theory building process that we have developed offers a generic approach that could feasibly be used by other teams working in other settings (and with or without technology use).

The approach was extended in the “Dialogue and IWBs” project which built on the dialogic teaching approaches characterised in our analyses. As described in Chapters 1, 6 and 10, this involved working with a handful of expert teachers – again including Lloyd Brown – in co-constructing a notion of classroom ‘dialogue’ adapted to the context of IWB use. A further study trialled use by mathematics departments of the TMEDIA multimedia resource as a stimulus within a cycle of teacher-led professional development – through video-stimulated dialogue and critique, joint lesson planning, peer observation, feedback and reflection. That work directly applied the findings of the follow-up study by exploiting collaborative video viewing as an effective tool for sustained professional development in the context of broader departmental and school leadership support. It is described in the following chapter.

CHAPTER SUMMARY

The findings suggest that for at least some, the sociocultural theory introduced and reformulated during the analyses provided a powerful analytical lens upon emerging practices, including those not incorporating technology. It also offered teachers a new terminology to describe their practices. All of the participants reported deep insights and lasting effects upon their own thinking and, except where external

constraints operated, on teaching practices 1 year on. Outcomes reported included increased reflectiveness, a general impact on strategic pedagogical thinking, raised metacognitive awareness of routine practices and critical questioning of underlying pedagogy, values and assumptions. The approaches developed during T-MEDIA had additionally been disseminated to and adapted by other subject colleagues in every school.

The study illustrates how collaborative analysis of lesson videos can be used to engage teachers in deep reflection, critique and debate. This approach supports development of an analytical scrutiny of classroom teaching and offers a significant professional development opportunity. In particular, under conditions of sensitive support, teachers will readily accommodate theoretical constructs into specific areas of professional thinking and practice.

NOTES

- ¹ While we have some anecdotal evidence of pupil learning and motivation from teacher reports, and positive impact here clearly fuels sustainment and spreading of new practices over time (they would be abandoned if perceived to be not 'working'), systematic measurement of pupil outcomes and correlation with project participation would have been impossible in a study describing teacher development over 1 year and across different pupil groups.
- ² This included a whole school lesson observation schedule based on our coding scheme (Appendix 8) and a short article about the research in a Teaching and Learning Group newsletter. Note that it was beyond the scope of the study to conduct interviews with colleagues who had not participated in T-MEDIA.
- ³ Three further categories covered participants' experiences of the research collaboration, of the research process generally, and of being asked to apply and refine constructs from sociocultural theory. The findings emerging here were reported in the case study Chapters 2–4.
- ⁴ Teacher questions were often progressively 'funnelling' towards a desired response: Bauersfeld, H. (1988). Interaction, construction, and knowledge: alternative perspectives for mathematics education. In D. Grouws, T. Cooney & D. Jones (Eds.), *Perspectives on Research on Effective Mathematics Learning* (Vol. 1, pp. 27–46). Hillsdale, N.J.: Lawrence Erlbaum..

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TEACHER-LED PROFESSIONAL DEVELOPMENT USING A MULTIMEDIA RESOURCE TO STIMULATE CHANGE IN MATHEMATICS TEACHING

Sara Hennessy, Anne Bowker, Mark Dawes and Rosemary Deaney

INTRODUCTION

The focus and methods of the T-MEDIA project and the development and structure of the resulting multimedia CPD resources were described in Chapter 1. Subsequent chapters have described the process of how two of us as university researchers worked closely with the teachers to develop intermediate theory. Chapter 8 then investigated the extent to which the ideas and practices developed by the T-MEDIA teachers were later taken up or adapted by other teachers. To facilitate wider sharing of the themes emerging and practices captured and analysed, the intermediate theory was embedded in the multimedia resources along with video clips of authentic practice and written commentary. The **Supporting Professional Development for ICT use in the Secondary Mathematics Classroom using a Multimedia Resource** project reported in this chapter was subsequently commissioned by the National Centre for Excellence in Teaching Mathematics (NCETM) as a consequence of strong professional interest generated by the T-MEDIA multimedia resources.

We describe the evolution of a teacher-led programme of professional development for secondary teachers, supported by the T-MEDIA mathematics multimedia resource. (The mathematics case study itself is not described in this book which focuses on our studies involving IWB use, but more information about the mathematics practices documented is available in Deaney & Hennessy, 2011). The resources are intended to support teachers choosing their own focus for development. This study explored how that could work in practice in schools, with minimal external support. We report how, in two departmental communities of inquiry, the resource was used to stimulate five teachers' classroom use of technology. Participants undertook cycles of joint critique of the material, design of new approaches, classroom trialling and peer observation, group reflection and analysis, and refinement of approaches for future design and teaching. An advanced skills teacher, Mark Dawes, conducted the research in his own school and one other. He recorded discussions, observed trial lessons, and carried out teacher interviews at the end of the trialling period and 6 months later.

In this chapter we explore the perceived influences of the process upon teachers' thinking and classroom practices. We begin by outlining the structure of the CPD process and use of the multimedia resource. The next sections describe the research methods followed by the themes and issues arising during the recorded discussions in each case study school. The chapter also looks at the spread of new approaches within participating schools. It mentions subsequent follow-up work and draws some conclusions and implications.

DEVELOPING THE CPD APPROACH

The T-MEDIA mathematics multimedia resource contains video clips from lessons employing a range of technology tools, and built-in professional development activities (see details in next section). The first aim of the study was to develop a way for mathematics departments of secondary schools and colleges to use the resource as both a provocative external stimulus and a tool for supporting their own development of either pedagogical approaches or effective uses of technology. Building upon contemporary approaches to CPD outlined in the Section Two Introduction, our proposed model is based on an iterative research cycle of teacher-led discussion and critique, lesson design and classroom implementation, peer observation, individual and collective analysis, reflection and refinement, feeding into future design and classroom practice. Its aim is to encourage teachers to try different approaches, using their own classrooms as testbeds, monitoring the results and acting accordingly.

Importantly, the focus of the inquiry and development is not imposed by external educators, CPD or subject leaders or head teachers, as is often the case with CPD programmes for mathematics teachers. For example, the RECME project commissioned by NCETM (2009) and a string of previous initiatives over the past four decades "seemed to set out to change teachers rather than involving teachers in change" (McNamara, Jaworski, Rowland, Hodgen, & Prestage, 2002). Here, using video allows a shared experience to act as a springboard for participants to identify important teaching issues to work on in the classroom (Jaworski, 1990). Teachers are asked to identify problems that they deem necessary to resolve, and to set their own agendas and targets to be achieved within a time period which fits sensibly with other commitments. The process is carried out by practitioner-researchers situated within a departmental community of inquiry (Bjuland & Jaworski, 2009; Jaworski, 2006). In such a community, "teachers try new ideas, reflect on outcomes, and co-construct knowledge about teaching and learning in the context of authentic activity" (Butler et al. 2004, p. 436).

The second aim was to document short case studies of trials of the CPD model and the perceived effects. Our research questions here were:

- How did participants perceive their experiences of the CPD undertaken through the collaborative inquiry process?
- To what extent did participants perceive that their engagement in the CPD process that arose from using the resource influenced classroom practice? Were any

changes reported in the practices of individuals or participating groups, either in relation to technology use or not?

- To what extent and how was involvement reported to stimulate any impact on pedagogical thinking?

THE T-MEDIA MULTIMEDIA MATHEMATICS RESOURCE

The resource illustrates how Sarah, an experienced secondary mathematics teacher, exploited different technological resources to develop learners' understanding of the concepts of intercept and gradient over a sequence of six lessons. Sarah had taught for 8 years and was Head of Mathematics at a co-educational comprehensive school with 800+ students aged 11–16. She had experience of mentoring and training in the UK and in South Africa. Her colleague Hilary had taught for 3 years at the same school and mentored newly qualified teachers. She was interested in taking forward the use of technology in her teaching.

The lessons depicted were filmed in an ordinary classroom setting where students (aged 12–13) spanned a very wide attainment and behavioural range; unusually, there was no grouping of students into classes by perceived mathematics 'ability' in this school. As in the three T-MEDIA case studies previously outlined, two university researchers (Sara and Rosemary) collaborated with Sarah and Hilary in critically reviewing in depth the video and other data. We drew on and refined constructs from sociocultural theory to describe Sarah's strategic use of technology.

The multimedia resource¹ portrays many of the pedagogical strategies that Sarah typically used (as detailed by Deaney & Hennessy, 2011), organised under five broad themes: *Using multiple tools and resources*; *Fostering a supportive and collaborative learning environment*; *Developing concepts and responding to learning needs*; *Capitalising on unexpected outcomes and errors*; *Managing use of the technology*. The interactive resource is designed to stimulate teachers' thinking about when and how they might use projection technology to support their students' construction of mathematical knowledge. A set of 13 jointly selected lesson video clips (typically 4–6 minutes each) forms a basis for teachers to reflect and debate (see screenshot in Figure 9.1). As indicated in Chapter 1, navigation of the resource is deliberately flexible. Clips can be approached in alternative ways: focusing on the technologies used, perusing the lesson videos in sequence, or exploring hyperlinked clips illustrating the central themes. The resource can thus be used to explore either issues around the use and choice of different hardware and software, or more general pedagogical issues.

TRIALLING PRACTITIONER-LED CPD WITHIN MATHEMATICS TEACHER COMMUNITIES

Structure of the CPD Process

In essence, the process afforded by the T-MEDIA multimedia resource helps groups of colleagues from the same department to create their own CPD activity. The

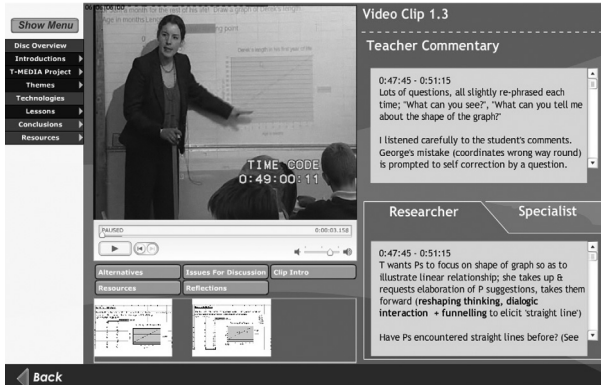


Figure 9.1. A video clip screen from the T-MEDIA mathematics resource.

flow diagram in Figure 9.2 illustrates the iterative process and activities that are encouraged, while still conveying the flexible use of the resource (Bowker, Deaney, Hennessy, & Dawes, forthcoming). In our model, the resource is introduced by each group's designated coordinator during two or three initial sessions (3 hours total). The group ideally views the introductory screens, familiarising themselves with the resource layout and aims. They go on to watch some video clips and discuss issues arising through constructive critique of the practices depicted and through anecdotes from the group triggered by viewing the clips. Ideally, contributions are made by all members, as in the 'anecdoting process' described by Duffin et al. (1991). Clips may be replayed with a conjecture or question in mind (Coles, 2012).

The structure and provisional focus of the CPD and an initial pathway through the resource are then negotiated and agreed (e.g. a Technology route might explore different uses of Autograph software – in pairs on laptops versus projected to the class; a Theme route might focus on *Fostering a supportive learning environment* by following links to clips depicting the sub-themes of *confidence building, collaboration, motivation*). In the course of discussion teachers may relate positively to what they have seen or they may disagree with some of Sarah's decisions and ideas. The other built-in materials and activities (all optional), such as the commentary, questions, prompts and suggested alternatives, may help to support the discussion. The teachers consider how emerging ideas might impact on their own practice and they refine the shared focus for development or exploration.

The role of facilitator is particularly pivotal in sensitively mediating this early phase. Facilitators may ask teachers to comment on what they find noteworthy upon viewing a clip and use their ideas for discussion (van Es & Sherin, 2008). Coles' (2012) pioneering work in this area identifies further responsibilities including decisions about which clips to show and when to replay, establishing discussion norms, supporting the articulation of difference, metacommenting on discussions to

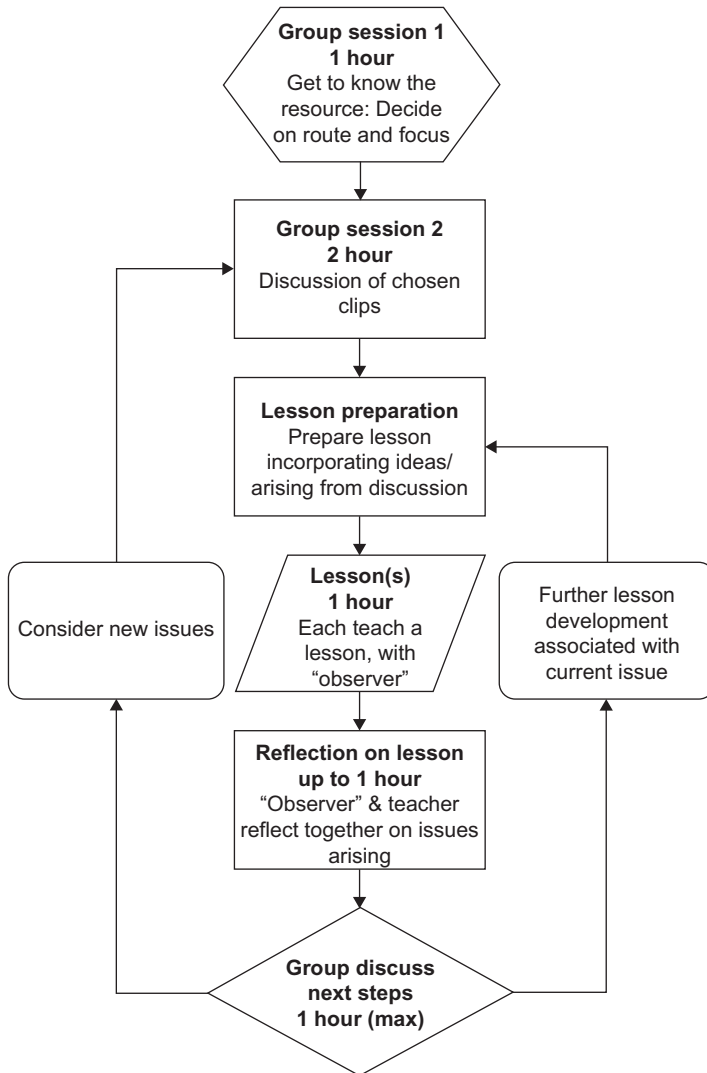


Figure 9.2. Proposed process of using the multimedia resources for CPD.

assist in defining a purpose, and above all, curtailing evaluative discourse and over-interpretation by focusing on observations (Jaworski, 1990).

The teachers then each plan a lesson in response to the discussion (1 hour of individual work). This may draw on materials or pedagogical strategies from the video clips (perhaps applied to a different topic area); it may incorporate alternatives that were discussed by the group; or it may focus on other ideas arising during the discussion, possibly in relation to developing current departmental or individual

practices (e.g. one teacher wanted to ensure that everyone was actively involved in whole-class work). Each lesson (up to 1 hour) is observed by at least one group member. In a post-lesson discussion (2 hours), the participants work collaboratively to reflect on the chosen issue from their different vantage points, to analyse success of the new approach and propose revisions, and to consider what might transfer to other settings. It is not a traditional “feedback on teaching” session. Instead the participants provide alternative understandings of relevant incidents and pose constructive questions for joint consideration such as:

- Was the type of technology / pedagogical approach used appropriate for this particular group and the teacher’s objectives?
- Are there any ways in which the technology could be exploited more fully next time?
- How responsive, engaged and motivated were the learners in this lesson?

The teacher-researchers then meet again for a whole group discussion (2 hours) about common themes arising and possible ways forward for themselves, their colleagues and/or the whole department. These may include further cycles of lesson planning and refinement (exploring a new issue or the same one further), peer observation, regular discussion meetings and/or changes in departmental practice or technology provision. In our study, the initial process took approximately 9 hours per participant over a 3-week period.

Trialling the Effectiveness of the CPD Process and Its Impact Across Two Schools

The research was based in the mathematics departments of two Cambridgeshire schools: one in a high performing school (Magnolia School) and the other deemed ‘satisfactory’ by Ofsted (Willow School). The teachers involved in each case constituted a subgroup of volunteers from a large department.

Mark Dawes, an ‘Advanced Skills Teacher’ (AST) in mathematics and highly experienced professional development leader, was contracted to both develop teachers’ use of the resource through facilitating the CPD process and to conduct the associated research. He embarked on this with three members of his own department in Magnolia School and subsequently refined the process in Willow School, chosen because he had connections there in his capacity as an AST, and it had a contrasting profile in terms of lower pupil performance.

Mark facilitated the whole group discussions and digitally recorded all meetings; post-lesson discussions were largely fluid reflections upon how teachers perceived the new approaches had worked and what might be changed or investigated in future. He took unstructured observation notes during teachers’ trial lessons, simply recording what the teacher did and students’ responses.

After the trials were completed he interviewed each group of teachers together about their experiences, including what aspects of the resource were useful, what

sort of guidance they would give other teachers about how to use the resource, and how they might embed the CPD process in their departmental practice. One member of each group was re-interviewed 6 months later, exploring the subsequent impact on stimulating the department's capacity or motivation to use technology in the classroom; sustainability of the process of sharing ideas, lesson planning and observation; impact on classroom practices and thinking; contributory or constraining factors.

Finally, Mark himself was interviewed at length at the end of the trialling period by a member of the research team. Questioning covered his perceptions of any impacts of the project and of his own roles as AST, researcher and in one school, colleague and participant. Note that neither Mark nor the other interviewer was involved in design of the multimedia resource itself. However Mark clearly played the roles of both 'insider' – in his own school – and 'outsider' researcher (Bassey, 1995) – at Magnolia School. We wanted to see how the model might fare in these two modes of experienced, familiar peer facilitator working with his colleagues, versus highly competent practitioner working in another school. The interview was conducted partly to encourage Mark to compare and reflect in as much depth as possible on his activities from both perspectives in order to increase objectivity and learn more about these different models.

All of the semi-structured interviews were digitally recorded and transcribed. Written material was subsequently given to teachers for validation and feedback. All school and teacher names used here (except Mark²) are pseudonyms. A broad thematic analysis of the meeting notes and interview transcripts (using electronic colour highlighting) was guided mainly by the research questions but allowed for themes derived inductively from the data. The analysis revealed: the teachers' responses to the multimedia resource, the themes and issues emerging (including technical difficulties) from the lesson activities trialled, consequent plans for modification, changes to or confirmation of classroom practice – with rationale, change in pedagogical approach, future plans for teacher development within the department, peer coaching during interview. Observation notes provided informative contextual information and triangulation for the self-report data. The following account draws out the themes and issues most representative of the recorded discussions.

Magnolia School

The first trial focused on how teachers interacted with the material to develop their thinking, which in turn suggested some broader possibilities for making use of the multimedia resource. Three volunteer teachers with very different teaching styles and levels of experience took part at Magnolia School. Anna was a newly qualified teacher who was keen to develop students' mathematical understandings. James was an experienced second-career teacher who wanted to encourage the 'quiet' students to contribute more in the classroom. The third teacher, Joanne, was experienced

and prepared her lessons carefully so as to avoid putting herself or her students “on the spot”. Joanne, in particular, had seldom been involved in training outside the school, thus this initiative gave her a rare opportunity for development work. All three welcomed being a part of the project, seeing this as adding to what they valued in their repertoire. In this trial, Mark acted as facilitator and participant. The four colleagues were used to sharing teaching ideas, though not working together in a sustained way as in this project.

The colleagues began, in the first two sessions, by familiarising themselves with the multimedia resource and observing a video clip (3.1) suggested by Mark. In this 3-minute clip, students had been asked to write down the coordinates for three points on an unlabelled line $x = 3$ projected using Autograph software onto a non-digital whiteboard. They then came up to the board to identify off-screen points on the line. Sarah elicited the equation $x = 3$ and invited a volunteer to show where $x = -2$ would go. Students offered additional points. The clip shows how students were free to pass on questions to peers when unsure and it illustrates the themes of *active involvement*, *annotation*, *capitalising on mistakes*, *making connections* and *collaboration*.

Initially critical of the teacher in the clip, the group questioned and speculated about the context of the lesson. They put forward their own ideas of what they would or would not do, and through the ensuing discussion a growing critical appreciation of what Sarah was doing emerged. The three teachers (with Mark facilitating the overarching process) contributed equitably and demonstrated a reflective stance throughout the conversations about particular aspects of pedagogy. In the second session, for example, the same clip prompted a discussion about choosing students to answer a particular question. Anna, developing the theme, said:

How do I choose who it is that is going to answer, and why do I prompt that particular child? There will be a situation when I prompt somebody whom I want to boost their confidence. I know they will know the answer ... I can tell by her face or looking at her book earlier [...]. There are sometimes people who I'll say, 'Paul, listen' [...] ok, Paul, what's your answer?' I know he doesn't know the answer but actually I need to lean on him to focus.

James added:

Another strategy that I find hugely useful is you leave the question with the pupil. You take the spotlight off them. You say 'OK, we're going to leave that with Ben ... now Ben, in a few moments I'll come back to you' ... and it doesn't stop the class, but Ben knows that he's on the spot, but he's not in the spotlight.

Such conversations allowed teachers to share not only practice, but also the rationale underlying the various techniques they used. Teachers also referred in passing to '*scaffolding*' and '*fading*' (gradually withdrawing support), reflecting the language used in the analytic commentary in the multimedia CPD resource. For example, Anna, in a discussion about which students to question, commented:

Those that put their hands up really quickly have probably got the answer: you can tell by their faces, they're quite relaxed and ready to contribute. And I want to find out if somebody else is with me, or I want to scaffold somebody else's work. I could go nice and gentle and say 'Oliver, what do you think?' Why do I always have to pick from the hands that are up?

Such terms afford teachers opportunities to refer to complex teacher practices precisely and concisely during discussions, but their effectiveness is dependent on listeners understanding what is being related. Within this group, the resource appeared to provide, or at least reinforce, such a common understanding, an effect also observed during the T-MEDIA team discussions (Hennessy & Deaney, 2009a).

In the third session Mark's colleagues chose to focus on "online games and motivation", although Joanne asked "Shouldn't [motivation] be what we do every day?" However, after a brief conversation Anna reflected: "You feel like your routines for motivating children are well established and actually revisiting them may surprise you at some point," A protracted discussion arose about the meaning of motivation, involvement and enjoyment, the relationships among these, and the ability to measure various aspects of them. Each teacher then established what pedagogically they wanted to achieve in their experimental lesson. For Anna, this was to enhance excitement through group work; for James it was to get the "quiet" students to be more noticeable through encouraging mutual student support; and for Joanne it was both ensuring that girls were more involved in the lesson and encouraging all students to be involved in whole class work.

Building on both this and an earlier discussion about questioning, all of the teachers planned lessons with some element that was new to their teaching practice, but with a shared focus of student motivation and involvement. Two teachers used group work; one used strategies to increase student involvement in whole class activities. The precise nature of each lesson was in part associated with the particular classes and topics they taught, but also offered an opportunity for teachers to try out techniques that required more preparation and collegial support than would normally be possible. The relevance and complex nature of such situated learning – the theoretical basis of our design – is exemplified in the following illustration of how a teacher combined the needs of a class, the resources available and a long-term pedagogical interest, to further his personal aim of becoming a (self-defined) better teacher. James had previously met the idea of encouraging different members of a group to become experts in an aspect of the work in hand, through first working with non-members of the group and then creating a competition through which the group would need to work collaboratively in order to be potential winners. Struck by the idea, he had toyed for several months with how this might be used within mathematics: for him this project offered the opportunity to finally try out the strategy.

The lessons were conducted by all four participants, with Mark observing his three colleagues (so that he could collect the necessary data, which would have

been difficult if his colleagues had observed each other) and two of them observing him. In the post-lesson discussions between observer and observed, colleagues were asked to focus on the success and potential improvements of the lesson in terms of achieving the pedagogical aim, using particular examples. Discussion was largely led by the observed teacher, with the observer asking how the teacher had achieved a particular goal or action.

During the post-session interviews, reflecting on the whole process, the participants' comments indicated that the discussion generated in response to the stimulus is critical to deepening reflective practice within a community of inquiry. As Anna said: "[The video clip] triggered the conversation, it triggered the lessons, but if I didn't have the group to discuss it, ... if I didn't have the discussion in the middle, it wouldn't quite influence as much and give me as many ideas." Her remarks emphasise that this is not a process that can be as successfully undertaken by an individual alone. Interestingly there was also some evidence of concern about not spending more time using the resource in the process, after the initial exposure: "I'm not sure how much we've focused on using your [resource]. I mean, as a prompt it's been quite helpful ..." This may be because the teachers were used to a more transmissive approach to professional development, and considered the multimedia resource potentially to take the place of a 'speaker.' In our model of teacher development there was intentionally less time spent attending to such 'external inputs' and rather, increased opportunities for discursive input by the teachers themselves. The teachers valued the small number of clips observed, the extended related discussions, and the opportunity to develop their practice situated within their own long-term interests in pedagogy. Mark himself reported "improved variety within lessons and different ways of encouraging pair work and group work" as outcomes of the work at Magnolia School. He anticipated that "that would then lead to a greater buy-in by the pupils, [leading] to more motivated pupils and more interested pupils."

Willow School

The second trial took place in a long under-staffed and fractured 'Mathematics and ICT' (Information and Communications Technology) department, with a subgroup of teachers who reported having a limited repertoire of teaching styles. There was little mutual support for staff development available, with limited scope for making use of the benefits normally expected of a community of practice. Matthew expressed the situation as:

such ... a lonely existence trying to survive off my own wits and we never get together as a department and talk about 'how do you teach this?' 'How would another teacher go about doing that?' I haven't even had a chance to observe anyone else teaching, ... so I'm really keen.

Despite the potential problems in developing a community of inquiry in this context, compared to Magnolia School, the gains from taking part in the trial were more

noticeable. This was possibly because the starting point was different and the two teachers and Mark developed their own community during the period of the trial.

Matthew was an experienced teacher and former head of department. However, after teaching abroad, he did not feel abreast of current strategies and sought support in engaging students purposefully. The second teacher, Callum, was a self-confident ICT specialist teacher who also taught mathematics. Unlike Matthew, he had not previously met Mark, and thus in the initial phase of the project Mark took the lead in developing good relations to support the genesis of the community of inquiry.

As with the previous trial, Mark spent two sessions introducing the multimedia resource and specific clips for discussion. He emphasised that the lessons in the clips were not intended to be examples of “best practice” and they involved a real class of students. He showed the extra information available in the resource that contextualised the lessons. Watching the first clip (3.1) the teachers discussed the relatively limited technology used, though Matthew identified that he would like to encourage students up to the whiteboard more often, as seen on screen. In the second, longer session, they looked at another clip (5.1: “Card sort” in which students match graphs to equations). As with the earlier trial, the teachers initially engaged critically with what they observed, and put forward alternative ways of conducting the lesson. As Callum put it, collectively scrutinising the teaching in the video was “what’s given me the impetus of thinking ‘well ok, it’s all right sitting criticising, but what would you do differently?’” The ensuing dialogue developed their thinking in some new directions, drawing on their collective experiences of mathematics teaching (Mark and Matthew) and using ICT (Callum). Teachers occasionally spontaneously adopted specialist terminology introduced in the resource’s written commentary, whilst constructing their own meanings for the new concepts:

Matthew: I really liked her questioning and... taking a wrong answer and... is that the *funnelling*? You know, when she was giving them alternative questions that kind of clued them into the right answer. . . . it’s a little thing that I’ve filed away that I might try using.

Matthew affirmed his understanding by checking definition of *funnelling* in the resource glossary.

Callum: I like the idea of *scaffolding* in maths. I don’t think that’s something we do enough of. It’s not just copying out sentences and filling in the missing gaps either.

The possibilities offered by even one of these video clips became apparent when participants considered different ways that they currently taught gradients and then created and explored new ways of teaching the material through the software that they had available.

The teachers’ engagement in reflection and support during discussions was more varied than in the first trial school. On occasion there was thoughtful peer support, for example when Callum responded to Matthew’s interest in bringing students to

the board and his concern about the degree of engagement of remaining students, by suggesting that those interacting with the IWB might be used as a conduit for the ideas of the rest of the students in the class: “That way there’s still maths happening in the room, but the maths isn’t happening at the front, the maths is happening in the main body [of the classroom].” In another meeting Callum asked: “How else would you use IT to teach gradients? . . . I can’t really expand on what she’s done, really, I can only tweak.” Matthew responded: “With your [IWB], you could draw a line . . . and get a kid to come out, and say ‘See if you can rotate this line so that the gradient is 1:1’, so you could actually get them doing an interactive thing.”

On other occasions the interchange was more reminiscent of some of Manouchehri’s (2001) observations of teachers politely offering “tips”. Mark responded by encouraging the teachers to engage more deeply with pedagogical ideas. For example, when both Callum and Matthew were praising a particular video clip, Mark asked for specific examples of what they considered “the good points” in order to help them probe aspects of pedagogy that they found novel and interesting.

There may be a range of reasons why these teachers sometimes appeared to struggle with articulating their pedagogical rationale. They described a strong institutional focus on behaviour management, with little opportunity to discuss pedagogy. This implied that they not only lacked practice in engaging with deep pedagogical reasoning, but were now subversively working with ideas that did not immediately fit with the school’s performance management targets. Associated anxiety with discussing such (novel-to-the-department) ideas with colleagues, and lack of experience in asking probing questions may also have affected their discussions. Having at least one member who can ask appropriate stimulus questions would appear to be important for developing a critical and reflective outlook in such a community. This need not be an AST, of course. Indeed, referring to the preceding example of prompting, Mark pointed out that “while it happened to be the researcher who raised the key question here, it may well have been raised by one of the participants in other settings, so the researcher does not appear to have been vital to this part of the process.”

The two teachers decided upon focussing on using ICT to support adding and subtracting integers. Matthew, working in an ordinary classroom with an IWB, aimed to elicit ideas from students, as he saw his usual style as a “domineering ringmaster” and wanted to try something that “was a little bit edgy and a bit different”. Callum, working in his usual computer suite, wanted to both increase student use of the IWB and to try out the MyMaths software (used by Sarah) to increase students’ independent computer work.

Discussing his lesson, Callum considered what went well and what he had discovered about the way his students worked. Armed with this new knowledge, he considered alternative strategies that might work better. In contrast to Callum’s confident interpretation of his lesson, Matthew was convinced that the lesson he planned and taught had not gone well. He spoke of it as having “all gone a bit pear shaped” from the point in the lesson at which the students had struggled (and

ultimately failed) to create and to articulate a particular rule. Mark suggested that this had been a valuable process, even though they had not reached a definite ‘answer’, and questioned whether the lack of pace in the middle part of the lesson might have been caused by the use of an inappropriately easy activity. Matthew initially agreed: “In that MyMaths thing for example, if I’d gone through another two or three examples [it would have worked better]”, and, as the conversation developed he appeared to reflect further on this:

You’re completely right about that My Maths ... I went through both lessons from start to finish, and why did I start on that first [page]? That thing with the thermometer going up and down and guy playing cricket, what is the point of that? I can see for the less able kids it’s nice, but in the context of my lesson it was just stupid, wasn’t it?

The role of the observer here in prompting the observed to focus on pedagogical aims and mathematical challenge rather than what might be labelled superficially as “student behaviour” and “pace” seemed an important aspect of the success of this process for Matthew, as he corroborated later. This (uncommon) type of conversation after an observed lesson, leading a teacher to reflect on how other inputs affected the lesson and alternative models of evaluation, can develop immediate or long-term pedagogical thinking. It contrasts markedly with the more usual “performance management” style of observation feedback.

In the final session of the project a couple of weeks later, Matthew and Callum were invited to comment on the project outcomes. Matthew wanted to go back and spend more time with the multimedia resource. Reflecting on the process he had been through, he said: “It’s funny but the technology [used by Sarah] wasn’t the thing that struck me really. It was the style of teaching and the interactivity with the kids [...] it’s just been a real eye opener.” He went on to say, “I’ve actually tried doing a few things, even in the last couple of weeks, that without this stimulus I wouldn’t have changed. But I am very conscious that it’s going to take me a little while to hone my skills really because it’s changing a style of delivery.” He thus saw this project not as “tinkering at the edges” of his teaching but as helping to effect a fundamental and ongoing pedagogical change. Indeed, in a follow-up interview 6 months later, he said: “I’ve internalised everything I’ve done with you, I’ve taken on board and I have changed the way I teach”. On being asked to give examples of what he had internalised, he said: “I think it’s trying to be more student-centred and getting the students involved with making suggestions – even if they’re wrong.” He planned to develop his own practice to incorporate effective use of online games and then to share this with his department.

Callum also referred to a deepening of thinking about teaching, commenting “It’s the difficulty of getting the interactivity but the interactivity actually having meaning,” and “What the project made me think about is actually *how* do I want to build that interactivity and *why* am I doing it?” In this situation, where collegial discussion of pedagogical issues was rare and relationships strained, developing a community

of inquiry more obviously required development of trusting relationships, carefully constructed probing questions and time for discussion. Authentic collegiality would seem to be requisite for this type of CPD. Nonetheless a temporary community of inquiry among the two department teachers and the outside AST was made possible. As with the first case, the flexibility of the resource and richness of the clips allowed each of the teachers to develop their own – pedagogical or technological – interest. In interview Mark reported that both participants had perceived the experience as “really meaningful CPD.” He added that the experience for Callum as an aspiring Head of Department “helped to change his view of what working with colleagues could be like, because he was not [previously] a team player.”

The Teacher-Researcher’s Reflections on the Process

Mark reported rather different experiences as, first, a participant observer and facilitator in his own school, and second, an external ‘expert’ teacher facilitating in another department. In his school, his insider knowledge of pupils offered an advantage when working with peers:

I would perhaps expect pupils to react in particular ways in the lessons, or would perhaps know and anticipate some of the things that they were going to say.

His colleagues’ experience of him also gave him credibility in the role of facilitator:

The fact that I’d got a relationship with the three teachers already means that there wasn’t a tension. . . They’ve all seen me teach on multiple occasions. They all know and believe in the things that I do in the classroom, so I think if I didn’t have that sort of relationship with them or if they didn’t know me well or didn’t believe that I could cut it in the classroom, that might perhaps be different.

However, his knowledge of his peers’ teaching raised a concern beforehand. Although the group included “one colleague who doesn’t normally participate in any form of CPD, who is not somebody who tends to evaluate their own teaching to a large degree,” Mark reported that

my colleagues are overall excellent practitioners already, and one of the things that I slightly wondered about beforehand was ‘will they get much out of this?’ But the fact that the teachers did get so much out of it was exciting and interesting, that this is something that really does work well with everybody and . . . turned out to be something that really did capture their imagination and did fire them up.

At Willow School, Mark felt that his AST status carried significant weight; he perceived this as advantageous in encouraging teacher participants to engage with the process and with himself, but also that it may have initially intimidated one of them, who “saw me as somebody to defer to”.

I didn't have a prior relationship with Callum at all, I met him once before the project started and that was when I asked him if he wanted to be part of it. . . . I think some of this comes across in the way that he was talking to me with Matthew, I think he saw me as being in a power position, that I'd seen him teach previously, I taught his classes for a day for him to observe me teach and use the IWB a while previously, and so he knew me as a consultant, as an AST. He saw me as somebody who could do things in the classroom that he couldn't do, and so I think that was helpful in that he was very open to listening to things that I might propose, like 'do you fancy being part of this project?' for example, but I think it was perhaps then a little bit more of a challenge to get him to find anything positive in what he was doing . . . which means that in his own feedback of his lesson as part of this project, he was very very negative and it took quite a while to turn him around to see that there were actually quite a lot of positive things that he'd done, some really exciting things that did work well.

I saw that as being the positive part because [the pupils] were talking in groups, they were struggling, they were, some of them, having really creative ideas. Then, when that was shared as a whole class, they did by my reflection get there as a class and that was the bit where there were people behaving as mathematicians do, there, whereas seeing the mercury sliding up and down the thermometer [in MyMaths] for these pupils wasn't [challenging enough]... I think it was only at that point that he properly evaluated and started to think about his lesson and 'yes, actually I shouldn't have used that question from the textbook because that was too easy and I shouldn't have used that bit of MyMaths because that was too easy', and that made a very big difference to him. So that particular conversation where I could pick out positives, but it [his practice] was something that he'd never talked to anyone about before, was really quite sad, but also extremely exciting.

Overall, Mark's feeling was that his 'expert' outsider role had helped Callum to reflect openly on his lesson and enabled him to identify an authentic problem; Callum's self-critical stance and lack of confidence was tempered by Mark pointing out some successful actions and outcomes.

I think that wasn't necessarily a tension there but that it did perhaps change the way he reacted to things. And in lots of ways I suspect it made him more open to taking part in it because it did feel very much as if I was one of the very few people he'd actually had positive feedback from [. . . .]

Callum corroborated the benefits of talking about his practice during the final discussion at Willow School, adding "I do feel very encouraged". Our own experience of Mark is likewise that he is a notably enthusiastic teacher who always looks for positive points and mediates sensitively; these qualities made him very supportive to the participating teachers, whether direct colleagues or not.

Mark concluded:

So it did mean that I wasn't there as an impartial adviser, researcher, observer, so yes, being an AST certainly affected things; I'm not sure it affected things negatively, necessarily.

Indeed the overall outcome for Callum was strikingly positive, not just according to his own reports but also as described by Mark:

He then finished at the end of the project by saying that 'this is the start of a journey for me, this is the start of something. This project has really kicked something off in me. I'm going to have to think about it more and more and I know it's going to be hard but I really want to do this.'

We intended the resource ultimately to be used in different kinds of communities, and with different levels of mediation, including, for instance, by college lecturers working with student teachers as well as ASTs doing outreach work, school-based professional development leaders or autonomous groups of seasoned professionals. Trialling it in two modes elicited some inevitable differences in the dynamics within the communities, whilst indicating that either an internal or external facilitator can work. In one case (Willow) the leader's 'expert' status was more salient; in the other his 'peer' status may also have been influenced by his AST label, we cannot know for sure. However analysis of the transcripts of discussions among Magnolia school participants enabled other research team members to infer that participants were both confident and open with one another, suggesting the AST label had little or no impact on the potential utility of the resource by a group of peers.

Any subject teacher group is likely to have varying levels of experience and status represented; there may be an AST, newly qualified teacher or head of department, for instance. Cochran-Smith and Lytle (1999) argue that novice and experienced teachers can learn together through inquiry by posing dilemmas and questions, challenging common routines, and offering each other alternative perspectives on their work. A group using our resource may want to appoint a less experienced or less pedagogically interactive teacher as its facilitator; the prompts built in offer more support if needed. In the case of Willow school, however, we consider that the changes reported were unlikely to have come about in the absence of skilled facilitation of the kind that Mark provided, unless the prompts and analytic commentaries were drawn upon to a much greater degree.

Future Implications

In both schools, the teachers were enthusiastic for the activity to continue in some way and to incorporate other colleagues; they wanted more time to be made available for projects of this type and specifically for discussing ideas. James considered it "desirable" but "difficult" to "institutionalise innovation" in this way. This resonates with the assumption underpinning the inquiry stance that teaching will involve

collaboratively inquiring into teaching processes and approaches and that teacher learning is linked to wider school change efforts (Cochran-Smith & Lytle, 1999).

Teachers' suggestions included making "innovation of practice through reflection" a performance management target and using departmental meetings or in-service time to undertake Sessions 1 and 2, or ongoing reflection on teaching more generally, using stimulus material and sharing lesson resources and experiences. Further ideas involved using existing formal peer observation mechanisms – or creating them – to cover time away from teaching to observe colleagues. There was unanimous endorsement of the need to develop the process as CPD carried out *by* teachers rather than done *to* teachers. A cascade model was also proposed, so that one member of the original group using the T-MEDIA resource might lead a new departmental subgroup, sharing experiences about what had worked. New groups might then collectively choose to travel an alternative pathway through the resource.

Follow-up

The pattern seen in these two schools, of initially being critical of the teacher in the clip, followed by speculation, discussion of strategies that teachers would themselves use, and finally culminating in a more nuanced and appreciative understanding of the lesson observed, has since been observed in a third school and at other workshops when teachers have had an opportunity to engage with the multimedia resource. It is a common way of interpreting and internalising what is being seen, and appears to be a useful part of developing critical alignment, as long as the facilitator ensures that critique remains respectful rather than judgmental (Coles, 2012; Jaworski, 1990). If this is so, the resource offers a 'safe' opportunity for challenge and critique, which might otherwise be restrained if simply observing one's own colleagues. Indeed this perceived benefit of the resource was highlighted at a number of invited CPD workshops on aspects of our research that were facilitated by Mark at successive NCETM annual conferences for practitioners and policymakers and training days for both newly qualified and "Influential Mathematics Teachers" locally and regionally.³

The workshops resulted in teacher take-up and attracted enthusiastic audiences of key stakeholders from government and agencies (Advisory Committee on Mathematics Education, Teacher Development Agency, Mathematical Association, Ofsted Chief Adviser on Mathematics). A keynote by Prof. Celia Hoyles (NCETM director at the time) commended initiatives carried out "by teachers and for teachers", versus "done to teachers", quoting our phrasing directly. Mark reported that these events generated "huge excitement" and that

Teachers were very keen to start using the materials in their schools and for outreach. Teacher-educators quickly saw potential for trainees. Delegates [appreciated holding] a constructive, non-threatening discussion of an unknown teacher; they suggested using a clip at every department meeting for a year.

A ‘toolkit’ to support the choice of a pathway through the multimedia resource was also devised, evaluated and refined through observation and discussion. It was again commissioned by NCETM and is hosted on their portal⁴. The toolkit comprises four sections, including (1) an introduction to the T-MEDIA resource and toolkit; (2) a sample pathway guide; (3) a resource screen list and (4) a briefing sheet for the senior leadership team. The trial is not reported in detail here but a paper by Bowker, Deaney, Hennessy and Dawes (forthcoming) focuses on the development and testing of the ‘toolkit’ by a group of four teacher colleagues in a third school facing very challenging circumstances who undertook an independent process of CPD supporting technology use. They chose their own route through the video clips, adapting the suggested pathway to one that was meaningful for them. After 6 months, all of the teachers reported increased use of technology in their classrooms and continued their conversations about integrating technology use; two had also increased their pedagogic repertoire.

CONCLUSIONS

The two case studies have shown how the T-MEDIA mathematics multimedia resource was used to initiate productive discussion among colleagues in two quite different schools, in turn increasing their confidence to experiment with new teaching techniques. The professional dialogue documented – whether facilitated by an ‘insider’ or an ‘outsider’ – demonstrated a deep level of critical engagement by the teachers in both deconstruction and development of practice. Further, there was some evidence that the resource encouraged the shared use of new or refined language for concepts quite possibly already held tacitly by teachers (such as scaffolding, fading, funnelling, motivation and engagement). In keeping with previous observations, this supported them in articulating and exploring their models of learning (Hennessy & Deaney, 2009b; Pollard, 2005).

Using peer discussions to prepare a pilot lesson and then engage with feedback specific to its experimental purpose highlighted and helped to tackle some key issues arising in each setting. It also proved a powerful way of furthering the sharing of knowledge and inquiry, including critiquing and improving existing practices, proposing and trialling new practices – hence achieving critical alignment (Jaworski, 2006). The power of such discussions appears to derive from a combination of the stimulus and the phrasing of questions that partners in the inquiry pose to one another, particularly in the feedback on lessons, as elaborated in Chapter 11.

A key strength, designed into the whole programme from the start, was the flexibility offered in terms of encouraging practitioner-researchers to explore their own interests (Cordingley, et al., 2004) within the collaborative framework of, ideally, an established community of practice. In such a community trust exists, uncertainty is accepted, and ideas can incubate and develop temporally (Cochran-Smith & Lytle, 1999). (However, as seen at Willow school, it may be possible to use the process to create a temporary community of inquiry within a fractured

department). This flexibility would appear to encourage ongoing commitment to the process, as it fulfilled teachers' own needs to develop ideas from the basis of their personal models of student learning and of teaching with technology, rather than, perhaps superficially, using externally imposed models. The process afforded status to participants' own meanings (de Freitas, et al., 2008) and agendas for development and research. The process, through supporting a burgeoning community of inquiry, potentially offered support to colleagues with a range of professional development needs simultaneously and was relatively cost-efficient too: "It was only a handful of hours that each teacher spent on it [yet] it had huge immediate impact" (Mark).

CHAPTER SUMMARY

This chapter reported on T-MEDIA follow-up work for the Supporting Professional Development for ICT use in the Secondary Mathematics Classroom using a Multimedia Resource project commissioned by NCETM. It explored the possibilities of using a research-informed multimedia resource as a stimulus for on-site professional development in schools. An iterative cycle of reflective practice included discussing the external stimulus with colleagues, planning a lesson or new activity/approach, classroom trialling, peer observation and post-lesson review. The process gave teachers an opportunity to have their personal models articulated, challenged and developed through both observing the clips available and devising the follow-up lessons based on the discussions.

Use of the resource in this way was found to provoke extended, reflective discussions that both underpinned innovations in teachers' practices, and highlighted critical aspects of peer facilitation. We concluded that it provided a useful illustration and constructive critique of other teachers' practice. It was not heavily used but rather acted as an effective springboard for teachers' exploration of their own professional interests. This study formed the basis for the research-informed professional development approach advocated in the final chapter of this book as a culmination of the wider work. First, the next chapter investigates how teacher and team thinking about dialogue evolved through the collaborative video review process undertaken in the Dialogue and IWBs study, and how this influenced subsequent classroom practice of participating teachers and schools.

NOTES

- ¹ The mathematics resource and the cross-subjects one are hosted online on the NCETM portal at <https://www.ncetm.org.uk/resources/7045> and <https://www.ncetm.org.uk/resources/7387>. All five T-MEDIA resources are also freely available at <http://t-media.educ.cam.ac.uk/> or on CD-ROM at cost price via the research team's publications website at <http://www.educ.cam.ac.uk/research/projects/istl/>.
- ² Note that Mark and his colleagues are all happy for him to be named in this paper. As he was our collaborator, we felt it appropriate to make his role clear.
- ³ Dawes, M., Hennessy, S., Deane, R. (2008) Supporting Professional Development in the Secondary Mathematics Classroom using a Multimedia Resource. In strand: 'What current professional

CHAPTER 9

development activities are there and how do these inform us about future planning?' NCETM Annual Conference, 2008. https://www.ncetm.org.uk/resources/ict_conference_workshop_c4. Also presented at Training day for newly qualified teachers in Cambridgeshire (2009), and NCETM Annual Conference (2009), https://www.ncetm.org.uk/resources/annual_conference_09_workshops, and 4 regional NCETM Influential Maths Teachers events (2008/09).

⁴ <https://www.ncetm.org.uk/resources/7045>.

USING THEORY IN RESEARCH TO STIMULATE NEW WAYS OF FRAMING AND SUPPORTING CLASSROOM DIALOGUE

Sara Hennessy and Paul Warwick

INTRODUCTION

The focus and methods of the Dialogue and IWBs project were described in Chapter 1. The participants were three teachers who had integrated IWB use and dialogic teaching into everyday practice. They participated in five intensive workshops designed to raise further their awareness of the nature and functions of classroom dialogue.

Chapter 6 illustrated how our team of university researchers and teachers co-constructed intermediate theory via developing the dialogue and dialogic strategies tables. The data presented in this chapter derive from the cross-case analysis (Phase 5) conducted by the university research team. This analysis served to elicit teachers' perspectives on the collaborative research and analysis process itself and its outcomes for them. This was achieved through systematic coding of broad themes across all (27) teacher diaries, (5) workshop transcripts, (3) review meeting transcripts, (9) interviews, (3) follow-up questionnaires and (3) certification reports, using HyperResearch™ 2.6 software.

Here we look particularly at the influences of the process upon how teacher and team thinking about dialogue evolved, and its influences upon subsequent classroom practice. The first section begins by presenting data on perceived influences of the team discussions and the workshop stimuli on participating teachers' thinking and lesson planning. The next section describes how dialogic principles became embedded in participating teachers' practices and thinking. The chapter concludes by looking at the spread of new approaches within participating schools.

TEACHER PERSPECTIVES ON THE PROCESS OF RESEARCH COLLABORATION

Experiences of Team Discussions Around Promoting Classroom Dialogue

A clear message emerged concerning the professional development of all participants in the Dialogue and IWBs project. This is that there are considerable benefits to be derived from fostering an environment where expertise can be shared between teachers and university researchers and, importantly, where the focus is on understanding and

developing principled pedagogy. By this we mean pedagogy that is theoretically rooted, explicitly articulated and laid open to critique, and tested in the context of classroom practice. Initial workshops in Phase 1 yielded a range of thoughtful diary reflections from teachers, including self-scrutiny, honest expression of fears and pedagogical dilemmas, question posing, development of issues raised in our discussions and teachers' corresponding plans. The following excerpts indicate some of these:

The first workshop day has enabled me to really start thinking in depth about my own practice and the powerful impact a more structured approach to 'talk' in the classroom could have . . . Alexander [2004 booklet] – the idea of dialogic teaching being cumulative, with children and teachers building on each other's ideas, really stood out for me, as it is the one which I feel I currently address the least. . . . In order to move forward, I need to look now at . . . using questioning more effectively to enable cumulative talk to take place more regularly. (Caroline)

Mercer [research collaborator's presentation of his prior research] – very interesting to hear about what was actually found, or not, in schools when talk was explored. Again, the curriculum pressures and the need for content delivery seem to play a part in preventing talk being used to full effect. (Caroline)

If pupils discuss things and get the point 'wrong', a teacher explanation then has some context and is more meaningful. I understand this idea better after our discussion today. (Lloyd)

Subsequent reports reflected further on various ways that our team discussions influenced teaching practice and lesson planning. For instance Diane articulated dialogic objectives in her certification report:

I wanted the children to have opportunities to talk within the whole-class setting and in groups, and to be able to present their ideas in a range of ways. These aims were stimulated by our initial work as a research group, beginning to consider what dialogue consisted of and how it could be initiated.

Key changes to lesson planning this time were . . . to introduce ground rules for talking [we used a set of talking rules from Mercer's work] to support the group work . . . it was especially important that the children were able to talk with focus about issues and opinions, being able to begin to articulate why particular safety rules are important.

Lloyd's diary after Workshop 2 articulated his thinking about the collaborative inquiry. It included the implications for understanding the complexities of dialogue. These complexities came to light as we sought to establish common ground and iteratively developed our ideas:

We'd all obviously reflected quite a bit on the previous session. This helped make the first part of the day very interesting as we developed our definitions

and ideas further. One could see us re-visiting things we had talked about previously ... So nothing is easy in trying to articulate what we mean by dialogic teaching. I think we have already found that it means many different things to different people and it could mean different things to the same person at different times. However. . . I feel there is a shared view amongst our group that learning is something much more than just being teacher-dominated a lot of the time ... this is really central to what happens in the classroom. I know this is one of Alexander's key themes too ... but I'm not sure he sees it as so central, so often. I'll need to think further on this.

He went on to point out that what he considered the “dialogic approach to lesson planning” in Workshop 3 was itself productive:

I like to bounce ideas off people when planning as it invariably means I can use theirs! ... So, in my plan for Lesson 1, there are influences and some very specific themes/activities that come from colleagues in the group.

Caroline appreciated the logical order of “starting with the theoretical perspectives and then looking at how that applied to our current practices ... each workshop session allowed us to build upon and extend our own knowledge and understanding as well as further develop the joint construction of the notion of dialogue” (follow-up questionnaire). Timetabling of her lessons on consecutive days proved problematic, however, since “the reflection and refinement of ideas for future lessons felt quite rushed”. The research timetable was generally welcomed though; it allowed Diane to “learn at a rate which was challenging but supportive”. Teachers found the discussions and opportunities to develop practice with colleagues “invaluable” and “fantastic” personal and professional development experience.

The process culminated in reports of positive experiences (including substantive outcomes for learners) and individual challenges perceived by all of the teachers. Their purposeful exploitation of new opportunities posed by the technology and some changes in their practice were described. For example:

There are more explicit opportunities for dialogue built in [to my 3 lessons] ... being someone who uses the IWB on a daily basis anyway ... rather than just using it as a planning and organisational tool ... really thinking about the purpose of each slide and how it can be used as support for the pupils. (Caroline)

Overall, thoroughly enjoyable, *and*, the key, loads of opportunities to take things further in school. I also feel empowered to read Robin Alexander's work critically (in a positive sense!!). (Lloyd)

It was a privilege to be part of this project, and to benefit from the input of University researchers and expert colleagues. Having the opportunity to work on a different plane from my usual, practical-based approach was illuminating in many ways, and I found it refreshing to be working collaboratively to develop definitions of how dialogue would ‘look’ in our classrooms, and to pinpoint

how and for what purposes the IWB was actually being used within a lesson. . . It has been invaluable to set aside the time to learn more about dialogue, about using the IWB and to reflect on all that has taken place. (Diane)

In Workshop 4 Diane described a noticeable positive impact upon one low attaining child's confidence and willingness to participate after a critical episode identified in her first lesson. In the episode she had played sound files, recorded individually by the children themselves using the IWB's own audio recording facility before the lesson, each answering the question, "When is it right to keep a secret for myself and for a friend?" This strategy of playing pre-recordings of pupils' opinions to the whole class was considered to give them "another voice" through which they could express their ideas. It is an effective stimulus for class dialogue since it 'pre-packages' the information for discussion and forces pupils to respond to each other. An excerpt from our discussion follows.

Sara: [The pupils' viewpoint] has been given its status by recording it, putting up the link, everybody focusing on it.

Diane: And it's interesting isn't it, because, bless Mary really...She is not a child who very often expresses her views, she really struggles to understand anything. . . .And I was concerned about playing her clip. I wanted her to be one of the ones that I used, but I also didn't want everyone to go "huh?" What she does say actually does make sense, but I was also aware that some people might not get it. So part of my role there was that I wanted to protect her right to take part in the discussion. What was interesting for me was that later on in this lesson she volunteered to take charge of her group. [. . .] There was a discussion at her table and I had to say, "does anyone want to take charge?" And she said "yeah" and she never does that. It's about opportunity as well, isn't it?

Paul: Well it's about the environment, isn't it? It's directly about an environment where you feel you have the ability to contribute. And in the context of these kinds of lessons, where the talk has been constructed in that particular way, she obviously knows she had.

Five months after the final workshop, Lloyd reported on some follow-up work in which a group of very low achieving pupils aged 11–12 used the IWB to share with the class their ideas about how images can show power:

With this group, I needed to think more about scaffolding the dialogue to help them advance their learning and 'classroom tactics'! . . . The IWB pen [stylus] acted as a microphone and if you had the microphone, others had to listen to you. There were also teacher prompts for things that I wanted the kids to say to try and ensure that they engaged with what the previous speaker had said.

These findings are consistent with those of Baumfield and Butterworth (2007). Professional learning situated within a mutually supportive partnership can stimulate

development of teachers' own practices. Existing pedagogical strategies and ideas about technology use can be deconstructed while keeping teaching and learning at the forefront.

Influences of Workshop Stimuli Upon Teacher Thinking and Lesson Planning

Many of the quotations in the previous subsection offer clear evidence of the influence of the stimulus resources employed in the workshops (summarised in Table 1.2 in Chapter 1), and this is explored in more detail here. First, diary reflections and certification reports included teachers' considered responses to the literature and university researchers' presentations, and the issues of personal significance they were consequently stimulated to address:

Mortimer and Scott (2003) – although the “Communicative Approach” grid seemed quite hard to apply to the examples given initially, upon reflection it does seem useful as a way of categorising the ... different kinds of dialogic teaching at different stages of the lesson ... Looking at where to place the authoritative talk so that it helps to construct some degree of ‘common meaning’ from speculative discussion is what would logically seem to lead to the deeper levels of understanding we are hoping pupils reach. (Caroline)

I found the specific input on the work of Alexander and Mercer very interesting, as it resonated with the work we have been doing in school on Assessment For Learning, developing teachers' questioning skills and developing Speaking and Listening. I was challenged to think about the way in which we help children to participate in dialogue, about what vocabulary and language we use, and how we use questioning to gauge the level of children's understanding within lessons. (Diane)

Caroline considered Alexander's (2004) dialogue booklet “very clear and accessible” and felt able to put his ideas into practice. Lloyd likewise considered it a “very, very useful stimulus” and welcomed its “contentious issues”. He had even mentioned it in his discussions about the lessons with the two Learning Partners present, who had requested more debate and further challenge of pupils to justify their positions in lessons. This had raised further questions for Lloyd, aired during his video review meeting:

Alexander talks about teachers in England and Europe being different in the way that they challenge kids' contributions. ... and [students] were quite interested in that ... Perhaps I need to ask questions that are going to allow me to challenge kids' responses more. Fair point.

Is there something in that “dialogic teaching” that the kids see their importance in making it work well as well? ... You know, “this is a learning community”. “We all have responsibilities.”

He reflected in depth on this in his certification report too:

I was more concerned in the lessons with gathering together the thoughts of as many students as possible, to allow everyone the opportunity to reflect for themselves on these. Robin Alexander's (2004) survey of international research on classroom talk highlights that in continental Europe, teachers are 'more honest' in their feedback to children than those in England. He suggests that it is often common for a child's contribution to be praised regardless of its appropriateness or quality, so as not to discourage the child. Perhaps the two students [Learning Partners] see a need for the teacher to be more judgmental in order for them to progress further. There is certainly merit in this argument although contextual information is important when considering the best approach. These were almost my first lessons with this class and so confidence building for the students was very important to me. However, perhaps some of the students want more synthesis of views from the teacher. The survey returns suggest I do use the views of students. But they don't suggest whether or not students would like to be guided more to a particular answer. My hunch on this would be that most students from the group wouldn't but it is worth further investigation.

Lloyd was also particularly taken with the Mercer *et al.* "Thinking Together"¹ materials and planned to share them widely:

REALLY REALLY USEFUL!! These materials are [readable and] great to encourage discussion about different ways of approaching things in the classroom ... Am hoping it's okay to publicise in school as we want all teachers to be able to benefit. I really feel, with some guidance, colleagues will use it, at least for discussion. I also intend to make senior managers aware of it. Useful for Heads of Faculty discussions.

He was pleased to receive a copy of the book on dialogue by Mercer and Littleton (2007) as a present from us after the study and reported that he planned to share sections from it with student teachers.

Caroline appreciated the Cardellichio and Field (1997) paper on questioning because it "reinforced previous work in this area and again provided practical ideas." All three teachers found a presentation about dialogic teaching and learning (including ideas and transcripts concerned with managing talk) helpful in stimulating thinking about the meanings of terms. Caroline said in her follow-up questionnaire that the presentation helped her to "recognise what [she saw] happening in [her] own and colleagues' classrooms – highlighted time pressures with respect to meaningful talk".

Both Caroline and Diane reported that they found Lloyd's lesson observation coding system appealing and wanted to try it out in their schools. This scheme included – and thus exposed these two teachers/schools to – some of our "intermediate theory" terminology derived from the T-MEDIA collaboration; for example new

categories of dialogic interaction such as *dialogic class discussion*, *dialogic peer discussion* and *dialogic synthesis*.

The teachers also described what they had learned from watching the T-MEDIA video clips. Lloyd highlighted the utility of considering alternative approaches to the practice depicted, a key element of our professional development approach here and more generally. He articulated how he had realised the importance for dialogic teaching of exploiting the permanence afforded by the IWB:

I'd seen the T-MEDIA Science video before but our discussion helped me to reflect from other angles on it (dialogic learning!) [and] made me think about applications of [the IWB] in my own teaching. It was also useful to share ideas on other things that Chris might have done in the lesson. This, again, can lead to new ideas for us all. The clip and discussion also re-emphasised the ability the IWB provides to store pupil work. It doesn't have to be wiped away! Over time, with this technology used more and more, this could have a bearing on how kids view the importance of their ideas to shared dialogic learning. (Lloyd)

After seeing the Science clip where children worked on a true/false/don't know task and were then given input, I tried this with an informal Science assessment. Children worked in groups, sorting statements about shadows/reflections. I listened in/discussed also, then we drew together ideas, shared explanations, came to conclusions ... with children very involved throughout. (Diane)

[Watching the initial video recordings] confirmed that teachers must create a secure setting in their class, forming strong working relationships with children. (Diane)

The teachers also gained insights from discussion of their own pilot video clips and from each other's clips:

[Being filmed] made me notice the way I often reformulate children's responses and consider doing that less often to help children to listen to and question each other. (Diane)

In what you [Lloyd] said, you set up that all answers are very acceptable, by giving status ("what you bring to this lesson can change our knowledge"), [and by] what language you used with the children. (Diane)

I thought you [Caroline] were scaffolding really well. When they needed a bit of help you prompted them ... you were suggesting there in your body language, "you found out something that I haven't thought of". (Lloyd)

However, Lloyd found all of the clips "hard to contextualise" without more information; workshop time constraints of course acted here, but strenuous efforts were made by each teacher to explain the exact context of their clips to the group.

Finally, teachers reported having “greatly developed” and varied their (initially competent but not expert) use of the IWB as a resource to support talk. They appeared to become confident with astonishing rapidity, sharing with colleagues many of the technical skills they had learned from IWB expert teacher Chris. They expressed gratitude for his “particularly inspirational session” and “invaluable practical guidance”; “[He] fired me up with some great ideas ... Some trepidation at how easy he made it look!” (Lloyd).

This morning I showed the other Year 6 teacher the Square of Truth² which I made after getting back to school on Friday after the workshop – she loved the idea, and an hour later had made a Chicken of Truth to check right/wrong spellings! I obviously stole this and tried it with my children at the end of the morning after our spelling lesson – children loved it! (Diane)

Chris had offered pedagogical messages too, integrated with exposure to new kinds of IWB use, and these were recorded in post-workshop diaries for future consultation, and in some cases reportedly drawn upon in the lessons observed.

Two teachers had been inspired by our demonstration of the visualiser technology (a digital form of overhead projector connectable to the IWB for instantly displaying, manipulating and saving images of concrete objects), which was new to all of them. Lloyd immediately bought one and found it motivating to learners, supportive of dialogue and very useful for showing resources and pupil work. He also reported that our mention of using laminated mini-whiteboards to engage the rest of the class while one pupil was at the IWB had stimulated his thinking and consciously led to his extensive use of mini-whiteboards during and after the lessons filmed.

EMBEDDING DIALOGIC PRINCIPLES IN TEACHER PRACTICES AND THINKING

The teachers described various applications of the dialogue tables (Tables 6.3 and Appendix 7). All of them mentioned grounding of the table elements in their own practice (“When we talked about what they were, we explained situations in which you might see those things”: Lloyd). For instance, in Workshop 4 Diane reported how she had tried using the table as a checklist when reviewing her own lesson videos: “After a while I thought ‘I’m marking loads of these, that’s really good!’” She suggested that this technique might have utility for other teachers in “building in time to review and reflect: how do we know whether dialogue is happening?” Diane deliberately did not add guidance to the “You will see us” column since she “anticipate[d] that this would form a good collaborative task for staff members to undertake as part of professional development work”. She also mentioned how development of her revised representation of dialogue (Table 6.3) reflected changing patterns of interaction in her classroom and some discussion followed. In this excerpt Diane refers back to previous workshop discussion about pupils continuing dialogues internally in between whole class activities, and here, between lessons.

Lloyd: Would you have that [dialogue table] up on the wall?

Diane: Well, what I'm thinking is, what I was looking for was some of these . . . which is why I was struggling with some them trying to explain. But you see. . . "telling each other what we've learned when we were thinking by ourselves", you know, that's about the internal dialogue thing, isn't it? That struck me because last week we were doing 'anti bullying week' and somebody said to me "You know we've been talking about bullying at school?" I said yes, and she said: "All week I've been thinking, can grownups get bullied, where they work?"

Lloyd: Interesting.

Diane: Exactly. Do you want to talk about that? But I liked that fact that she was saying: "all week I've been thinking..." Now I picked that up; I might not have picked that up in the same way before. [...] I couldn't have said, "I wonder why Miri's been thinking of that?" Do you see what I mean? So I was trying to keep this [dialogue table] relatively simple for older children. Younger children wouldn't find it so [useful].

Lloyd: I bet you wouldn't see that up in many secondary school classrooms, but actually that would really encapsulate many of the themes for kids, for kids to understand what we've been talking about. [. . .] It would be interesting to go home and teach and use that.

Lloyd's follow-up questionnaire confirmed his belief in the usefulness of the processes of reflection and trying out ideas:

Taking a few points and trialing those was useful . . . I've developed my teaching of the Suffragettes as a result . . . and aim to use the notion of "willingness to change one's mind" as something to frame lesson activities.

"Willingness to change one's mind" emerged as a significant construct in our thinking about preconditions for dialogue and its 'tentative' nature, and one that was supported in the classroom by the provisional nature of objects on the IWB. Lloyd in particular embraced it. Earlier we described how he deliberately challenged pupils to take others' views into account in creating a joint video storyboard. He then discussed this explicitly with the class: "I suspect most of you . . . at some point might have had to change your mind on what you've thought here. Is that right, or not? [Pupils: Yes.] Has that been easy or difficult?" Likewise an Open University podcasted interview with Diane (Rawlins, 2011) offers independent testimony for the pupils' change in beliefs through dialogue and for the implications for practice perceived by the teachers:

Having children actually saying 'I thought this was true, but I've learnt something different', was tremendously powerful. It was by looking at those critical episodes and what was key in helping children to learn, I began to draw the most important things for me to be using in school.

Diane provided some further helpful introspective reflections on the journey she had undertaken. In her follow-up questionnaire and interviews she identified some mechanisms that she believed had led to change:

At the time the project started, I guess I was very unsure of what dialogic teaching really was ... Participating in the project gave me access to dedicated input from specialists, as well as the added extra – filming – which allowed me to review and consider what happened in the lessons realistically, and to look beyond my initial impressions of what the children had learnt.

I do feel that there has been a real change, certainly in my thinking and in the way that I feel very committed to exploring this kind of learning ... I explicitly don't repeat back what they say, as much, and I actively ask them to ... respond to what each other have said.

For her, the process culminated in detailed and thoughtful recommendations for other teachers that further elaborated how she had extended her own understanding of dialogue and incorporated IWB use. For instance, her certification report proposed:

Planning should include opportunities for talk which are not just focused on getting the “right answer”, but may involve speculating, questioning, criticising and building new understandings of concepts. This must be backed up by skilled teacher intervention in modelling and prompting children to question each other's ideas and views, eg “X, what do you think about Y's idea?” ... [and] planning for opportunities within lessons for children to see the IWB as not just the teacher's resource, but their own; a resource which can aid them in recording or presenting their views.

In sum, our case studies of teachers' experiences of adapting a pedagogical approach to accommodate technology use within their own settings illustrated how they went beyond an improved understanding of classroom practice. They moved forward both their thinking and practice in some concrete ways; theory had informed practice, and practice, through regular meetings, was informing theory. Although causal linkages cannot be established firmly in qualitative case study data, our confidence in this statement derives from the wealth of evidence where links were made explicitly, as illustrated above and also in responses to the questionnaire item “How did participation in this project impact on your thinking or practice at the time or since?” All three responses indicated that the process had directly increased awareness and understanding of dialogic teaching and “the principles behind purposeful talk in the classroom” (Caroline). For instance, Lloyd wrote:

Developed my thinking about dialogic teaching enormously ... I had my ideas broadened by teachers, researchers and pupils. Has made me reflect on [what is] “knowledge” ...

Note that a dialogue about dialogue continued with pupils outside of the classroom here. We have already mentioned the feedback from Learning Partners requesting

more challenge of views. Lloyd also reported how he had listened to and responded to feedback from the two pupils about the degree of teacher control in the three lessons filmed.

The learning partners work has made me reassess my own thinking about a ‘dialogic lesson’ and particularly the role of the teacher within it. When watching the videoed lessons with the two students, they expressed strong views that too much of the discussion was mediated by the teacher. I feel this is an accurate reflection in some senses. The activities and timings of the lesson were set by the teacher. While I attempted to have minimal say in the findings that students came up with to frame our discussions, I can see that for students, this may have seemed like a traditional teacher-led lesson in some ways, with the teacher setting the tasks and organizing the collation of ideas. They felt a more unstructured approach to dialogue would be more powerful. As a result, we planned a later lesson together on whether democracy was a better method of government than dictatorship. One of the students, in his reflections on this lesson, felt that the more unstructured approach, with more dialogic class discussion, led to students being able to build well on each other’s ideas and more effectively than in the three-lesson sequence for the project.

Classroom applications reportedly continued to be in evidence after the end of the project. Lloyd is currently making links between dialogic teaching and “dilemma-based teaching”, a Humanities model concerned with thinking skills and social/emotional aspects to decision making. It helps children to develop a complex approach to looking at problems, getting them to see that dilemmas are multifaceted (e.g. “Would you protect a Jewish family in Nazi Germany?” or “Would you move from countryside to town in 1800?”), often with no clear pathway to mutually acceptable resolution.

FROM PERSONAL DEVELOPMENT IN A GROUP CONTEXT TO SCHOOL DEVELOPMENT

Each of the teachers has reported subsequently that they have continued to develop their new form of dialogic practice and to share this, our workshop resources and research findings with colleagues across their schools in ways that were practically relevant to their professional development. This was especially true of the ultimate version of the teacher-friendly dialogue table (6.3). Indeed, we were surprised and pleased to learn that, in each case, self-sustaining, whole-school practical initiatives aimed at fostering classroom dialogue across subject areas spontaneously evolved and were shared with novice teachers. These are ongoing even though the project has officially terminated.

In Caroline’s case, a whole-school development focus on dialogic teaching was instigated as part of a Masters in Education project that she undertook at Cambridge the following year to follow up the work. This built directly on the conclusions from her study, reflected upon in her certification report as follows:

This project has further convinced me of the value of dialogic teaching and that the IWB can be a powerful resource to help support this approach. This is by no means saying that this is the only approach and tool to be used, but rather that they can form an important and valuable part of a teacher's 'toolkit'. [...] The key points that emerged from a teaching perspective were that the IWB certainly supported learner engagement and motivation and aided me in terms of both lesson preparation and flexibility during lessons. Its ability to allow for cumulative working is also a real strength. In a follow-up questionnaire, the majority of students involved in the project stated that they valued both the IWB and dialogue as tools to enhance learning. As this is surely at the heart of all we do as teachers, it is this that I feel makes this approach an important one within my teaching repertoire.

Her subsequent Masters project (Neale, 2010) explored how a dialogic approach could best be developed and embedded within the school as an integral part of the teaching repertoire. She developed a 'Talk for Learning Development Group' with colleagues in English and science departments, working successfully together on a joint enterprise for the first time. The group discussed theoretical perspectives on dialogic teaching, audited their own practice using Diane's dialogue table, and developed and trialed a range of strategies to encourage dialogue in the classroom. These were shared with the whole school staff and the group supported interested colleagues in leading change within their own classrooms; several colleagues adopted the approach. The greatest impact for pupils was creation of a safe classroom climate in which dialogue could take place; teacher confidence with using strategies to promote dialogue increased and talk reportedly became more purposeful. Through the IWBs and Dialogue project and her Masters study, Caroline herself has developed a marked confidence in using theory to develop her own and others' practice.

I have particularly valued the planning of development work and action based on literature, again a definite change in my working practice. I feel the theoretical underpinnings of the project gave it a depth and substance which would have been lacking otherwise and it has been interesting to explore the links that exist between classroom research and pedagogic development. . . I now feel that I am far better prepared to lead change within school and have far greater confidence in my abilities to do so. (*ibid.*, p. 62).

In her submitted work for certification (Rawlins, 2009), Diane reflects in some depth on her own developing understanding of her practice as the project evolved. She makes several recommendations for others that built upon it, proposing three key factors that she feels "will allow primary teachers to fully exploit the IWB to aid the development of a dialogic approach to teaching and learning". These are: Creating the conditions for dialogue to thrive; Supporting children in accessing learning through dialogue; and Exploring the potential for employing the IWB as a dialogic teaching tool. Each of these is elaborated with recommended teacher

actions; for example “Children should have the opportunity to make use of the IWB to present or record learning as individuals or groups.”

Indeed, Diane’s main concern throughout the project, as a Deputy Head of her school, was to make her own learning “truly worthwhile” by building on it in staff development sessions. She instituted staff meetings to consider how her dialogue tables might be used as a basis both for planning developments in classroom practice and for professional peer observation. As she describes in her certification report, Diane drew on ideas about specific uses of the IWB with her staff as a way of encouraging discussion of the substantive points from, initially, Table 6.3. As one example, she used an idea taken from the workshop sessions – that of one picture fading into another – and asked colleagues to work collaboratively on a lesson plan that might incorporate this simple idea as a way of promoting classroom dialogue. There was, as one might expect, a range of highly creative responses to the basic challenge (for example, a school picture from the UK fading into an equivalent one from a school in Africa, in the context of work on contrasting locations in geography). Yet the point for Diane was that she was mediating the teachers’ learning about dialogic approaches through the use of the technology that had been at the core of her own involvement in the research team. This approach supports Diane’s belief that, in exploring the potential for employing the IWB as a dialogic teaching tool, “teachers need the chance to benefit from the support of a more skilled colleague”. However, this is not a simple relationship (for example, the transfer of simple technical competence is insufficient). As Warwick, Hennessy and Mercer (2011) strongly argue, it is the ways in which tool use can be seen to serve, promote and develop pedagogical intentions that is of paramount importance. Diane’s approach with her staff is a strong endorsement of this principle.

While the teachers considered that “it was good to take time to think of the theory behind the practice!” (Diane), the many pressures in today’s schools of course mean that there are competing priorities for professional development time, as Diane explained in her report (Rawlins, 2009, p. 13):

With hindsight, there are many more things I would like to have done: for example, pupil interviews following the lessons to gain their insight into what they found most helpful to learning; some recorded or written responses from staff after trying out the resource they made during our staff meeting; lesson observation using my version of the dialogue table, to evaluate the kinds of approaches already in place. Some of these things were tentatively planned, but events in school during the Summer Term meant that they were sadly not carried out. This is a particular issue for professional development for teachers; how do they ‘find’ the time and overcome the obstacles?

Nevertheless it is clear that a sustained focus on the development of teaching and learning, sanctioned and driven by schools’ senior management, is an absolute priority. This work perhaps indicates one way forward, and Diane’s principles for staff development reflect the intertwining of pedagogical principles and IWB use that characterised this project, as also summarised in her report (Rawlins, 2009, p. 12):

Conclusions and recommendations relevant particularly to staff development:

- Staff need a shared understanding of what dialogue in the classroom looks like; my version of the dialogue table, annotated with guidance and ideas from team discussions, could be a useful way of ensuring this happens. Teaching Assistants also need to be a part of this understanding, so that they can support the dialogic approach effectively.
- Practical support to encourage experimentation and creativity towards confidently using the multimodal features of the IWB in lessons.
- Practical issues to be considered: these include allowing time to gather images when planning a topic or series of lessons; making sure lesson planning is creative and not formulaic, and includes a range of teaching and learning opportunities.
- Building in time to review and reflect: how do we know whether dialogue is happening? Teachers may also wish to monitor themselves or be observed with this as a specific focus, perhaps using the dialogue table as a tick list.

Crucially, as work in her school progresses, the project outcomes are already being used in developing school policy with respect to teaching and learning. Indeed, a very significant contribution made by Diane was the ‘Teaching and Learning Policy guidance and proposed action plan’ that she devised to promote a whole-school approach (for example, through dedicated staff meetings). The sample action plan included in Appendix 9 is aimed at senior leaders and can also be adapted for use by smaller groups, or when working with other schools or institutions. It constituted a further resource for our co-authored professional development materials, described in the next section. Both Diane and Lloyd wanted personally to extend the findings to teachers elsewhere (“actionable practice”: Groundwater-Smith & Dadds, 2004). Indeed Diane reported:

At Arbury, we are involved in working closely with the Faculty of Education with their Primary PGCE trainees and within the county with NQTs [newly qualified teachers] on developing behaviour management skills and strategies; I am one of Cambridgeshire’s Primary Leading Behaviour Teachers, and am frequently observed teaching by a range of practitioners. I can see many opportunities for bringing into these situations my enhanced understanding of how to create the conditions for dialogue to thrive, and how to support it by employing the interactivity and multimodality of the IWB.

Finally, Lloyd reported:

There has been significant use of IWB technology at our school. By the end of this year, all classrooms will have IWBs. In some, teachers are using them to support dialogue. In others they can sometimes be used to prevent it. The school has already held a research conference centred on dialogic teaching and there is a commitment amongst a growing group of colleagues to develop classroom talk. We have made a promising start and this project can now suggest how the

IWB can enhance dialogic learning. I hope dissemination of this work can help colleagues ask new questions about the talk in their classrooms.

RESEARCH TEAM CO-AUTHORED OUTPUTS FOR OTHER PRACTITIONERS

As outlined in Chapter 1, the research collaboration led to extensive professional learning materials published by Open University Press (Hennessy, et al., 2014) with a view to wider dissemination. These include our negotiated understandings of classroom “dialogue” and “dialogic pedagogy”; a resource bank of annotated screenshots and video exemplars of practice; face-to-face workshop activities; and short readings based on the literature and the research, including a personal account from each teacher, based on their certification reports (see detailed outline in Appendix 10). These aim to build on teachers’ growing technical confidence and to develop pedagogical expertise with IWBs, stimulating debate and trialing of dialogic approaches in other settings. The resources include 21 downloadable video clips with descriptions, publicly hosted on the University’s streaming media site at <http://sms.cam.ac.uk/collection/1085164>.

We have also set up a project website at <http://tinyurl.com/OUPIWB/> offering case stories written by the teachers themselves, plus some of the professional development and lesson materials. Reviews of the professional learning resource proposal (mainly from teacher educators) have highlighted “the strong pedagogical approach proposed focusing on the nature of teacher and learning classroom interactions rather than technical dimensions,” the grounding in both observations of classroom practice and in research, “strengthened by tools/templates for self analysis”, and the “teacher voice” coming through. The responses indicate that the collaboration is independently perceived to have utility outside of the partnership schools.

The collective and individual outcomes of the collaboration additionally culminated in a joint international conference session some six months after the project ended, requiring the whole team to reflect further on what we had learned. Drawing on their certification projects, each teacher presented an impressive account of their own professional development and of follow-up work in their schools, and these held equal status with our own contribution to the session. Engaging teachers in further forms of joint publication is admittedly more difficult without dedicated time and support; however, the six of us co-authored an invited article illustrating the project outcomes, appearing in a publication on interactive whiteboards distributed to all schools in Australia and New Zealand (Hennessy et al., 2010).

Finally, a series of pilot Dialogue and IWBs workshops has been conducted with teachers across the UK (and one in Dublin), trialling draft versions of our collaboratively produced professional learning materials and the video resource bank. This confirmed the value of the materials beyond the project schools. The events include an invited workshop with 25 leading teachers, run in 2011 for the Bradford education service in Yorkshire to support their Raising Achievement Strategy, which was enterprisingly focused on classroom interactions and theory-driven innovation.

Teachers who attended subsequently reported that they all planned to “cascade the ideas to staff at school,” “put them into practice”, and “set whole school goals.” They typically found the content “practical and relevant”. Five similar workshops were offered in 2011 to teachers in two Hertfordshire schools by Laura Flitton, a teacher contracted to the project whose independent report stated:

It was really valuable to highlight that the materials and video clips were a stimulus for discussion, reflection and trialling of new ideas, not a model to copy. In fact, many colleagues were quick to criticise clips and offer suggestions for how they would approach leading the lessons. . . The ‘Dialogue Table’ was a valuable tool which encouraged colleagues to audit their own practice. . . The paper-based resource bank was considered an excellent stimulus for discussion and development of ideas. All colleagues suggested that there was at least one aspect of the resource that had encouraged them to think about developing their practice. In summary, the materials were well received and considered to offer an innovative way to link dialogic teaching with the IWB.

CONCLUSIONS

The whole team is encouraged that our efforts appear to have culminated, as intended, in resources that incorporate key elements of dialogic theory recontextualised for classroom teaching with the IWB. At the same time the resources are evidently deemed accessible and useful to practitioners in schools and teacher education. In this study our collective in-depth reflection on the applicability of grand theory about dialogic interaction to practice both “filled out” (Ruthven, 2001, p. 181) the notion of dialogue as it was appraised in action, and extended it in some new directions. The theory was made salient through sharing the substantive outcomes of this research carried out by a small number of teachers, but it intentionally remains open to questioning and reformulation by others. These others include theorists interested in dialogue, for whom intermediate theory may potentially provide valuable feedback from testing the applicability of their theories in relation to planning and analysing classroom lessons. This might result in reconciliations and refinements, for example by offering some insights into the often contradictory notions of cumulative discourse and consensus building. It might extend the common association of dialogue with “talk” by conceptualising new, more visible and re-useable digital artefacts (objects jointly constructed on the IWB) that both stimulate and embody dialogue.

Intermediate theory is by its nature both situated (context-specific) and principled. This means that while its representation captures the outcomes of working in a small, finite number of settings, with possible minor variations in outcomes across teams exploring similar issues, there are also significant invariants across settings. Its wider use in classroom practice was explored in the last two sections of this chapter. The theoretical insights and, in particular, the reframing of dialogic teaching and learning in terms of the use, and revisiting of multimodal artefacts in mediating learning

over time, are not elaborated here but they are the subject of ongoing theorising, as described by Hennessy (2011). They complement the rather different learning of the team that was evident in the evolution of the methodology described in this book. Rather, they constitute a key substantive outcome of the study for us as academics and for colleagues elsewhere who share our research interests. Note that the published professional learning resources, especially the resource bank and related video clips, encapsulate the main substantive findings of this work – concrete examples of the dialogic practices developed and trialled by the teachers in the Dialogue and IWBs project, and to some extent in T-MEDIA and an earlier project. A further journal article offers illustrative examples of Lloyd's effective strategies for using the IWB for orchestrating dialogue in his history lessons (Mercer, et al., 2010).

A follow-up project funded by the British Academy (2013–15) is already underway. This involves collaboration between a large team at Cambridge and a team led by Sylvia Rojas-Drummond at the National Autonomous University of Mexico to develop and disseminate a comprehensive framework for analysing dialogic interaction that is sensitive to cultural variations. Drawing on video recordings of dialogue in groups working at computers too, the teams are integrating their analytic frameworks devised over a number of projects into a single one that can explain a wider range of classroom lessons and modes of technology use. The tool builds upon the work of the Dialogue and IWBs project and is intended to cover teacher-student and peer interactions in a wide variety of subject areas and classroom settings. These include whole class and group work, and learning with and without digital technology. Our thinking and struggles to make sense of the key ideas and issues are hence ongoing over time.

To conclude, our collective representation of dialogue became a valuable tool which was used purposively by the teacher participants for deeper analysis and improvement of practice in other teaching contexts, within both their own and colleagues' classrooms. We believe that developing a community of inquiry of the kind described here, with the inquiry including individual certification projects, meant that ultimately teachers and schools pursued their own goals and constructed their own meanings of dialogue (as reported too by Jaworski, 2007). Indeed, we were delighted to find that in each case study, whole-school initiatives aimed at fostering classroom dialogue across subject areas were spontaneously implemented, were shared with novice teachers, and are still ongoing. This was a remarkable outcome in itself, confirming that the risk we took in bringing together practitioners across disciplines paid off.

The question of 'scaling up' such endeavours is, of course, a thorny one. We hope that our professional development materials, created as a result of this project, will go some way to achieving this ambitious aim.

CHAPTER SUMMARY

This chapter presents findings from a thematic analysis conducted by the university research team across the three case studies of dialogic teaching with the IWB. It

draws on data from interviews, teacher diaries, workshop transcripts, review meeting transcripts, follow-up questionnaires and certification reports. Teacher perspectives on the process of research collaboration are presented through characterising their experiences of team discussions around the notion of dialogue, and it explores the ways in which those discussions and interaction with the workshop materials impacted upon their thinking, lesson planning and practice. Approaches to dialogic teaching were reportedly extended and embedded in all the schools involved.

As described in Chapter 6, the co-inquiry extracted, from the complexity of authentic practice, some key characteristics of IWB-supported dialogue and dialogic pedagogy. Outcomes also included a sample Teaching and Learning Policy Action Plan, outlining one teacher's proposals for staff development in her school. Along with our illustrative examples of teacher practices, these materials form a springboard for further critique and modification in other settings, subject areas, and with different pupil groups. This flexible framework and the practices developed have already been spontaneously adapted and exploited for wider use in each school. They also form the basis of workshops and co-authored professional learning resources for other practitioners that have been piloted and commercially published.

NOTES

1 <http://thinkingtogether.educ.cam.ac.uk/>

2 This device exploits hide and reveal functionality and creates suspense during activities in which learners make predictions then objects are dragged and dropped 'into' a square box and immediate feedback is given about their pre-classified properties, e.g. true/false, prime number or not.

This chapter was based on two co-authored articles, posted by permission of the publishers (Teachers College, Columbia University and Taylor and Francis):

Hennessy, S., Warwick, P. & Mercer, N. (2011). A dialogic inquiry approach to working with teachers in developing classroom dialogue. Teachers College Record, 113 (9), 1906–1959. Available online at <http://www.tcrecord.org/content.asp?contentid=16178>

Warwick, P., Hennessy, S., & Mercer, N. (2011). Promoting teaching and school development through co-inquiry: Developing interactive whiteboard use in a 'dialogic classroom'. Teachers and Teaching: Theory and Practice, 17(3), 303–324. doi:10.1080/13540602.2011.554704.

CONCLUSIONS AND FUTURE DIRECTIONS

Theory is a symbolic tool that is significant for “its ability to define the problems that teachers face, clarify their confusions, and suggest possible solutions to these problems” (Gordon, 2007a, p. 123). “The practice of teaching, on the other hand, provides the context, material, and testing ground for educational theory” (*ibid.*, p. 120).

INTRODUCTION

Conclusions drawn from the seven chapters in Section One were presented in detail at the end of Chapter 7. That chapter theorises about bridging between research and practice through reflecting on the methodological approach to theory building via collaborative review of lesson video resources. The *intermediate theory building script* described the process of aligning perspectives of teachers, their colleagues, university researchers and subject specialists in a way that may provide guidance to others. Complementary roles within the research team were characterised and preconditions, critical features, and scalable benefits of the evolving approach were identified. The process encouraged the shared use of new or refined language and yielded new, joint understandings of theory and practice that may be mutually useful to practitioners and academics.

This chapter builds on that discussion by drawing out the further implications from Section Two, which reports on the impacts on participating teachers, their colleagues and schools of engaging with theory, reflection and trialling new approaches. The impacts of these processes on thinking and pedagogical practices could be said to increase professional capital (A. Hargreaves & Fullan, 2012) by supporting teachers’ development of a more reflective and analytical outlook, critical questioning of routine practices and underlying pedagogy, and related new terminology.

The chapter offers some suggestions arising from this and related work to indicate how we might formulate new forms of collegial professional development that aim to engage a much wider practitioner audience. This might involve further intermediate theory building and/or adapting the evolving outcomes of theory-building processes in new settings. In this way the discussion attempts to address one of the questions that all models for closing the gap between research and practice tend to gloss over, that of which generalisation claims the research makes (Broekkamp & van Hout-Wolters, 2007). The chapter includes some implications for further research.

PRACTITIONER-RESEARCHER COLLABORATION AND THEORY BUILDING
THROUGH CRITICAL, REFLECTIVE DIALOGUE

In the Introduction chapter I argued that making explicit, integrating and exploiting both scholarly and practitioner knowledge in the course of working towards common goals potentially offers both parties a fruitful line of inquiry. It presents new opportunities to build and constantly scrutinise a strong professional knowledge base that bridges across and informs both the teaching and research professions about how we might support effective teaching and learning in our schools. Hiebert, Gallimore and Stigler (2002) postulated that researchers might thereby gain a rich source of new ideas, testable hypotheses and relevant findings, and that teachers could draw on their academic partners' methodological expertise in testing difficult-to-implement but promising new ideas. The studies reported in this book indicate that the actual benefits are immeasurably wider. Compared to conventional research carried out by university researchers alone, collaborative research with practitioners can additionally engage much more intimately and authentically with the practical classroom contexts and issues that the research addresses and develop deeper insights into the perspectives of the key players within them. Co-inquiry yields solidly grounded findings that are known to be useful to some practitioners at the very least (since they were co-investigators as well as participants), and that are likely to resonate with a wider audience of teachers in similar contexts. This chapter explores approaches to professional development that aim to secure that wider reach (and hence to increase professional capital within the broader education system).

Critical, Reflective Dialogue

The work reported corroborates prior findings that co-inquiry can be highly productive for developing pedagogy – in this case concerning the classroom use of educational technology – as long as a critical stance is taken and new ideas are critiqued from the perspective of existing practice (James & McCormick, 2009; McIntyre, 2005). Dialogue is the medium for this critique; indeed the theme of dialogue runs throughout this work. The book describes the methodology through which a dynamic and recursive process of dialogic interaction took place between applied practical theory and grand theory, and between theory, research and practice – with research generating the theory and informing classroom practice. It describes a further dialogic (interpersonal), dynamic process of co-inquiry between academic and school-based researchers, centring on pedagogy for making use of IWBs effective. In one project, this pedagogy supported *classroom* dialogue. Our dialogic interaction was described in Chapter 7 as follows:

We perceive the development of our own thinking in the same way as we view classroom dialogue – as a dynamic, situated and ongoing process whose individual and collective dimensions are interdependent. In this view, new

meanings are never final or fixed but emerge between intentions and responses of participants as they put forward what they see as significant to the group and they arise out of (rather than overcoming) difference (Wegerif, 2007).

This final chapter additionally conceptualises dialogic interaction between teachers working with peers as co-inquirers, as outlined in the later section on using intermediate theory in a wider context.

Nehring *et al.* (2010) highlight the “catalytic power of reflective dialogue for deep learning” (p. 404) and improved educational practice. As illustrated earlier, we engaged in both reflective dialogue in which existing ideas and practices were made more explicit and clear, and generative dialogue in which new insights and perspectives were created (Isaacs, 1999, Chapter 1). Achieving this depended on the mutually respectful environment we created, where all participants were willing to listen to other voices and to raise and consider assumptions and perceptions without being bound by them (‘suspension’: *ibid.*). The dynamic relationships in conducting this reflective practice were exemplified and discussed in Chapters 2–7 and the conditions of sensitive support were outlined. Preconditions and key characteristics of the approach were listed in Table 7.1. The teachers increased their capacity for critical, reflective dialogue (Harford & MacRuairc, 2008) and demonstrated a deep level of critical engagement in both deconstruction and development of practice. This included reflecting on concerns, regrets and problematic issues, as illustrated in Chapter 9 for instance. Jaworski (2006, p. 204) emphasises that

in a community of inquiry, rather than providing solutions ... critical inquiry or critical alignment creates the clarity and strength of purpose to recognise and ... tackle issues consciously and collaboratively. It does not remove the issues, nor ... tension or discomfort.

She asserts that issues and tensions within practice are addressed through developing “inquiry as a way of being” within the community (*ibid.*, p. 206). In our studies critical reflection, appraisal and dialogue were supported by the collaborative inquiry we undertook in partnership to analytically scrutinise classroom teaching using lesson videos and summaries. The experience of this process in our workshops with teachers resonates strongly with the inquiry approach described by Carter and Richards (1999):

There is a constant focus on sense making, building up one’s own ideas, understanding how different people approach problems in different ways, and exploring how sharing and reflecting on these differences can help deepen one’s own understanding. The teachers find that articulating their understandings and having to defend their ideas forces them to grapple with what it means to really understand something (p. 69–70).

In my view, this process of making sense of new ideas applies to interrogating theory too, as elaborated below.

Evolution of Intermediate Theory Through Co-Inquiry

Our collaboration included an equitable researcher–practitioner exchange in a process of video review and intermediate theory building. This process involved critiquing a range of carefully selected external stimulus resources: both theoretical and practical outcomes of a range of published literature and the team’s own prior research, video footage from teachers’ own classrooms and other video exemplars of teaching practice. Workshop interchanges formed a basis for ongoing practical theorising about the processes underlying interactive or dialogic teaching and learning. University researcher and practitioner perspectives were integrated during these workshops along with insights from prior practice, from the thinking evolving through team discussions, diary reflections and interviews, and from iterative reviews of new lesson videos and other data. We wrestled with sociocultural learning theory and theories of dialogic pedagogy in terms of how they interacted with practices in the specific settings, both informing and illuminating them. Scholarly theory, teachers’ professional knowledge, practical theories and practice were all thereby informed by the research in progress, and vice versa, so that the boundaries between them became increasingly blurred. Intermediate theory building was thus a complex, reflexive process of construction that continually blended elements of these different types of knowledge in a myriad of combinations and tested them out in the practical arena of technology-supported classroom activity. We analysed their applicability and manifestation in different practical settings, within and between taught subject areas.

As elaborated at length in Chapter 7, a process of video-stimulated reframing underpinned the intermediate theory building; our diverse perspectives were articulated, critically scrutinised, elaborated, compared, debated, reconciled and revised – through intensive and iterative engagement with the digital video and other data. Reviewing the data captured over a series of lessons both stimulated and scaffolded development and testing of further interpretation and the evolving analytical framework. Negotiating the designation of critical episodes offered a lens on the teacher’s pedagogic rationale and strategies for planning, teaching and assessing a technology-based lesson sequence, on patterns of classroom interaction (between teachers, learners and technology) and on levels of learner participation.

The co-inquiry process itself was captured through analysing reflective teacher diaries, transcripts of meetings and workshops, follow-up questionnaires and accreditation reports. The resulting data illustrated how the process of engaging respectfully with, and questioning and reflecting on, each other’s practices, was itself dialogic as we sought to co-construct, test and refine new meanings and interpretations of classroom interaction, dialogue itself and dialogic pedagogy in the novel context of technology use. The process culminated in democratically negotiated, enriched understandings and re-contextualised formulations of these constructs, framed in accessible language and grounded in authentic classroom practice. Importantly, some elements of grand theory were “filled out” (Ruthven, 2001, p. 181) or reformulated as they were appraised in action. The trialling helped

to test the practical applicability and boundaries of new approaches in a given context, resulting in re-contextualised techniques and practices.

This achievement was heavily dependent upon the collaborative model of working together that we developed. This helps to meet the call from participants in a recent study by Vanderlinde and van Braak (2010, pp. 308–309) for a model where “researchers and practitioners would work together and recognise each other’s expertise and professionalism... teachers are seen as professionals with a knowledge base and a conceptual framework, instead of technical executors.” As elaborated in Chapter 7, in our studies there were both shared and distinct roles and responsibilities of the university and teacher researchers in the inquiry process and in developing the analytic frameworks. The whole team was involved in viewing, selecting and analysing video clips, and collaboratively developing and refining representations of intermediate theory. In some cases teachers took the lead on shaping these representations. The university team took responsibility for the broad research focus, design and methods of data capture and analysis in each project, although the research focus was refined during our collaboration. We drew on our knowledge of educational research methodology and sociocultural theory, managed integration and circulation of the data, synthesised and facilitated the video review and workshop discussions, and created a “safe and secure” environment for aligning the team’s ideas. Teachers were the recognised experts in their disciplinary areas and devised all the lesson plans, drawing on their situated pedagogical knowledge for using IWB technology in their subject area and/or for supporting dialogue. They also held rich, contextual knowledge about their pupils, schools and the subject curriculum. Importantly, articulation of their applied practical theories along with their diary and interview reflections played a valuable role in operationalising and recontextualising scholarly knowledge through the review process. As the book hopefully demonstrates throughout, both bodies of knowledge and kinds of roles were equally valued and we learned a great deal from each other.

Perspectives, values and professional goals of our different cultural groups will inevitably retain some differences for the foreseeable future (for example, academics need to publish their findings in peer-reviewed journals). The desirability of blurring their boundaries is in any case questionable (Biesta, 2007). However, through developing a way of working together at the research–practice interface they may become more closely aligned over time.

Teachers in the study by Vanderlinde and van Braak (2010) argued that they were “more interested in having a direct dialogue with the research community than reading their scholarly papers” (*ibid.*). The authors point out that such a dialogue can be difficult to achieve in short-term interactions. In our studies, we found that a significant investment of time and energy was needed for co-creating knowledge, but felt that this paid off in terms of the outcomes outlined above. The theory introduced and refined during the analyses provided a powerful analytical lens upon emerging practices, including those not incorporating technology. As described in Chapters 8–10, the participants reported deep insights, increased reflectiveness,

critical questioning of underlying pedagogy, values and assumptions, and sustained effects upon their own thinking and teaching practices. The approaches developed were additionally shared with and adapted by other colleagues in each school. Two teachers in the Dialogue and IWBs case studies undertook inquiry projects that additionally yielded knowledge about *learner* perspectives on dialogic teaching. These shaped their subsequent practices and fed into the public presentations of their work.

Note that the desire of the teachers taking part in both main research projects to participate in continuing professional development and self-reflection was a factor prompting their original selection. It could be argued that the 10 practitioners were thus an atypical sample and that collaborative theory building may not be within the capacity or realm of interest of the average teacher. I do not believe that this is true, as long as the process is clear and supported and the theoretical constructs are made accessible. The value of theory in helping university and practitioner researchers to ask the right kind of questions, in bringing underlying issues sharply into focus (Alsop, Bencze, & Pedretti, 2004), and in providing the language, the constructs, the models and criteria through which educational contexts can be examined rigorously and systematically (Venville, 2006, p. 822), has been argued and illustrated throughout this book. Moreover, other analyses of teaching through theoretical lenses have noted the ways in which teachers' practices and introspection reflect current educational research, including for example technology-mediated instruction, problem-based learning and open-ended inquiry (Alsop, et al., 2004). In our work, dialogic interaction, scaffolding and fading and a number of other themes (see Chapter 5) emerged from the teachers' own analyses of practice, albeit using different terminology sometimes. Despite the marked challenges the teachers occasionally experienced in grappling with theory (see Chapter 8), we found that they were keen to do so and they saw the utility of theory-informed practice. Mark Dawes (teacher-researcher in the trial of the multimedia mathematics resource reported in Chapter 9) described part of his rationale for wanting to be involved with the NCETM-funded follow-up project as follows.

The chance to be involved in something that had research behind it, and had some theory behind it was also very exciting, because of having seen and lived through the introduction of the Numeracy Strategy which didn't have a firm research backing, certainly not in the same way that some of the things that happen in other countries around the world have.

Work with student teachers indicates that through reflection on classroom observation and practice, theoretical concepts (those which have practical value) and their associated language take on clearer shape. They are used more confidently and purposively, becoming tools for deeper analysis of classroom practice. "In this way, pedagogical learning can move beyond 'semi-conscious trial-and-error'" towards "a model of informed analytic professionalism" (Ruthven, 2001, p. 181). I presume that such learning can continue – at more advanced levels – throughout a teacher's

career. Our research confirmed that in-service teachers are highly motivated by creating rather than just applying knowledge.

The next section explores how the emerging intermediate theory and illustrative examples might stimulate reflection, adaptation, trialling and refinement by other practitioners who have not engaged in the original process. Appropriating new theoretical ideas into their practical reasoning provides a new context for research (Randi & Corno, 2007) and guides principled development of new practices and pedagogies. At the same time it increases the “pragmatic validity” of the original research (Nuthall, 2004, p. 273). I consider how professional development could build on the research approach described here to engage a wider practitioner audience in developing pedagogical insights and more theoretically informed practices. This might take place via two routes, the first being through further intermediate theory building, extending the co-inquiry outside the partnership. Possibilities may arise within other research partnerships with different pedagogical concerns for adopting or adapting the process of collaborative theory building itself. While there is no expectation that others will adopt our approach wholesale, considering the issues identified here may be helpful to anyone designing new forms of collaboration. Many of these issues apply also to co-inquiry between teacher peers, which in the absence of a funded research project permitting sustained collaboration between practitioners and university researchers, is more realistic in most cases. It may in any case be the desired way forward in many schools, although the merits of external versus internal facilitation is one of those issues discussed below. The second, more likely, route is through sharing and adapting the resulting intermediate theory in new professional development or classroom settings, as elaborated below.

USING INTERMEDIATE THEORY IN A WIDER CONTEXT

I guess because we knew that it wasn't just for us that we were doing it, no matter how difficult [reviewing the lesson videos] might have been to fit in over a weekend, we did it because we knew that it had importance and significance. (Jackie)

This comment volunteered by English teacher Jackie illustrates the perceived meaning of creating resources for other practitioners. While this book has foregrounded the outcomes for the research collaborators and alluded to spin-off effects within the schools, intermediate theory – in general and the specific forms developed here – may have useful messages for practitioners and researchers elsewhere too. McIntyre (2005) points out that before they are welcomed by school managers, practices have to be validated in terms of educational merits, cost-effectiveness, social acceptability and general practicality. Likewise for other teachers to reassess their attitudes and beliefs and ultimately make more durable changes in practice, they too may need to see or gather evidence that a new practice improves pupil learning (Fielding, 2005; Guskey, 2002; J. G. Wells, 2007). These conditions remind us that educational

researchers' assumptions about "dissemination" to practitioners (documented by S. Brown, 2005; D. H. Hargreaves, 1999) can be unrealistic; it does not denote a straightforward imparting of findings and "uptake" of new practices, guidelines or "application" of new ideas (see the introductory chapters). Nor is it even just a case of adapting for new contexts; rather it means laying them open to *critical scrutiny*. In producing the various professional development materials arising from this research, our aim was modest in terms of offering ideas and exemplars that teachers might engage with in reviewing or researching their own practice, and that teacher educators might draw upon accordingly. Building on the empirical findings of collaborative research such as ours, however, means scrutinising the relationship between the evidence generated and the plausibility of the interpretations drawn, namely 'warranting' (James, et al., 2005) the themes and exemplars emerging from analysis of the data from observations, interviews and workshop recordings.

Where a researcher seeks, for example, to establish a claim that if teachers follow a particular course of action, specified learning outcomes are likely to result (or even that they are not), the evidential requirements to support such a conclusion are stringent. Indeed, other studies and well-developed theoretical interpretations may well be required to establish a plausible account. (*ibid.*, p. 112)

This means returning to theoretical understandings developed prior to a study, which are based on relevant research and which may or may not be modified through the study. These are important for framing the conception and interpretation of the empirical data. Theory does not give research a warrant, though, since the data are always open to alternative interpretations. The latter must be systematically considered in order to draw robust conclusions about outcomes for learners and pedagogic practice (*ibid.*, p. 119).

McIntyre (2005, p. 378) asserts that making practices useful to others necessitates "abstracting their key effective generalisable features from the enormously complex real personal practices of the individual teachers". While substantive results cannot easily be generalised from a small number of case studies in diverse settings, the dialogue tables and critical episode criteria we formulated, for instance, served to make some headway toward abstracting some key characteristics of dialogue in the context of IWB use. They also summarise the principled pedagogy emerging from reflection on and "critical alignment" with theories of dialogue and modes of practice through the inquiry process (Jaworski, 2006), although manifestation of the principles inevitably threw up quite different patterns in our three diverse contexts (Putnam & Borko, 2000).

Further related substantive outcomes – the lesson materials and video footage illustrative of supporting dialogic teaching with the IWB, including rich exemplars of pupil dialogue – are described in more detail elsewhere. Along with the dialogue tables and other resources, including a reader containing the teachers' case stories

and other accessible accounts of dialogic practice and theory, these collectively formed the basis of a published professional development resource (Hennessy, et al., 2014; <http://tinyurl.com/OUPIWB/>). The activities aim to stimulate reflection on current practice, analysis of underlying rationale and discussion between colleagues of dialogic approaches. Likewise, the online T-MEDIA multimedia resources (<http://t-media.educ.cam.ac.uk/>) encapsulate emerging themes within narrative accounts hyperlinked to related video clips and analytic commentary. They make the rationale underlying the practices depicted more visible using recontextualised and refined constructs from sociocultural theory. Hence reflective practice (and further refinement of theory) may be developed in other educational settings using these two sets of resources. The materials could also illustrate new practices for pre-service teachers and stimulate them to think about which strategies they might want to try out themselves. Our recent workshop trials of the dialogue resource and videos in two new schools offered some promising evidence that interaction with the resources provides a valuable stimulus for discussion, reflection and trialling of new ideas.

Through producing the multimedia professional learning resources, we have begun to build on the steps that the teachers have already taken to share the work with colleagues. In both of our projects, some teachers spontaneously generated personal representations of our jointly constructed intermediate theory designed for wider use. In two cases, they refined these further to create tools for whole school development (Lloyd's classroom observation schedule; Diane's dialogue tables). These theory-informed but practical tools designed by and for practitioners are more likely to have an "impact" on practice within their schools than any reports or presentations we might produce (however accessible their language). Again, one-way distribution of these tools is unlikely to be effective; our teachers all planned to share them with colleagues during ongoing staff meeting discussions and to continue to refine them over time collaboratively with their peers.

Further contextualisation will be essential, and public examination of our resources – indeed, dialogue with and about them – must be encouraged. This means working towards wider changes in practice through further development and testing of principled pedagogy, gaining feedback and continuing to refine the tools the teachers have developed over time collaboratively with their peers. For instance, Diane has already spontaneously drafted a school Teaching and Learning policy action plan (Appendix 9) outlining how the critical links between theory and practice would be made. The two-way nature of their interaction is embodied in her second step: "How do dialogic teaching and the dialogue table in particular fit in with our approach to teaching and learning (or vice versa!)" Building on existing practice is explicitly incorporated in her dialogic teaching "audit" (based on the dialogue table she developed: Table 6.3), and in her plans to "share [in her school] qualities of dialogic teaching [and IWB uses] already evident in our teaching." Using such tools in new settings must begin by assessing the similarities and differences ("fit") between the new and original situations (Schofield, 2007).

In conclusion, we may be able to shortcut the lengthy process of building intermediate theory from scratch. This might be done by offering other practitioners ready-made representations of principled pedagogy; these can then form a springboard for their own further critique. They can iteratively refine the intermediate theory and the materials that embody it, as they investigate them – and warrant our outcomes – through action research in new contexts. Such action research may probe further into the kinds of questions we spontaneously generated while reviewing the lesson videos (see Rosemary’s reflective account in Chapter 7 for examples), continuing the dialogue. Providing these concrete representations for practitioners potentially offers them a wide variety of opportunities to explore, build, refine and apply theory themselves, as summarised by Gordon (2007a), writing about the teacher education context. He suggests four related ways that theory may be applied in classrooms:

- applying parts, aspects or insights of a theory;
- using theory to provide educators with a new direction for reflection, action and meaningful dialogue;
- reconstructing a theory to meet the needs and problems of a specific context;
- providing educators with various ideals and standards for evaluating their practice and imagining possible (more stimulating) alternatives.

It is recognised, though, that warranting and using – testing out and adapting – findings from collaborative research in the classroom can be as complex as generating them.

A PROPOSED APPROACH TO SCHOOL-BASED PROFESSIONAL DEVELOPMENT BASED ON COLLABORATIVE CLASSROOM-FOCUSED INQUIRY

Overview of the Model

The research outlined in the first section of this book culminated in a trial of a school-based model of professional development, stimulated by viewing of selected multimedia resources, as summarised in Figure 9.2. Teachers in two mathematics departments engaged in cycles of joint critique of the material, designing new approaches, classroom trialling and peer observation, group reflection and analysis. The approach involves sustained, planned, structured and purposeful opportunities for teacher learning with colleagues through reflective dialogue and practice with an agreed area of focus. It has underpinned subsequent work, leading to the co-authoring, piloting and publishing of practical resources for using the IWB to support classroom dialogue, as already mentioned. It has also inspired the development and trialling through weekly workshop sessions over a school year of a professional learning programme to support primary teachers in sub-Saharan Africa. The open resource features video clips of interactive teaching and digital technology use that we have filmed in Zambia and South Africa (see <http://www.oer4schools.org>). The central tenets of the collegial approach can be summarised as follows.

It is school-based research and professional development led by practitioners, ideally working in face-to-face small groups. The teachers collaborate as equals, act as peer mentors, jointly plan lessons and observe each other in order to develop new ideas. Their courses of action are initiated and driven by their own needs and adapted to their own contexts. Teachers share responsibility for innovating and embedding improved practices in their schools (Frost, 2012).

It is not a one-off intervention, but part of a long-term process of reassessing pedagogy and critically reflecting upon practice (Cordingley, et al., 2004; Hoban, 1999). Teacher development is a gradual, flexible process and one that depends on sustained support; learning may proceed slowly and hesitantly as horizons of understanding expand, rather than through sudden leaps of insight (Wallace, 2003).

Professional dialogue between colleagues is central. UK teachers have regular discussions about teaching with their line manager but performance management meetings typically focus on their own classroom teaching. The discussions stimulated by critiquing the video clips can be more wide-ranging, allowing teachers to examine and reflect on the effects of different types of activities without needing to account for their own actions and decisions.

The research and professional development activity takes place within an established and supportive, self-regulating community of inquiry. School leaders and administrators actively support the process. The activity reflects broad community rather than individual goals concerning innovation and change, linked to collective efficacy – the perceived performance capability of a social system as a whole (Bandura, 1997). The issues that its members choose to explore and the actions and theories-in-use that they implement are contextualised through their situation within a localised school and/or departmental learning community (Retallick, 1999) which promotes mutual trust and teacher agency (Frost, 2012).

Immediate classroom trialling related to the professional dialogue, plus post-lesson review, explicitly encourages an iterative cycle of reflective practice and supports change (Jaworksi & Wood, 1999). Joint planning, teaching and reflection can increase teachers' risk taking and creativity (Sebba, et al., 2012). Ideally peers observe each other and offer feedback specific to the research aims (See Figure 9.2).

The inquiry (including peer feedback) is focused on supporting student learning, that is, on the impacts of new approaches for pupil engagement and valued learning outcomes for all learners; on which pedagogical strategies are applicable, assistive and appropriate for the context; and if applicable, on the added value of using a new technology. Changes in practice and improved

student learning are publicly documented (Annenberg Institute for School Reform, 2004).

There is a provocative external stimulus for change and innovation; it is informed by theory and research. The intermediate theory embodied in the materials is itself open to further critique. The video exemplars and other materials are not intended to be models of “best practice” or “what works” but to provide a mixture of different approaches for consideration. Many teachers will see familiar practice, while also being challenged by new ideas. Some will be inspired to trial aspects of – or improve on – the practice depicted.

The materials include specific built-in prompts for reflection on approaches depicted and on teachers’ own current practice. Importantly, the focus of discussion is guided towards participants’ own experiences and planning, rather than merely interpreting what is depicted (Duffin, et al., 1991). The guidance can be more or less structured, depending on how experienced the teachers are with the technology and the pedagogical techniques.

Readers familiar with the literatures on professional development and school–university partnerships will recognise that the approach shares some similarities with the key design features identified by previous researchers and reviewers. For example, Wells (2007) found that the five factors of greatest influence in supporting teachers to use technology to improve teaching and learning were: duration of process; centred on participant concerns and guiding teachers to explore theory and pedagogy; active experience of the innovations; collaboration; support – long term, sustained pedagogical and technical. In the concluding chapter of a book outlining various ‘Professional Development School’ models operating in the United States, Robinson and Darling-Hammond (2005) identified 10 characteristics of successful collaboration within school–university partnerships: mutual self-interest and common goals, mutual trust and respect, shared decision making, clear focus, manageable agenda, commitment from senior leadership, physical support, long-term commitment, dynamic nature, information sharing and communication. Further studies highlight the crucial role of reflective practice in teacher research for enhancing teachers’ professional learning, development, self-esteem (Groundwater-Smith & Hunter, 2006; C. McLaughlin, et al., 2006), and confidence in their ability to promote student-centred learning and deal with problematic situations that arise in teaching (Ayubayeva, 2012).

The approach espoused here is consistent with such models and explicitly builds on the wider body of research in the area of professional learning. However it clearly has some additional features (as in the final two points listed in the box above), and there are several important design considerations that lead to problematising some of the assumptions underlying previous programmes. These include the thorny issue of teacher autonomy and choice, the relative merits of teachers viewing their

own versus others' practices, the question of who should facilitate a professional development programme, and where the time to engage with it over the long term will come from. They are now discussed.

Level of Prescription

Our professional development resources are designed to be used selectively by different individuals or groups pursuing their own pathways through the nonlinear structure, and to stimulate creative experimentation in new and unpredictable directions. Our studies of technology use show that for some teachers this means encouraging more pupils to come up to the whiteboard, increasing pupil participation in lessons, and enjoying more hands-on use of whole class technology. For others, the benefits of peer collaboration using portable technologies in the classroom might become apparent and stimulate a decision to shift the mode of organisation and invest in more laptops. Further teachers have been encouraged to develop whole school approaches to reflective practice and/or to supporting classroom dialogue. Likewise the 'dialogue tables' are illustrative and open to adaptation by teachers using alternative digital tools and non-digital tools, with different ages and kinds of pupils, and for use and adaptation by pupils themselves.

The design principle here is consistent with Leat's assertion that 'research products need to offer a density of connected ideas through which schools can create their own trajectory of change' (Leat, 2009, p. 19). It also allows for teachers with different levels of experience to engage with the materials and with each other in different ways. For example, Ayubayeva's (2012) recent research in Kazakhstan indicated that very experienced teachers were keen to collaborate informally, including with newly qualified teachers, who they perceived as a new source of knowledge about 'contemporary pedagogy.' By contrast, mid-career teachers remained isolated from both mentoring work and observing lessons of their more experienced colleagues; their strategy was to use others only if they were believed to know more than themselves. Thus the desired institutionalisation of reflective practice and collaborative learning can be hijacked by individuals' own interests and development, and the latter can influence the benefits for individuals. The literature in this area confirms, however, that critical reflection within a supportive community, as in our studies, can, however, enhance the reflective process beyond individual teacher interest. For example, Loughran suggests:

In order to better understand the nature of professional learning and its impact on professionals, it is clearly important to be able to find new and innovative ways of looking into the knowledge of practice and 'unpacking' it in meaningful ways. In so doing, that which is insightful, challenging, thought provoking and helpful in the development of knowledge for, and of, practice might then be applicable beyond the individual and speak to the broader educational community. (Loughran, 2007, p. xiii).

Involvement in an inquiry process assists the unpacking. In our studies of IWB-supported dialogue it facilitated the teachers' – and in turn their colleagues' – understanding of the theoretical principles underlying classroom dialogue and how and in which situations they might be applied. Teachers can align their practices and approaches with aspects of theory that they themselves deem relevant (Bransford & Schwartz, 1999). Conversely, teachers developed their understanding of how curriculum or practice might be adapted to pertinent aspects of the theory and to new resources available (Bransford & Schwartz, 1999; Randi & Corno, 2007). This involves practitioners themselves identifying teaching problems that might be solved through applying theoretical principles. It furthers evolution of the kind of generalisable explanatory theory that teachers need to guide their own practices (Nuthall, 2004). The general approach contrasts markedly with provision of a programme or scheme of work for teaching in a particular area using a specified (explicit) or underlying (implicit) approach. In the model proposed here, the theory is made salient through sharing the outcomes of research carried out by a small number of teachers, but it intentionally remains open to questioning, reinterpretation and reformulation by others.

The Role of Multimedia in Supporting Flexible Use of Professional Learning Resources

T-MEDIA culminated in a series of interactive hypermedia environments that combine:

- video clips of classroom lessons with descriptions of the pupil contexts and learning objectives, and sample teaching materials;
- analytical perspectives of teachers, university researchers and subject specialists on the teaching and learning portrayed, including emerging themes hyperlinked with concrete examples and speculation about potentially useful modifications;
- teacher diaries, pupil work, teacher and pupil interview data.

While some multimedia environments depict particular views of innovative teaching, the nonlinearity of more flexible, rich and open-ended systems allows teachers to visit and revisit various sources of information quickly and easily, to consider multiple perspectives on an event simultaneously and to define and explore problems of their own choosing (Putnam & Borko, 2000). An example is Lampert and Loewenberg Ball's (1998) Student Learning Environment (SLE), a hypermedia learning environment that similarly combines videotapes of classroom mathematics lessons, instructional materials, teacher journals, pupil notebooks and work, and teacher and pupil interviews, as well as tools for browsing, annotating, and constructing arguments. "Like traditional cases, these multimedia and hypermedia materials provide a shared context for the exploration of pedagogical problems. They can come much closer, however, to mirroring the complexity of the problem space in which teachers work" (Putnam & Borko, 2000, p. 8).

The T-MEDIA cross-subjects multimedia resource illustrates most clearly how some pedagogical strategies are applicable in very different classroom and subject contexts, but not universally, and how their manifestation can look very different. It is up to teachers to decide what to take away from such resources; they are not prescriptive, but merely provocative. In particular, the analytic commentary and video clip introductions built into our resources raise awareness of key pedagogical issues. They make explicit the detailed rationale underlying the approaches taken in order that other teachers can engage with them and can consider them in light of their own existing approaches. (Accessing these commentaries is of course optional and some experienced teachers will prefer to access lesson materials and videos only, while novices may benefit from exposure to more rationale.) Moreover the prompts for teacher reflection and construction and discussion of responses with colleagues, a critically important feature of our hypermedia environments, deliberately encourage this linking with everyday practice.

In their “educative curriculum materials” that unusually integrate teacher and pupil learning goals, Davis and Krajcik (2005) employ some similar design principles but instead of depicting actual practice they provide teachers with a fictional narrative integrated into a lesson plan. For instance these illustrate how they might engage pupils with questions about astronomy during a scientific inquiry lesson, or support them in basing explanations on evidence, and/or develop subject matter knowledge. The materials (described on p. 3 as “cognitive tools that are situated in teachers’ practice” to help them add new ideas to their repertoires) help teachers to mindfully abstract general underlying pedagogical principles and adapt them to their own teaching situations, developing questions to teach other curriculum topics that they judge would benefit from an inquiry approach. Teachers thereby become adept at theory-based curriculum design and adaptation and are readily able to identify situations in which theories might apply. The authors contend that using such materials may promote the development of a disposition toward reflection as well as teacher learning, in different individuals, and our follow-up studies reported in Section Two confirm the same findings.

Users of our T-MEDIA resources are exposed to and interact with the expertise of another teacher as did those studied by Davis and Krajcik (2005), who thereby gained “an appreciation for the role of questioning in scientific inquiry” (p. 7). We proposed that novice teachers in particular could become inducted into the wealth of ways in which IWB technology can be used in classrooms. However these uses are not all necessarily recommended nor are there cut-and-dried recommendations to be made in this area even if they were desired. There is a built-in reluctance in our materials to direct users to adopt particular practices and our discussion prompts deliberately encourage the user’s challenge of the pedagogical strategies they see portrayed. The underlying values of the commentators will inevitably sometimes be evident; however, since there are four or five – academics and teachers – in each case, hopefully particular views portrayed are not unduly dominant.

It must be acknowledged at this point that objectivity is an unattainable goal and implicit endorsement of certain approaches will creep into any form of professional development (including purely teacher-led forms), if only through the choice of issues that developers or participants choose to highlight amongst the multiple possible foci in any lesson. For instance, I am the first to admit that a ‘dialogic’ communication approach is of particular personal interest in considering how teaching and learning might be enhanced (based on my awareness of the literature in this area rather than my imagination). What this means, though, how it might look, in which situations it is appropriate or inappropriate, and how it might be fostered in different school and classroom and subject contexts, are questions open to interpretation, conjecture and ideally, systematic inquiry.

While I would argue that the Davis and Krajcik approach tacitly subscribes to the modeling of ‘best practice’ and the lesson plans are fairly tightly scripted, the built-in endeavour to prepare teachers for future learning (Bransford & Schwartz, 1999) clearly goes beyond ‘copy me’. A ‘one-size-fits-all’ assumption is sensibly dismissed and the tension between scaffolding and prescription is addressed through offering teachers guidance designed to help them adapt lesson plans. This may not be sufficiently flexible for experienced practitioners, however, who typically do not want detailed lesson plans, but only insights into new approaches they can incorporate into already successful plans of their own in order to enhance the quality of their teaching.

Randi and Corno (2007) concluded that “one goal of research for practice should be preparing teachers by promoting their ability to identify and call up, as needed, general principles and theory-based practices that resolve their immediate problems” (p. 341). This increases opportunities for teachers to see instances where research is relevant to existing and future teaching situations (*ibid.*). It offers a more realistic approach to bridging the gap than for all teachers to engage in the primary research, optimal though that may be. Accordingly, the Dialogue and IWBs project drew on T-MEDIA, similarly depicting authentic practice. It also portrayed some elements of the Davis and Krajcik (2005) approach – illustrating a pedagogic (dialogic) approach deemed desirable, and making its underlying rationale explicit, yet encouraging teachers to make their own connections. However we went a step further in distilling the principles into a tool for professional development.

Both the emphasis on collaborative work with peers and the use of video technology to provide vivid exemplars of real practice and illustrate overarching theoretical themes serve to set this work aside from that of developers of other professional development materials such as Davis and Krajcik. The latter authors do however make the bracketed addendum: “Participating in face-to-face or online discussions with other teachers who are engaged in inquiry-oriented science teaching would more directly contribute to the teacher’s enculturation. Such discussions could build on ideas from the narrative” (p. 7). Likewise they suggest that online educative curriculum materials could incorporate audio and visual records of teachers’ enactment of lessons. “Teachers might even be able to request different versions of

lesson plans that incorporate more or less prescription, guidance, or choice” (p. 10). This is encouraging, but they go on to worry that teachers print out lesson plans from the Web rather than reading them online, missing some hyperlinked educative aspects; this re-invokes my concern with professional development approaches that assume teachers need to receive a full complement of prescribed materials and cannot be trusted to make their own professional choices. Moreover the challenge arises of helping teachers to engage in productive, substantive conversations, structured around a framework for considering an innovation (Marx, et al., 1998). Online materials need to elaborate the principles underlying the new approach and facilitators are needed to scaffold new understandings of these.

Work with secondary school science teachers by Marx *et al.* (1998) confirms that using multimedia environments as a CPD tool can be a useful form of support for approaches like our own, i.e. those that are based on cycles of collaboration, enactment, reflection and adaptation that extend over time. “Ultimately the aim is for teachers to use a range of practices that are congruent with the principles of innovation and which are tailored to their own situational constraints and personal preferences” (*ibid.*, p. 35). This is achieved through an interactive multimedia compendium of rich cases documenting teachers’ experiences in enacting a project-based approach to science education (CaPPs, or Casebook of Project Practices). Like the T-MEDIA resources, the application includes unstaged footage, background information about the cases, teacher commentary and discussion/reflection prompts. However it not only illustrates how teachers meet the challenges the approach poses, but is entirely organised around these, including step-by-step guidance through the resource and commentary that “informs the user what they will learn by exploring the video clip” (*ibid.*, p. 38), a rather more prescriptive approach than ours.

Accessing T-MEDIA discussion prompts is optional and in our experience in-service teachers often prefer to generate their own. Indeed they typically take off without hesitation on whole new tangents in exploring some aspect of the practice portrayed. They thereby do the job for themselves of tailoring the stimulus material itself to their own situational constraints and personal preferences. Our resources were deliberately more open-ended in design in order to allow teachers to explore the myriad of pedagogical (and managerial / technical) issues surrounding classroom technology use and interpersonal interaction in that context. This flexibility also allows for the chain reaction proposed by Leat (2009) whereby one innovation causes practice to unfold and raises questions which invite the adoption of further innovations. Teachers can use the overarching themes the resource portrays as an (optional) organising tool though, along with type of technology use. Our resources fall mid-spectrum between CaPPs and Lampert and Ball’s (1998) SLE in terms of prescription to users. The latter presents teachers with a large body of information from which they develop and explore their own questions. Studies of using SLE with student teachers indicated that their investigations sometimes pushed their thinking forward, but sometimes collection and interpretation of records of practice simply reinforced the students’ initial assumptions.

Developers of both systems (along with Putnam & Borko, 2000) collectively raise some unanswered research questions about the instructional purposes that these complex systems address: what is being learned – and how – about innovative classroom practice from interacting with them and with other users?; what organisational structures and scaffolds best support this learning? Both systems offer written commentary by teachers and workspaces for recording comments and reactions, and Marx et al. (1998) have experimented with functional, navigational and metacognitive scaffolds and prompts. Moreover, are different types of system more appropriate for student, novice and experienced teachers? Which types of teachers should be depicted in the cases? Do any of the resources have a limited shelf life beyond which teachers might move on to creating their own cases and discussing these with colleagues “so that the challenges and their possible solutions become real examples of professional problem solving and exchange” (*ibid.*, p. 41)? This is akin to what our dialogue project aimed to achieve, through combining initial video and other stimuli with subsequent trials in teachers’ own classrooms, although the specific practices trialled were analysed and discussed in more depth with university researchers than other practitioners. The approach proved successful for our very limited sample but trialling other variants of the approach in future might be informative.

That work has ultimately led to development of an interactive professional development resource that is aimed at focusing more specifically on supporting dialogic interaction in the context of IWB use. Like CaPPs it is a little more structured than the T-MEDIA hypermedia resources themselves – although the ‘toolkit’ commissioned by NCETM offers a guided pathway through one of the T-MEDIA resources (Bowker, et al., forthcoming). Of course there will always be interesting issues arising from rich video footage about subsidiary concerns, such as the choice of whether to use technology for a particular activity and in what ways; it seems important to retain the flexibility to pursue these, especially when many will be unpredictable or situation-specific. Our resource for supporting dialogue is deliberately semi-structured, offering a guided pathway through and posing questions for discussion, plus the flexibility to dip in and out of both the suggested activities and the rich resource bank of varied examples. The observation of Marx *et al.* (1998) that teachers focus on single clips and do not tend to synthesise across clips is consistent with our own. Their solution of posing tasks that direct teachers to collect information from various clips is employed to a degree in our resource too, but only to introduce some ideas and to illustrate them with a handful of clips. A bank of further clips and resources is freely browsable and tools like the dialogue table are supplied in electronic form for printing or adapting (see Appendix 10 for a detailed outline of the resource).

This discussion raises the question of what are the implications for professional development that is owned by teachers, and that shifts away from unidirectional ‘dissemination’ of research findings? In our work, what was made public was not only a set of detailed lesson materials and video footage associated with a narrow

range of illustrative subject practices, but the chief contribution was a set of pedagogical principles that might be adapted and used by teachers in other, very different contexts (with and without technology) where *they* deem them relevant and compatible with personal goals. Likewise some might be considered and rejected altogether by other individuals, since their rationale and utility are intended to be scrutinised. Equally teachers may be inspired to better the practice they see depicted, or to try something entirely new; the desired outcomes are not a particular approach to using technology but a reflective outlook and a principled pedagogy.

Finally, our approach to teacher learning shares some similarities with ‘Lesson study,’ an increasingly popular Japanese programme of in-service teacher-led professional development (now adopted and adapted in some other countries too). The approach is similarly situated firmly within authentic teaching contexts and has collaborative and video elements (Fernandez & Yoshida 2004). A small group of practitioner colleagues identifies an area for change, meets regularly (typically once a week for several hours) to collaboratively develop, implement, analyse, evaluate, refine and perfect lessons in conjunction with colleagues. They observe a live lesson (although transcripts and video are sometimes employed too) and collect data on teaching and learning. They then proceed to disseminate the outcomes to others within – and later outside of – the school, typically through presentation of the ‘live’ or videoed lesson, but helpfully including explicit reporting of rationale, activities, teacher perspectives, theories linked with concrete examples (Hiebert, et al., 2002). Lesson study is implemented internationally in a variety of different ways, some more inclusive than others in terms of whose practice is observed. Often at the heart of this approach, however, is an assumption once again that there exists a ‘best practice’ that is transferable to other situations and other teachers.

In contrast, the approach taken here assumes that teachers ultimately need to find their own way to deal with the challenges that they individually face in their own settings, as well as working towards shared goals with colleagues – both university researchers in their teams and practitioners in their subject departments or schools (these two sets of goals may vary or coincide). Consequently a teacher going through an iterative process of collaborative professional development increases expertise in his/her own teaching. Indeed novice teachers are equally welcome to participate; in this domain of technology use particularly, they often have a lot to offer more experienced colleagues. Furthermore during the process all teachers involved are, by turn, both observer and observed, underlining the ongoing discussions as occurring between equals with different viewpoints (whatever their formal status), rather than between a coach and an apprentice, or an expert and novice. A teacher who has gone through the process may subsequently become a facilitator of the *process*, however.

The lesson study and related models (e.g. Goldstein, et al., 1999) which move from workshops into working alongside teachers and modeling practices (albeit ‘preferred’ practices) in the classroom offer a useful potential direction, as they directly and immediately implement the cycle of development of theory and practice. Jaworski and Wood (1999, pp. 145–146) point out that at each stage the effects of

practices need reconciling with the theoretical perspectives on which they are based, and the theories are enhanced by what is learned from practice. This reflects the need for practitioners to critique their professional decisions through closely questioning what is effective and the evidence for effectiveness. Likewise:

Throughout the research process, from project conception to the interpretation of results and the presentation of conclusions, there is movement back and forth from data to theory in an iterative sequence of theory testing and theory building. Most important is the development of a disposition of healthy scepticism that encourages researchers to question their own assumptions, to make their theories explicit and to seek alternative ways of making sense of the data (James, et al., 2005, p. 116).

Finally, more thought is needed about how to make opportunities available to teachers without pressurizing them. The report on joint practice development by Sebba *et al.* (2012) asserts that developing peer lesson observation in particular starts from a willingness to learn by opening up your teaching space to another teacher. “Trying to persuade teachers to engage in it on the basis that it will be worthwhile is difficult, as they only know if it has been worthwhile and how it has been so, after experiencing it” (*ibid.*, p. 12).

Teachers Viewing Video of Their Own or Others' Practices

The above discussion indicates that passive viewing or encounter of others' practices, new approaches or theoretical concepts is unlikely to lead to lasting change. Practitioners need to process the new information, making sense of it for themselves and their own contexts. This raises the issue of whether teachers should be viewing and discussing their own versus others' practices, the merits of which have been discussed to an extent in earlier chapters (1 and 7). Our studies employed recordings and observations of (1) participants' own lessons, (2) other, unknown teachers in prior projects; (3) their known colleagues. We found each of the models employed to be effective in different ways. Secondary teachers working with subject colleagues and ourselves in T-MEDIA to review lessons filmed in one of the teacher's classrooms immediately capitalised on the critical friendship relationship already in existence, which seemed to yield constructive, non-threatening challenge from peers. Similar findings emerged from a university researcher working one-to-one with a practitioner colleague in analysing video from the teacher's classroom in each of the Dialogue and IWBs case studies; the discussion was frank but supportive and highly productive.

Teachers working across schools and phases and subject areas in that project were understandably reticent about critiquing the other teachers' practices – at least within the short timescale of that project when relationships had not been built up to the same degree as those with their own school colleagues. However, their critique of other (unknown) teachers' practices was more in depth, and the

input of such a varied group was very fruitful in terms of developing the CPD resources for wide appeal. The aim there was of course different to T-MEDIA where subject-specific resources were the goal. Finally, the subject colleagues in the NCETM-funded follow-up studies in two mathematics departments (reported in Chapter 9) benefited enormously from viewing unknown teachers' practices; this included developing new approaches. They also had a chance to review their own practices through discussing their colleagues' observations of their lessons; ideally, their lessons would be videoed and the videos used as a further stimulus for discussion, with the peer observer or within the departmental community of inquiry. Experience from lesson study – which integrates the viewpoints of multiple teachers – nevertheless indicates that colleagues are or become willing to observe and critique each other's practices when the focus of observation remains true to the original conception of the approach. The intended focus is on evidence of learners' thinking and learning processes (Kuno, 2012) and perhaps their responses to a particular approach being trialled, rather than on the individual teacher's actions, although the focus varies widely in practice (Lewis, et al., 2006). Recent work carried out in Taiwan by Liu (2013) indicates that teachers undertaking peer observation reported mental stress arising from comparing innovative teaching by other colleagues with their own teaching, although this seemed to cause teachers to think more innovatively. Our own experience over several years shows that initially at least, teachers will critique strangers' practices more freely than those of colleagues – in their presence.

The NRC review (National Research Council, 2001, p. 8) claims that video of others' practices offers “both the lens through which to view classrooms and a tool to develop a shared language with which observers can discuss what they see,” and this was borne out in our studies. Providing such illustrations of strangers' practices as an initial stimulus appeared to have the advantage that it can stimulate discussion without necessarily involving the emotional aspects that critique of either self or colleagues may engender – namely fear of criticism, inability to defend or articulate the rationale underlying practice, and tendency for less reflection (Borko, et al., 2008; Seidel, et al., 2011). However the NRC review highlights the dangers of over-generalisation, drawing unfounded inferences and of over-attributing causality since viewers are unfamiliar with the context. Subsequently trialling new ideas in teachers' own classrooms and discussing the outcomes with colleagues allows some inferences and generalisations to be tested out and a more informed approach to be developed, as reported earlier in the book.

In sum our experiences confirmed that the use of video recordings of both one's own and others' practices, within a supportive climate for dialogue and purposeful analysis, provides a very powerful stimulus that can lead to a profound rethinking of assumptions. Semi-structured analysis tasks led by an effective facilitator, and a supportive climate for discussion, help to mitigate the potential risks of looking at one's own practices with colleagues.

Using Research Videos for Professional Development in Other Contexts

The T-MEDIA colleague in each case study was heavily involved in selecting video clips depicting critical incidents and a range of practices for illustration to other teachers in the future. Teacher authoring of videos of others' practices has proved a powerful means of PD in other studies. Petrosino and Koehler (2007) described how pre-service teachers in a literacy methods class developed 'best practice' video cases – including accompanying text linking with theory – from a library of footage. Using video stories to situate learning in an authentic context evidently offers opportunities to pose and solve complex, realistic problems that bridge between the theory and practical knowledge of expert teachers. This embeds opportunities to talk about pedagogy. To develop the approach teachers could film each other's evolving (dialogic or other) practices and select clips for shared viewing and analysis. Tochon (2007) points out that cases for oneself or one's peers are idiosyncratic, whereas cases for others are built with generalisable knowledge; they infer generalities from particular experiences. An important design consideration in our work was whether the professional learning resources are likely to promote effective local adaptation and grassroots spread of innovation (Lewis, et al., 2006, p. 8). This can happen if local innovators gather valid and convincing data on students and use it to reshape instruction (the "local proof route": *ibid.*). In the kind of professional development proposed here, such spread will require a match between participants' and departmental or school agendas. The process, through supporting a burgeoning community of inquiry, forms a "joint action in which individual needs, challenges and interests [are] addressed in ways that support more collective aims" (B. Davis, et al., 2009, 155).

In contrast with the repeated attempts over time by the UK government to identify and disseminate "best practice" or "what works," including through use of video exemplars, it is increasingly clear that *multiple examples of practice* are needed. A number of examples might be designed to embody a particular theory and may ultimately help teachers to abstract and understand the underlying pedagogical principles (Randi & Corno, 2007, p. 336–7), as in the overarching themes in the T-MEDIA resources and the principles of dialogic teaching. Teachers may appropriate any or all of the dialogic principles we formulated – in line with their personal goals – and use them to analyse or shape practice in new settings. However, and crucially, we do not assert that they are relevant in all other settings. Likewise, video recording served to capture the important elements of the various pedagogical approaches for the benefit of practitioners in other settings; it now enables the approaches to be studied and adapted more easily at new sites. However, the rest of the cognitive work has to be left to practitioners as they make links for themselves with and across their own settings and in other curriculum areas.

The value of multiple examples and pathways within effective teaching and learning is now recognised by the US National Board for Professional Teaching Standards in publicising their new 'video observation' programme.¹ The latter contains a number

of cases, each including a 15- to 20-minute video of a certified teacher in action and written support materials. The National Board's licensed collections can be tailored to meet specific needs through users filtering their searches via categories such as rural or urban, different socioeconomic populations, and elementary, middle and high school levels, and even within specific content areas. However the emphasis seems to be primarily on evaluation by principals, administrators or peers rather than self-evaluation, collaborative scrutiny and improvement of practice. The website text argues that "in order to help teachers become accomplished, a principal or other observer must have a clear understanding of what 'accomplished' looks like." The programme is being used that way in the two states featured, although the video introduction takes a broader stance. Thorpe (2013) reports that the resource is now being licensed for use in teacher preparation programmes but that university faculties have a lot to learn in order to use it effectively. Moreover, publicity of the resource by the Board may need to shift its emphasis if it is to be widely used as the valuable professional learning resource that it may potentially be.

Teachers' Pursuit of Their Own Interests and Goals

A related design consideration in ensuring that a professional learning resource has "legs" is maximum flexibility in the pathways that practitioners can take. This means explicitly encouraging them towards constructing their own meanings, taking ownership of the material, generating their own inquiry questions, interpreting and adapting new ideas to their own local contexts, and building on what they already know, believe and do. It means that the focus and course of action is initiated and driven by teachers' needs and beliefs, and oriented towards key issues and questions related to their teaching, as in the original collaborative research reported here. In our studies, spontaneously resulting whole-school initiatives confirmed that the approaches were deemed relevant and practical.

In professional development programmes for digital technology integration in particular, too often the specific needs of teachers are poorly targeted (B. Davis, et al., 2009a). If professional development cannot be structured in an ongoing, localised, relevant and on-demand way, experience suggests that much of it will be wasted. Professional development for embedding the use of IWBs should start from where the teachers currently are and encourage them to question their existing practices and beliefs. In an already pedagogically interactive context, teachers need to develop confidence and learn how to exploit the potential of a powerful tool to support that pedagogy; the professional development activities will be very different from what is useful in a transmission-based context where the need is to develop both a new pedagogical approach and the technology skills required. Research shows that teachers otherwise respond to technology integration initiatives by simply adapting new ideas and technology resources to their existing practices and beliefs (Kennewell & Beauchamp, 2007). Note that every school or subject department will be at a different point in its evolution and will be situated

in a different context, requiring its own tailored and responsive professional development programme.

In sum, what is shared as a result of this work is stimuli deliberately designed to provoke contention, adaptation, discussion, self-reflection, action, re-evaluation and change, based on the following premises:

- most teachers want to improve their practice so as to increase learner engagement, attainment and life chances, and to this end, if supported they are willing to engage both in and with research (Elliott, 2004) and to keep experimenting and learning from feedback (Leat, 2009);
- the development process needs to meet teachers at the point where they are and offer them multiple exemplars, options and routes; so they can choose their own aspects of practice to research.
- teachers need to take ownership of the process and resources themselves.

External Facilitation and Teacher Leadership

Closely related to the issue of teacher ownership is that of who facilitates the co-inquiry process. Intermediate theory building ‘from scratch’ probably benefits from input from external, academic researchers, unless the participating teachers are themselves familiar enough with the scholarly theory, for example where they are engaged in Masters level study. Our experienced and knowledgeable teachers perceived many benefits in working with external academics. The co-inquiry partnership helped to modify the traditional separation between academia and the profession (as in some of the studies reviewed by Avalos, 2011). At the same time our roles and responsibilities remained distinct and complementary, as discussed in detail in Chapter 7. In our approach, as we have seen, new practices are not prescribed or imposed on a passive audience by an external expert who is ‘parachuted in’, as in the traditional meaning of “training”, but they are negotiated and developed with the active engagement of teachers. The latter bring their own experiences, outlooks, expertise and contexts to bear in that process of professional learning. This should remain the case even where the existing pedagogical repertoire is very limited, although here an external facilitator may be particularly pertinent. Moss and colleagues draw the following conclusion from their extensive study of the integration of IWB technology in UK secondary schools:

Perhaps it is only through some kind of external intervention though, at least initially, that teachers can be encouraged to fully explore more radical departures from their current pedagogical approach and thereby potentially get the most out of the full range of features that a new technology offers (Moss et al., 2007, p. 140).

Research on school networks engaged in developing teacher research identifies a supporting condition to be external agent support, often from university colleagues,

in providing research knowledge support, and collaboration over a substantial period of time in a safe and supportive group environment, to provide teachers with intellectual challenges and stimulation to help establish norms that build community (Ayubayeva, 2012; C. McLaughlin, et al., 2006; C McLaughlin, Black-Hawkins, McIntyre, & Townsend, 2008). Jaworski likewise argues that teacher research is hard to sustain without support or stimulus from externally based colleagues, such as university researchers, or from experienced researchers within a school environment. “Critical alignment is achieved through communities of inquiry involving students, teachers and educators, in which all participants are learners and in which learning can be regarded through learning theory lenses” (Jaworski, 2006, pp. 191–192). There is a reflexive relationship between using inquiry approaches and development of practice (where development implies learning and deeper knowing).

In many circumstances where teachers are working with existing intermediate theory, external facilitation may be less important, and of course, less practical. It is important to note that all of the professional learning resources derived from our projects are designed for teacher use without external facilitation where desired. A more research-aware colleague – or one or more teachers who have previously participated in a schools-university partnership – might ideally be the designated facilitator(s) though. This is the case in the whole-school initiatives arising from the studies reported in this book, and in our ongoing trials of the OER4Schools resource for primary teachers in Zambia; teachers who have worked intensively with us are now leading their colleagues. Such independence offers three advantages:

- it ensures that teachers and their schools retain ownership of the process and the agenda for change within their own contexts, and knowledge acquired is rooted in and relatable to their professional realities (Frost, 2012);
- it supports remotely located departments and minimises their costs;
- it avoids potential teacher dependence on outside facilitators, as is sometimes seen in sustained CPD programmes (Butler, et al., 2004).

Note that it is not a traditional ‘cascade’ model, because new participants are equally active in their engagement with the process and resources, and the professional learning will take a new direction each time, yielding new outcomes. It must be responsive to the needs and goals of the current participants and wider (school or national) agendas.

Joshevaska (2012, p. 63) argues that in many countries where professional development has been implemented in a fragmented fashion and led by external ‘trainers,’ it poses serious limitations because it focuses mostly on teachers’ individual professional needs rather than directly promoting the co-construction of knowledge, collective efficacy (Bandura, 1997) and ultimately, school improvement (Frost, 2012). It lacks an emphasis on the need for shared values and vision, collective responsibility for learning, reflective professional inquiry, and especially, collaboration, as key to the concept of professional learning communities (Bolam, et al., 2005).

Frost and Joshevska propose teacher leadership as a school-based CPD model for re-defining teacher professionalism (see the 2012 special issue of *Professional Development in Education*: 38 (2) for articles in this area). Teacher leadership recognises the potential of each teacher to be a leader in their school as part of their job as a teacher. It suggests that there is no need for a specially created hierarchical position in the school in order to promote change. Teacher leadership shares an emphasis on reflective practice and exchanging knowledge with many of the PLC features (the notion of a professional learning community was introduced in the Section Two Introduction). It also extends professional identity by promoting teachers' personal agency and the creation of their own vision of improved practice in order to secure educational reform (Frost, 2012). To be successful, it needs to be seen as a process beneficial to the whole school rather than something that only serves the purpose of personal promotion, and as co-creation of knowledge by teachers who have different experiences with regard to the same context and thus are equally capable of leading innovation – based on experience rather than position (Joshevska, 2012, p. 56). It is driven by teachers' motivation and commitment to enhance students' learning, that is, moral purpose.

A word of caution is advisable, however. Little (2003) warns that teacher-led collaborative groups could be limited by their own "horizons of observation," namely "the extent to which elements of a work environment are available as a learning context" (p. 917). Teachers' visions of teaching and learning are structured by their very positions as teachers. This can create paradigms of thinking that privilege certain voices and epistemologies based on preconceived notions of right, wrong, good, or bad in schooling. In the end, this horizon of observation can serve to limit the solutions teachers develop to improve their own practices or student learning. This can also be true for university-based educators; they likewise need to broaden the scope of their inquiry to problematise any and all aspects of the learning environment as appropriate. I have argued in this book that interrogating scholarly and practical theory is one way of overcoming the limitations of teacher inquiry identified by Little and by others (especially Hammersley, 1993).

Some support comes from the work of Hunzicker (2012), who found that teacher leadership is gradually developed through exposure to (a) research-based practices, such as action research for Masters study and school/district initiatives; (b) increased teacher self-efficacy through problem solving and employing student-centred instructional approaches; and (c) serving beyond the classroom – supporting and sharing with colleagues, engaging in inquiry and collaborative decision making, grappling with complex issues, giving/receiving feedback. All of these were features of the collaborative work reported in this book and of the kind of professional development process proposed in this chapter – which both benefits from and serves to develop teacher leadership.

Specifically, the dangers of a parochial or biased outlook may arguably have already been ameliorated through involvement of both external academic researchers and teachers in the collaborative research that produced intermediate theory and two sets

of semi-structured professional learning resources, as alluded to earlier. Our research indicates that they are also mitigated through expert facilitation and questioning. Our study with the mathematical resource (reported in Chapter 9) showed that the power of peer discussions focused on critiquing and improving existing practices and supporting student learning appeared to derive from a combination of the stimulus and the phrasing of questions that partners in the inquiry posed to one another, particularly in the feedback on lessons. Teacher learning through inquiry depends on asking fundamental questions about goals of teaching, the sense learners are making, and underlying assumptions of the participants (Cochran-Smith & Lytle, 1999). In initial meetings, assumptions underpinning the interpretative framework of the multimedia resource may be challenged too. Most important, however, is guiding the focus of questioning towards teachers' own situations and concerns and on what they want to work on with colleagues' support (Duffin, et al., 1991). This suggests that there needs to be at least one member who is actively using such questions as lenses for making sense of practice, particularly if this is not the norm. In most schools teachers may be able to develop such questions, especially if the community includes an experienced practitioner-researcher and if there is a culture of teacher leadership and inquiry. However, in departments with an ingrained focus on superficial outcomes or a lack of any inquiry tradition, this may prove harder. There, a skilled outside facilitator may be needed in conjunction with the professional development resource to support increased analytical thinking about teaching. This suggests that a minimum of three teachers is probably needed to form a community of inquiry to achieve the range of views and support needed.

Finally, and related to the findings of Hunzicker (2012) mentioned above, the *International Teacher Leadership* network coordinated by my colleagues at Cambridge² builds on their extensive work with UK teachers over many years in this area. It involves participants in many countries in joint structured discussion and reflection on their experience. This again extends the horizon of observation well beyond the local context. The network has identified key support structures and strategies: well-designed programmes and tools to support reflection, learning and sharing; certification; professional cultures which encourage innovation, collaboration and distributed leadership; opportunities for networking beyond teachers' immediate contexts. Less ambitiously perhaps, cross-organisational partnerships within one country offer another potentially fruitful model, although prior trusting relationships are very significant in the success of such learning networks (Fielding, 2005). Within schools, natural groupings tend to emerge, including primary teachers of the same stage or year group or secondary teachers of the same or related subjects (although cross-subject interaction can be very fruitful of course). In cross-school networks decisions would need to be made about constitution of the groups. The study of Teaching School alliances by Sebba *et al.* (2012, p. 13) found that combining teaching partners from the same disciplines or year groups enabled small schools to share 'relevant' experiences and challenges, but working with partners from different disciplines meant that colleagues shared

transferable techniques. We found that researching classroom dialogue is an area that benefits from input from diverse perspectives.

Communities of Inquiry: Release Time and Support from School Leaders

Collaborative opportunities are clearly more effective when research grants, school budgets or other funding enables dedicated teacher release from teaching. This provides the time for thought and collaboration with ‘external’ colleagues that is otherwise difficult for teachers to access in their normal working lives. It was particularly important in our study to provide encouragement and funded time for the lesson planning (Jaworski, 2007) and the diary writing that helped individuals to formulate their perspectives, responses, questions and plans for themselves, and thus to make them explicit to all of us. Remarkably deep reflection went on during the internal dialogue that underpinned these externalised thoughts (Säljö, 1995), particularly in post-workshop diaries. Complementing those personal records, notes circulated from team discussions and interim versions of the analytic schemes served to document our evolving shared interpretations of concepts such as dialogue, offering an important resource for our analyses and for teachers’ own projects. The quotes from teachers in the follow-up study reported in Chapter 8 confirm that while having to explain their actions was challenging, the participants appreciated enormously the chance for in-depth analysis and reflection that the collaborative video review process had afforded. Some reported a “profound impact” and “the most intensive personal reflection that I’ve been through for a long time”. They did acknowledge though that the process was complex, time consuming and difficult to fit into a normal teacher’s schedule.

All teachers would, ideally, have time to participate in the kinds of critical reflection, classroom inquiry and in-depth analysis of practice described here (coupled with accreditation). In the real world, few presently have that luxury, hence posing a key ethical concern (Hennessy & Deaney, 2009a). Even where funding is secured, appropriate substitute teachers are not always available. Of course, primary research is only one possible route to development for teachers. Important and more easily scalable benefits may also be derived from more modest forms of activity. These include self-reflection and personal engagement with representations of intermediate theory and video recordings of others’ practice and in a teacher’s own classroom. Camcorders are a useful professional development tool, and are now inexpensive. Such reflection may inspire practitioners with any level of expertise to develop and test new pedagogical strategies. Our work indicates, however, that peer support is both a catalyst for success and a critical motivator for participation in such development work in teachers’ own time. While some practitioners will be self-sufficient, informal collegial interaction in between lessons with some shared free time to review material together is probably a minimum prerequisite for most, along with open-mindedness and access to the kind of stimulus material employed in our studies.

In our research, the reward on investment of time was high in the sense that there were substantive outcomes from a relatively short intervention (short compared to the learning communities developed over a couple of years by Goodchild, 2007; Jaworski, 2007, for instance), particularly in the Dialogue and IWBs project. It seemed that sufficient momentum was built up to enable the development of dialogue to continue independently within the schools. However, our teachers were carefully selected, and others may need more time to achieve as much. The three teachers were already skilled at dialogic practice and they held subject or school leadership roles; thus they were well placed to lead further activity and to argue the case for a new approach. Less experienced teachers may find it beneficial to engage other, ideally more senior, colleagues in this endeavour. But if motivated by addressing themes of mutual interest, as our teachers were, then I believe that they can benefit equally.

The NCETM-funded follow-up work reported in Chapter 9 encourages us to believe that careful representation of our current versions of substantive outcomes might spark further cycles of inquiry involving much larger numbers of teachers working with school colleagues rather than with outsiders, and with more limited professional development time. That study also confirmed that lower levels of prior experience with teaching, with professional development programmes and with the particular technologies and approaches being explored (as compared with the original teachers) were not a significant obstacle; the teachers from varied backgrounds were willing to experiment and learn from feedback, with support (Leat, 2009). Avalos (2011) likewise observed that change within PLCs was not related to years of teaching experience but to the extent to which teachers had engaged in collaborative and reflective inquiry. The professional development model we evolved in that study led to significant reported change after only 3 weeks, albeit with 7 hours per teacher of funded time for discussion and peer observation. The work on ‘educative curriculum materials’ and ‘lesson study’ described above offers variants on this model, and there are undoubtedly more to be explored. All of these models could be construed as types of PLC, a pivotal feature of which is the critical interrogation of the underlying premises of teaching practice.

PLCs are often construed as being purely school-based, and they can be, where a group of practitioners is using intermediate theory as a springboard for their own collaborative inquiry. However they can also be district-based or national. Vanderlinde and van Braak (2010) highlight the notion of researcher–practitioner collaboration within the context of a PLC, reporting that teachers and school leaders see this as potentially valuable. James *et al.* (2005, p. 118) argue that the grounds for attributing plausibility to conclusions about learning outcomes which practitioners (and, of course, policy-makers) espouse may well differ from those adopted by researchers. Genuine, ongoing collaboration between ‘users’ and ‘researchers’ is the proposed way of addressing this potential divergence. The joint theory building described in this book could be situated within a broader kind of PLC that includes one or more schools and participating academics, plus, in principle, policymakers.

There has not been space in this book to explore the nature of the various school cultures in great detail but a supportive ethos and leadership team are clearly highly influential. They determine whether the kinds of research and professional development activities outlined might even be able to take place, whether and how they will be supported by leadership teams, including in terms of timetabling and space as well as support for innovation and risk taking, and how their outcomes may be sustained and developed further over time. Specifically,

principals will find creative ways to maximize the time and productivity of their most precious resource: their teachers. They will create spaces in the workday for teachers to collaborate, to view each other's classrooms, to solve problems as a team, and to build their expertise. Sometimes teachers will be encouraged to reach outside of the school's walls to build community partnerships and seek additional professional learning to help students succeed. Principals will recognize effective teaching and know how to facilitate educator professional development and career paths. (M. McLaughlin, 2013)

School leaders are strongly urged to consider the longer-term value that intensive bursts of collaborative activity can evidently yield in terms of both pedagogical growth and a more reflective outlook by participants (as outlined in Chapter 9). Even where short-term intensive activity 'kickstarts' the process, support for ongoing professional development is ideally part of a sustained, long-term process with timetabled opportunities for dialogue, planning, team teaching (Cordingley, et al., 2004) and inquiry (Alton-Lee, 2011). The seminal "Learning How to Learn in Classrooms, Schools and Networks" project across 40 UK (infant, primary and secondary) schools showed that a key factor in teachers fundamentally changing their practice and the classroom climate in order to promote pupils' learning autonomy was the teachers' own engagement in collaborative classroom-focused inquiry (James & McCormick, 2009). Teachers' professional learning was significantly correlated with their capacity to promote learning autonomy in their pupils, as long as it was supported by school management and leadership. Thus, a successful whole-school approach additionally depends on giving teachers "recognised responsibilities, authority, time to collaborate and [active] support from school administrators to assume leadership roles" (Teacher Leadership Exploratory Consortium 2011, p. 12) within their PLC. They may need assistance targeted on developing collaboration and leadership skills (C McLaughlin, et al., 2008). Participation of *all* teachers in a variety of leadership experiences (Hunzicker, 2012, p. 286) is needed. This requires institutional policies committed to prioritising and supporting the complex processes of collaboration and collegiality (C McLaughlin, et al., 2008).

Although it can be a huge challenge, experience from Australia indicates that shifting the focus towards a whole-school approach to ongoing professional development can make a major difference to progress in integrating IWB technology (Betcher & Lee, 2009, p. 137). Certainly research outcomes need to make connections with school agendas so that school leaders with power may sanction the process

(Leat, 2009, p. 19). School leaders play an often unrecognised role in visioning and leading innovation; along with teaching assistants they are often shortsightedly left out of IWB training initiatives (Moss, et al., 2007). Yet, rigorous syntheses of research evidence on professional development across the world clearly show that by far the largest effect of school leadership on student learning outcomes is when leaders promote and themselves participate in teacher learning (Alton-Lee, 2011). Finally, school leaders are of course important in managing contextual factors such as technical support, equipment provision and maintenance that support or hinder new innovations with digital technology and hence related professional development activities.

BEYOND THE SCHOOL LEVEL: THE LANDSCAPE OF PROFESSIONAL DEVELOPMENT

To truly affect long-term, systemic change the professional development approach must be designed to address the needs of the individual, within the context of their educational setting and the broader [national education] reform agenda. (J. G. Wells, 2007, p. 101)

The review by Wells (2007) of publications over the preceding decade on effective professional development emphasises that the latter agenda brings to light and addresses the significant barriers to implementing the knowledge gained. This means facing the cultural barriers of both schooling and research universities (Hiebert, et al., 2002) and discouraging the search for (unrealistic) ‘quick fixes’ based on an (unconvincing) generic notion of ‘what works.’ That notion is held in particular by government stakeholders with little patience for the kind of long-term investment of energy and resources that partnership research demands. Obstacles to teachers’ professional learning in the UK context identified by James and McCormick (2009) unsurprisingly included “pressures of curriculum coverage”, “pressures of national testing” and “pressures of a tick-box culture”. The landscape of professional development provision consequently appears to be highly uneven, particularly in terms of student learning outcomes.

There are many individually effective professional development programs and activities operating at school and system levels, but the overall pattern of provision is brief, fragmentary and rarely sequential. The capacity of the profession to engage most of its members in effective modes of professional learning over the long term is weak. (Ingvarson, 2013, p. 4).

Despite this negative picture, teachers’ professional development remains “one of the highest impact policy levers in education, with potentially transformational effects on both social and academic outcomes from the education system” (Timperley & Alton-Lee, 2008, p. 361). The chapters in Section Two offered some insights into the ways in which research can be “used”, whilst recognising that it can only “impact” upon practice through being interpreted and mediated in a variety of

processes to accommodate different circumstances (Gardner, 2011, p. 559). In this way, it can reportedly improve understanding, illuminate complex processes and reduce uncertainty (*ibid.*). What has become clear in the recent debate around the buzzword “impact” – with demonstration of research impact on “end users” now required to secure research funding – is that impact does not simply follow from synthesis, dissemination and clear communication of results. We also need to create the organisational cultures and conditions needed to roll out and scale up innovations in naturalistic settings (James, 2013) – no mean feat. Policy has a key role to play here, in providing opportunities for teachers to exercise leadership in developing professional practice, to set the direction of their own professional learning, and to create and share professional knowledge (Bangs & Frost, 2012). Critical evaluation contributes to education reform as teachers become inquirers of their own practices and ultimately “beneficiaries of their own research” (C McLaughlin, 2011, p. 395).

NEW TOOLS AND MODES OF KNOWLEDGE SHARING

An approach to producing, transforming and validating knowledge through research is important, and can lead to a new base of professional knowledge for teaching, but it is not sufficient; what are we to do with a shared professional knowledge base? How can it – and the issues arising in the process – be communicated to others embarking on similar journeys? There are of course many options. Video clips are considered a powerful medium; they can ultimately be embedded in practical, shareable tools and other outputs that are welcomed by practitioners elsewhere as means of supporting wider practice. We know that novice teachers in particular welcome seeing examples of practice rather than reading or hearing about them, and experienced teachers benefit from illustrative exemplars of new approaches too, making video a useful communication tool as well as a research and professional development tool.

Few journals report rigorous studies that are peer reviewed, physically and linguistically accessible, read, and held in esteem by both practitioners and university researchers; there are a handful (*School Science Review* springs to mind) but a great need for more if we are to truly bridge the chasm. However, journals – even those now helpfully accepting illustrative video material – tend to transmit findings in one direction; how can further, public examination and dialogue take place? Do interactive web-based tools, such as wikis, discussion fora, commentary facilities, have a role to play now? Betcher and Lee (2009) argue that these new media – in the form of Personal Learning Networks – are reshaping the way that many educators view professional development. Instead of waiting for their school to “deliver” it, these networks are creating a global learning environment for many lead educators that operates all year round. They extend across schools, educational sectors, countries, and time zones, brokered through online exchanges.

One approach worthy of further exploration is the ‘Researcher in Residence’ type scheme in Ontario described by Sebba *et al.* (2012). Researchers are placed in a group of schools, specifically to support the staff in using research and in undertaking

small-scale studies. Sebba *et al.* report that the schools themselves are developing ways of sustaining support for research in the longer term.

Another example of developing infrastructure to support engagement with research is *Journal Watch* (Gough, Lajoie, Shlonsky, & Trocmé, 2009) in which researchers and practitioners search journals monthly and review them through videoconferences in order to share findings with the broader community. This mediates research for a wider audience and potentially trains both new researchers and practitioners in critical inquiry. (*ibid.*, p. 2)

A further promising new initiative led by a consortium of UK universities is MESH (*Mapping Educational Specialist knowhow*) whose aim is for teacher educators to create an up-to-date, 'knowledge-rich, evidence-based system' through collective professional action. It is based on 'concept to classroom': encapsulating syntheses of high quality research that sets out to make a direct link between concepts, theories and classroom practice. MESH guides³ are peer reviewed and summarise local findings that translate to comparable settings in other regions; they present complex research-based pedagogic knowledge in accessible flowchart/mindmap format, backed up with academic references. They purport to offer just-in-time learning to support teachers in extending and deepening their professional knowledge. It is suggested that teachers demonstrating achievement of standards could show how they drew on and contributed to the evidence base themselves. There are group discussion fora too; it will be interesting to see whether teachers will access and contribute to the project.

This brings us back to the notion that practitioners can be co-creators of knowledge, given the right opportunities. De Vries & Pieters (2007, p. 246) pose some suggestions for new ways of knowledge sharing at conferences that are designed to bridge the gap between research and practice. These include meetings of conference delegates before and after the actual face-to-face meeting, and a virtual conference venue, for example using Second Life to set up different conference rooms for discussions and sharing of multimedia presentations. Conference delegates could podcast a lively discussion they had after attending a keynote about how the talk relates to their own classroom and research experiences and end by raising a central question that might be of interest to others. They could attach a discussion as a reaction to the speaker's PowerPoint. Other conference visitors, including those not present, could enter discussions about the questions raised. These ideas are centred on a stronger focus on collaborative preparation before a conference starts and collective co-construction of new ideas and projects after it has ended.

Finally, there are a number of very successful inter-institutional networks already operating nationally and internationally, as mentioned earlier: for example, the international teacher leadership programme, other schools-university partnerships, and the joint practice development in Teaching School alliances. Many local education authorities also support clusters of schools working in partnership or federation. These vary of course in their engagement with scholarly or intermediate theory. The recent political movement in the UK towards primarily school-based

initial and continuing teacher education could be construed as devaluing the role of higher education institutions (HEIs) in supporting teachers in conducting and engaging with research and development of practice. (The movement is in contrast to the policy within the internationally high performing system of Finland which requires all new teachers to hold a Masters degree.) In his report on '*Leading a self-improving school system*,' Hargreaves (2012, p. 10) is disdainful of "studying the formal literature on education ('theory')," favouring increased "craft know-how rather than book learning." No role at all for theory (or HEIs) in informing action research is mentioned. In their report evaluating joint practice development in Teaching Schools, Sebba *et al.* (2012) bemoan the fact that HEI involvement was almost non-existent, except in one alliance where there was close involvement and participants drew on work on professional learning communities. The authors argue that both use of existing research and engagement in ongoing research activities might be productively supported by HEIs.

DIRECTIONS FOR FUTURE RESEARCH

A key question is the level of willingness of teachers, schools, local educational authorities and policymakers to support the kinds of inquiry and critical reflection upon practice that our small-scale interventions have shown to be powerful for participating individuals, departments and schools. School-university partnerships fill a need for developing theory-informed practice that is already growing in schools and that hopefully will be more commonly met in schools themselves in future, although the bringing together of research-based and craft knowledge will always be potentially valuable. Further research into its impact on teacher thinking and practice in a wider range of different contexts would now be welcome, along with further understanding of what and how teachers learn from exploring rich multimedia learning environments, how much built-in or face-to-face guidance is useful, and for whom and under what conditions is a 'toolkit' useful. Our small-scale, NCETM-funded study (Chapter 9) began to explore these issues but more, systematic research is needed. Such research may help us to design increasingly effective professional development models tailored to different teacher learning needs.

In this research we have not trodden the pathway of controlled studies, although that could be another way of building upon the work carried out here, if it was so desired. In particular, systematically testing the impacts of using our professional development resources is desirable. Both larger scale testing of the approaches and resources and more rich case studies would be useful. Lewis *et al.* (2006, p. 10) warn researchers not to dismiss what they can learn from local, practitioner-initiated innovations nor to subject them to premature (and likely fatal) summative study, rather than to add something of value through research that explicates and refines the innovation theory. The methods that are needed to learn from, and add something of value to locally initiated innovations are as yet poorly developed and not yet agreed upon.

More research is needed to gather pupil responses to evolving dialogic and other new strategies (P. Warwick, et al., 2011) and to chart specific advances in student learning. Increases in student understanding might be measured, or more ambitiously, longer term changes in students' approaches to learning charted, for example more critical or independent approaches. Vescio *et al.* (2008) call for in-depth case studies of changes for sample students in classrooms of teachers working in PLCs, plus quantitative documentation of changes in student achievement over time as teachers engage in work in PLCs. Equipping schools with methodological tools and resources is also important (Groundwater-Smith & Hunter, 2006) to help them overcome the difficulties they may otherwise face in measuring student learning and investigating how it came about (Nuthall, 2004). This might also include, for example, support for carrying out focus groups and engaging pupils themselves as researchers. Pupils can even work across schools in leading school improvement (Sebba, et al., 2012). Their capacity to reflect on their teacher's pedagogical approach and to articulate its impact on their own learning was evident in the input from the Learning Partners in Lloyd's school, as reported in Chapter 10. Some pupils may be able to engage with intermediate theory, and it was mentioned in Chapter 10 that Diane planned to share the dialogue table with her class. Most intriguing was the report from Sebba *et al.* that one student in their study commented: "That was an interesting example of Vygotsky's scaffolding, Miss" (p. 14)!

Another potentially fruitful means of bridging between theory and specific classroom practices is 'design-based research' in which the researcher acts as an educator and vice versa, designing an intervention, and iteratively investigating and modeling learning and teaching processes in a specific, naturalistic learning environment in which they are present (Cobb, et al., 2003; Design-Based Research Collective, 2003; Vanderlinde & van Braak, 2010). Design-based research tests conjectures and collects multiple sources of data over time; more than one variable at a time can be investigated.

In contrast to most research methodologies, the theoretical products of design experiments have the potential for rapid pay-off because they are filtered in advance for instrumental effect (Cobb, et al., 2003, p. 11). 'What works' is underpinned by a concern for 'how, when, and why' it works, and by a detailed specification of what, exactly, 'it' is (*ibid.*, p. 13).

When executed rigorously, the approach problematises the notion of context; designs can be partial to outsider and/or insider voice (Tabak, 2004). Tabak argues for moving away from the traditional notion of intervention as a "prepackaged" artifact that is imposed on the local participants toward a notion of intervention as "a process of iterative co-construction between 'outsiders' and 'insiders'" (p. 231). Jaworski (2004) likewise queries traditional conceptualisations of design-based research in which teachers seem at best responsive implementers of external researchers' or stakeholders' designs, rather than co-owners.

Lewis *et al.* (2006, p. 8) assert that “it seems reasonable to ask that an innovation be highly developed (i.e., unlikely to benefit substantially from further design-based research and refinement) and transportable before subjecting it to summative trials”. That way, “ideally, a strong theoretical base as well as extensive descriptive information are in place to provide the intellectual foundation for understanding causal relationships” (National Research Council, 2002, p. 108). As already mentioned, instructional improvement at sites of spread is a crucial outcome (Lewis, *et al.*, 2006, p. 8). Design-based research and the kind of collaborative research described in this book aim to develop forms of theory too, but how we can evaluate this development and teachers’ understanding of it remains an open question. Likewise we need to develop nuanced ways of gaining explicit and consistent evidence about the complex processes involved in teacher-led professional development, and about the teacher and pupil learning taking place; Cajkler, Wood, Pedder, & Norton (2012, p. 12) point out that discussions and processes involved in developing research lessons in lesson study are complex and often based on implicit understandings, with learning embedded in the ‘messy’ social context in ways that are currently difficult to elucidate.

Finally, “a culture of high intellectual quality” (Hord, 1997a, p. 37) is a high priority in a PLC; Hord referred to it as a culture of inquiry, developing and applying new knowledge, and “bringing in new ideas and people.” Might it also include collaborative theory building?

CONCLUDING REMARK

Conducting a genuine inquiry through collaboration between university researchers and teachers while maintaining academic rigour may “remain the exception rather than the rule” (McIntyre, 2005, p. 372), but the research reported in this book indicates that it is achievable and rewarding in terms of professional learning for all participants and it can yield useful wider applications.

The evidence presented in this book hopefully conveys something of what our responsive practitioner colleagues contributed to the research partnership in each project. Let us give the final word to Lloyd Brown, who participated in both main projects and whose genuinely dialogic approach and deeply thoughtful outlook is fully apparent in his reflections during and after the research. In this extract from the self-evaluation in his accreditation report, he describes with honesty his perplexity over the tension between building ‘common understanding’ and a dialogic approach to learning.

Some questions are, of course, unanswered. For example, can we actually move a whole group of students to a common understanding of something and be confident that they have that common understanding? Is this even more difficult when one employs the open-ended approach implicated in the dialogic approach described? Is it even desirable or is it sufficient to stimulate

all students to expand their own knowledge and thinking in a new direction, but not necessarily towards an identical outcome? The project has also helped me think about the meaning of 'knowledge'. If a teacher has a belief that children can create historical knowledge through dialogue, what is the status of that knowledge? These are the kinds of issues one should continue to wrestle with in one's professional development. Furthermore, if you take a questioning approach to your own practice, you continue to grow professionally yourself. The project has reminded me that educational research will often lead to more questions than firm conclusions. (Lloyd)

NOTES

- ¹ http://www.nbpts.org/products_and_services/video_observation_progra?print=on
- ² <http://www.educ.cam.ac.uk/>
- ³ <http://www.meshguides.org/>

APPENDICES

APPENDIX 1. T-MEDIA TEACHER INTERVIEW 1 QUESTIONS

- How many pupils in the class and what ability level are they?
- What are your aims for this module and what do you want the pupils to learn?
- How does it fit in with other work they have done / will be doing and with the curriculum?
- How was this module developed and by whom?
- What forms of technology do you expect to use, and how?
- How much involvement will the pupils have in the activities?
- How familiar are the pupils with the technology?
- What other resources will be used?
- How will the classroom be organised? Will pupils work together on joint tasks some of the time?
- How do you expect use of the technology to facilitate pupil learning?
- What are the issues you will be considering in planning/preparing for the lessons?
- Is there any preparation needed to tailor the lessons for this particular pupil group?
- What plans are there for assessing learning during or after this module?

APPENDIX 2. T-MEDIA TEACHER INTERVIEW 2 PROMPTS

Your thoughts while preparing the lesson

- What you wanted the pupils to learn
- How you expected use of the technology to help pupil learning

Your thoughts looking back on the lesson

- How well pupils learned what you wanted.
- How well the technology helped pupil learning

Further thoughts looking back over the whole lesson

- At each stage of the lesson, the important things that you were giving attention to, picking up on, and doing

APPENDICES

Your thoughts about successful learning of [subject] in the lesson

- One or two examples of successful learning of [subject] by pupils where use of the technology was involved
- What you did (or had already done) to help make that learning successful

Your thoughts about key actions in making use of the technology successful

- The key things that you did in preparing for the lesson to make use of the technology successful
- The key things that you did during the lesson itself to make use of the technology successful

Your strategies for facilitating pupil participation

- Any actions that you took to facilitate pupil participation
- How many pupils participated

Your thoughts about key actions during the previous lesson(s) that were videoed

- The key things that you did in preparing for the lesson(s) to make use of the technology successful
- The key things that you did during the lessons themselves to make use of the technology successful
- Any modifications you may have made to the lessons

APPENDIX 3. T-MEDIA TEACHER INTERVIEW 3 PROMPTS

Your thoughts while preparing the lesson

- What you wanted the pupils to learn
- How you expected use of technology to help pupil learning

Your thoughts looking back on the lesson

- How well pupils learned what you wanted.
- How well the technology helped pupil learning

Further thoughts looking back over the whole lesson

- At each stage of the lesson, the important things that you were giving attention to, picking up on, and doing

Your thoughts about successful learning of [subject] in the lesson

- One or two examples of successful learning of [subject] by pupils where use of technology was involved

- What you did (or had already done) to help make that learning successful

Your thoughts about key actions in making use of technology successful

- The key things that you did in preparing for the lesson to make the use of technology successful
- The key things that you did during the lesson itself to make the use of technology successful

Your strategies for facilitating pupil participation

- Any actions that you took to facilitate pupil participation
- How well pupils responded

Your thoughts about key actions during the lesson(s) that were videoed since the last interview

- The key things that you did in preparing for the lesson(s) to make use of the technology successful
- The key things that you did during the lessons themselves to make use of the technology successful

Your thoughts about pupil learning over the whole lesson sequence

- How well pupils learned what you wanted
- How well the technology helped pupil learning
- How independently the pupils worked during the course of this lesson sequence

Your thoughts about modifying the lessons

- How you may have already modified this type of lesson in the light of your experience
- How you might modify the lessons in future

APPENDIX 4. T-MEDIA FOLLOW-UP TEACHER INTERVIEW PROMPTS

Since our video review meetings

Have you worked with [teacher/colleague] – or discussed the research with him/her any further?

Do you think your involvement with T-MEDIA has impacted on your thinking and practice in any way? If so, how? Can you give examples?

- Have you adopted any aspect/s of practice you saw modelled by T in the videos?

APPENDICES

- Are there things that you would like to put into practice, but haven't yet? What are these? And what are the barriers?

Have you taught [the topic that was videoed]? If so, to what year/group?

- Has your approach altered in any way since the last time you taught this topic? If so, how? Can you give examples?
- Why did you make these changes?
- What is your evaluation of their success?
- What, if any, has been the feedback from pupils?

If you have been using an IWB, have you modified your approach in any way? If so, how? Can you give examples?

- Why did you make these changes?
- What is your evaluation of their success?
- What, if any, has been the feedback from pupils?

Are you aware of any way in which your involvement with the T-MEDIA project may have had a subsequent, wider impact within the school/department (e.g. influence on policy/practice)? If so, could you give details?

Have there been any changes in policy/practice (national, whole school, or departmental) that have influenced or affected:

- your teaching generally?
- your teaching of the [videoed] topic?
- your use of IWB/technology resources?
- colleagues' use of IWBs/technology resources?

Reviewing your involvement with T-MEDIA research so far, what have been the most useful aspects?

Reviewing your involvement with T-MEDIA research so far, what have you found the most challenging or difficult aspects?

Can you comment upon your experience of the *collaborative* aspects of the research (e.g. working with a school colleague and university researchers, subject specialist input etc.)? This could include:

- How you felt about working in this way (how the different participants' contributions were made and exploited, how equitable the collaboration was, etc.)
- How the collaborative process might be improved

Can you say how easy or difficult it was to grapple with the notions and language of sociocultural theory when these were introduced?

- What, if anything, helped you to understand these better?
- How well did they fit with your own ideas?
- Did they influence your thinking or understanding of practice in any way(s) at the time? (which concepts in particular?)
- What about since then?

- How did you find the process of developing the coding scheme? (Did we reflect everyone's ideas in the codes and in the more global cross-lesson themes?)

Any other comments?

How were you introduced to the IWB? If you received training, who provided it and was it pedagogically or technically focused, or both?

Extra Questions for Filmed Teacher:

Can you comment on whether and how the collaborative research process helped you to make the thinking behind your practice explicit?

- How easy or difficult was it to express your thinking on this at the time?
- How easy or difficult would it be to express your thinking about it now?

Any assessment results relating to videoed pupil group?

Any feedback from pupils regarding any aspect of the videoed lesson sequence?

Specific questions arising from our analyses of meeting notes were also posed to each teacher filmed. For example:

You thought that our coding framework would provide a great framework for observing other teachers. Has this been used/developed? If so, how?

Can you comment on your experience of reverting to teaching without the IWB in your new school?

Did you show/discuss lesson videos with the class as you intended? What was their reaction?

APPENDIX 5. T-MEDIA PUPIL INTERVIEW PROMPTS

Your thoughts on what was good about the lesson

- The main things that were good
- What made them good

Your thoughts on what you learned about the topic

- The main things that you learned
- What helped you to learn them
- What your teacher did to help you learn

Your thoughts on what was difficult in the lesson

- The main things that were difficult
- What made them difficult
- What helped you with them

APPENDICES

Your thoughts on using ICT in the lesson

- The main ways it helped or not
- What it was that made them helpful or not

Your thoughts on what could have been better about the lesson

- The main things that could have been better
- What difference they would have made
- Any further comments

Using ICT in the other lesson(s) that were videoed

- The main ways it helped or not
- What it was that made them helpful or not

Using ICT in the lesson(s) that were videoed since the last interview

- The main ways it helped or not
- What it was that made them helpful or not

APPENDIX 6. LEARNING THEORIES: A SUMMARY

Teaching is based on assumptions about how people learn. Many theories exist, but they can be broadly grouped into three strands, as follows.

1. Behaviourist Theories

Behaviourist theories major upon learning as a conditioned *response* to external *stimuli* where environment is the determining factor. The focus is thus on changes in observable behaviour. Complex wholes are assembled out of parts and basic skills are introduced before complex skills. Procedures are emphasised and students are typically trained to respond correctly to instructions.

(Theorists include: Watson, Skinner, Pavlov, Thorndike.)

2. Constructivist Theories

Constructivist theories focus attention on the models that a learner employs when responding to new information or to new problems. The concern is with how learners *actively construct meaning, build on their existing knowledge structures*, and make sense of the world through organising concepts and principles. These theories underpin many areas of contemporary educational practice. For example, the present science curriculum is based on a sequential process of constructing knowledge and acquiring ‘expert’ problem-solving skills – through interaction with others and with objects.

(Theorists include: Piaget, Chomsky, Bruner [whose later work also engaged with sociocultural perspective], Hirst, H. Simon.)

3. Sociocultural Theories

Sociocultural theories see learning as occurring through interaction between the individual and others. Influences upon development include the institutions, *social settings* and *cultural artefacts* (including language) that make up the social environment. Learning involves participation in contextualised activity. It is not necessarily the property of an individual but is shared within the social group (*distributed cognition*). The collective knowledge of the group/organisation is greater than the sum of the knowledge of individuals. *Activity theory* emphasises the importance of participation but also the *mediating* use of tools and resources available in the specific setting. These artefacts may be material, e.g. computers, books, diagrams, Intranet resource bases etc. or conceptual, e.g. key ideas or processes. The *affordances* of the tool used can shape (enhance or constrain) the activity.

(Theorists include: Dewey, Vygotsky, Rogoff, Lave & Wenger, Engström, Wertsch.)

Implications for Teaching:

The teacher plays a critical role in creating an environment in which individuals can be stimulated to think and act beyond their current level of competence. Activities are designed within the individual's *zone of proximal development* (ZPD) so that a student can complete them with *assistance* (from teacher or more competent peer), which is gradually and purposefully withdrawn as the student takes greater responsibility for their own learning. Thus the teacher (as *mediator*) both diagnoses and operates within the ZPD, providing *responsive assistance* to bridge the gap between pupils' existing knowledge and skills and the knowledge and skills to be acquired.

Tasks are *collaborative* between teacher/student/peers; students are involved in the generation of problems and solutions. Individuals can have different levels of participation in the activity but the aim is for all to move towards *increased participation*. Pedagogy for using new technological tools is shaped by the prior intentions and approaches of teachers.

Mediating Strategies: A Sociocultural Framework

The sociocultural perspective offers a particularly useful framework for understanding how teachers mediate students' interactions with technology to support learning. Mediating action can operate in the following four main areas.

1. Structuring Activity

This involves both advance planning and lesson organisation. It includes designing tasks to build on established practice and known pupil characteristics, integrate new

tools and resources, exploit their affordances, and link with ongoing teaching and learning activities.

Strategies include: building scaffolding into activities

2. Guiding and Supporting Self-regulated Pupil Activity

This involves: proactive and responsive teacher mediation; continual assessment of appropriate level of learner participation; gradually withdrawing support as learners become more capable and their participation in activity increases; *balancing* freedom of choice, pupil agency and self-regulated learning with structured activity and teacher support.

Strategies include: modelling; scaffolding; fading; focusing; shifting responsibility toward learner; assisting performance through questioning; responsive assistance

3. Structuring Interpersonal Classroom Interactions

This may involve: incorporating use of technology as an *object of joint reference* within whole-class, teacher/learner or peer discussion; creating and capitalising on opportunities to share mediating agency (e.g. with learners/technology); building a stronger classroom culture of sharing ideas, reflections, procedures (with peers and whole class).

Strategies include: assisting performance through questioning; responsive assistance; shifting responsibility toward learner; fading; promoting collaboration;

Forms of communication include: dialogic interaction, dialogic synthesis, authoritative interaction or 'funnelling', authoritative exposition.

4. Adapting to Constraints and Contingencies

This involves responding to organisational, practical and technical constraints.

Strategies include: structuring lessons in anticipation of, or response to, constraints introduced by using ICT.

LEARNING THEORY GLOSSARY OF TERMS

Affordances

Perceived qualities of systems that can support or hinder interactions (e.g. dynamic visual representation) (Gibson, 1979).

Assisted Learning / Assisted Performance

The emphasis is on assisting, rather than directing, performance. The task is carefully tailored to the learner's requirements (*cognitive task structuring*) and placed within

the learners' ZPD where it can be performed with assistance (from teacher/peer/technology). Assistance can include modelling, feedback, contingency management, instructing, coaching and questioning; it is steadily decreased as responsibility is shifted to the student.

Use of *assistive questioning* encourages the learner to move their thinking forward, for example by supporting them with mental functions that they cannot produce alone. Assistance may also involve encouraging students' articulation of their reasoning and problem-solving processes (Bonk & Cunningham, 1998).

Authoritative Interaction / Funnelling

Interaction (pupils giving responses or making contributions) but teachers leading pupils towards target response or particular interpretation/understanding/solution, by controlling decision-making (Bauersfeld, 1988) or guiding via questions and answers (Mortimer & Scott, 2003).

Authoritative Exposition

Teacher-led explanation/presentation of one view. (Mortimer & Scott, 2003)

Dialogic Interaction

Discussion-based discourse in which teacher recognises and clarifies pupils' existing understandings and builds upon these to formulate joint understanding; intentional sharing / exploration of ideas, collaborative meaning making (pupils contributing ideas, teachers helping take ideas forward); may involve open-ended questioning, talking through answers, reflecting, interpreting, evaluating; with or without ICT; contrasts with 'authoritative' discourse (Mortimer & Scott, 2003).

Dialogic Synthesis

Teacher exploring/attending to/drawing together/building on/elaborating different views, but no pupil input during synthesis itself (Mortimer & Scott, 2003).

Fading

The gradual abbreviation and ultimate withdrawal of assistance so that learners' participation increases as independent thinking skills are developed (J. S. Brown, et al., 1989; Newman, Griffin, & Cole, 1989).

Focusing

Directing attention towards salient concepts or aspects of a task; may involve both pre-structuring activities or responding contingently during lesson, for example

by use of questioning (e.g. T Wood, 1994). Ideally support is more responsive to learners than directive (e.g. Anghileri, 2002).

Mediation

How the (mental and physical) activity of students is shaped by the teacher's plans, actions and interpretations of objects and processes (e.g. Tharp & Gallimore, 1988).

Modelling

Students are offered opportunities to observe and emulate or re-invent expert strategies in context, with the teacher 'modelling' processes involved, then providing and adjusting assistance (e.g. J. S. Brown, et al., 1989) as the learner becomes proficient.

Responsive Assistance

Responsive assistance is related closely with the other strategies outlined here. It involves helping the learner to extend their knowledge within the ZPD by *adaptively responding to perceived or emerging learning needs* through adjusting support. Learners may initiate interactions, including opportunistic requests for assistance/feedback as teacher circulates (e.g. Rogoff, 1995; Tharp & Gallimore, 1988).

Scaffolding

Providing assistance (in varying forms) that enables learners to engage in activity at the expanding limits of their competence (D. J. Wood, et al., 1976). Scaffolding may involve both preparing/structuring appropriate tasks and materials (e.g. Anghileri, 2002) and interacting with learners responsively during the lesson (e.g. Bliss, et al., 1996).

Shifting Responsibility Towards Learner

Transferring responsibility to the learner, for example by encouraging a shift from teacher direction towards self-regulation (e.g. through fading). The process is facilitated by continual re-evaluation of the learner's capabilities.

Zone of Proximal Development (ZPD)

'The zone of proximal development is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers' (Vygotsky, 1978, p. 86).

APPENDIX 7. EMERGING TEACHER STRATEGIES FOR SUPPORTING DIALOGUE WITH THE IWB

A. Creating a Climate Supportive for Dialogue

Developing a learning community

- Create a safe environment within the classroom for risk taking and working out or testing out ideas – give pupils experience in sharing ideas through gathering a diverse range of alternative views from a number of children
- Encourage peers to listen and speak to each other respectfully: “Rewind and replay” gives them a second chance
- Draw up Talk Rules with the class, making explicit your expectations relating to the dialogic approach and purpose of learning – through using dialogue
- Acknowledge that not all learners will want to speak – offer other ways of sharing ideas and opinions, such as writing on Post-Its and sorting/ categorizing, shared writing on IWB pages, discussing in pairs/small groups
- Exploit the flexibility / provisionality of the IWB and encourage learners to generate and test provisional ideas – using flipchart pages to record ongoing discussions, returning to them and changing or adding to them
- Inspire through enthusiasm – using creative ways to approach learning, trying out something different; explicitly showing interest in the learning, including pupils and teacher thinking of questions about the subject
- Use supportive, open, friendly body language and encouraging facial expressions (smile!); these are especially important for pupils who may be wary of having their ideas rejected, or may find it difficult to absorb new information quickly and therefore need a more sensitive approach
- Move away from the front of the classroom – circulate around pupils’ tables or even sit at the back of his classroom while pupils share their ideas at the board

Scaffolding learning within the community

- Motivate and support individuals, groups or whole class – verbally (explaining, pre-teaching of vocabulary or key concepts, finding a ‘way in’ to a lesson which is engaging), visually (using artefacts, images on IWB) or through other media (music, video clips – IWB can enable all children to see and experience these well).
- Set appropriate level of challenge and constantly readjust – check previous learning experiences, to avoid ‘we’ve already done this in Year 4’; use knowledge of pupils’ skills and abilities to plan sufficient challenge (broadening experiences as well as extending).
- Recognise effort and progress – use focused praise related to dialogue and learning, e.g. ‘That question you asked was great – I hadn’t thought of that...’, ‘Our groups worked well today because you were listening carefully to each other’s ideas...’; this makes progress explicit to pupils and creates a purposeful feel within the class.

B. General Teacher Strategies for Supporting Learning Through Dialogue Using the IWB During Lessons

Developing pupil-pupil dialogue

- Encourage pupil-pupil talk – explicitly identify opportunities within lessons to get children talking in pairs and groups; you can ask them to evaluate their experience and feed this back into the class talk rules/class ground rules for talk; use talk partners to help children get used to learning through talking and sharing their ideas
- Get pupils to monitor talk – this can be an interesting thing to do, as it enables children to recognise different aspects of dialogue (you could give them a simple checklist to look out for, e.g. agreeing, asking another person a question, disagreeing, changing your mind); we often ask children to report on what their group has been talking about – why not get them to report on how they are talking about it?
- Convey the significance of communication skills – explicitly stating why it is important to listen, comment, question etc.
- Encourage and model productive dialogue: the impact of the teacher in developing this area is significant, especially when working on higher-order skills. Teachers can focus specifically on supporting pupils with:
 - justifying – drawing out reasons, asking for evidence
 - developing reasoning and application skills (e.g. interpreting visual images relevant to the lesson)
 - constructing arguments (e.g. by using role play or a storyline)
 - positioning – helping pupils to decide where they are with their thinking on a particular issue
 - evaluating ideas / claims / arguments by considering evidence (fact/opinion)
 - posing counter-arguments – e.g. playing devil’s advocate
- Develop dialogue skills – make it easy for pupils to participate in dialogue by having available (up on display on the IWB or on cards available for children to access easily) possible sentence openers, e.g. ‘I agree with X because...’, ‘Could you explain a bit more about ...?’

Continuing the development of learning over time

- Make the purpose, scope and path of learning clear to children – give them the ‘big picture’ (how does our learning fit in with our daily lives and with what we already know?); use mind maps on the IWB to indicate how learning is developing, supplement with key images and annotations to represent key concepts – you can return to this at the start of a lesson or use it in the plenary to get children thinking about next steps
- Use children’s experiences in and out of school to help to establish the context (e.g. in a unit of work about personal safety, share ideas about potential problems and difficulties which they may have encountered)
- Use a sequence of resources to follow a line of inquiry, referring back to resources used earlier

- Save and revisit resources/annotations to reignite understanding: as well as using a straightforward mind-mapping technique, possibly expand the reviewing of ongoing learning by using class wikis, learning platforms, class discussion forums/blogs; make content accessible to children so they can continue learning outside the classroom (you could hyperlink to prior work or resources to support this); also, use the particular facilities of the IWB to make this exciting and motivating, eg using games to match pairs, create the ‘square of truth’, posing multiple choice questions, challenging children to create an argument using key vocabulary and images which have been used throughout the learning (there are lots of Flash games which can be easily adapted and used with IWBs).

Involving pupils in co-constructing knowledge

- For many teachers, this is an area that becomes a real turning point in the development of dialogue in their classrooms; the IWB is especially helpful in facilitating this (ideas below are largely IWB-focussed).
- Give status to children’s contributions, particularly encouraging them to be original; as well as giving focused praise and acknowledgement, these practical strategies are useful:
 - ask children to annotate flipchart pages with words, phrases, ideas, drawings, diagrams
 - use images/objects on flipchart pages for children to move about, link, shrink, enlarge etc., getting them thinking about how they are showing what they understand
 - display work (on IWB or in other forms) for other groups to see (eg on a learning wall display – flipchart pages can be printed off and enlarged); this is motivating, gives status to children’s input and may also stimulate continued discussion
 - save and print annotated flipcharts to use as a resource for talk groups
 - ask children to look at work from other groups, question each other, compare with their own group’s perspective – teacher can actively bring in discussion about whether seeing other groups’ work actually made us change our minds or help us to learn something new
 - give children the chance to work at the IWB to manipulate/link/develop ideas, eg give individuals/pairs a flipchart page to work on (encourage them to use hyperlinks to previous files from work in class or to link to helpful websites)
 - give children a set of photocopied mini-images and ask them to use images, words and phrases/sentences to construct diagrams which represent the outcomes of the dialogue/ learning which has been taking place (this does allow for assessment of the level of children’s understanding and their ability to distill this into a written form; some children will find this very challenging, and will do better to have the chance to talk it through with an adult so that their meaning can be made clear)
 - children can stick copies of mini-images in their books and annotate them to make their own personal records of IWB activity

- ask groups to present ideas to class, talking through and explaining them; encourage peers to comment.

Helping children to learn that ideas often change as we learn

This section is also heavily dependent on the climate for learning which exists in the classroom, and is greatly influenced by the level of teacher skill in supporting children in this more challenging aspect of dialogue:

- Model open-mindedness and tolerance of uncertainty
- Really listen to pupil responses to fully understand what they are trying to convey – and handle unusual/ unanticipated ones supportively
- Discuss examples of when we have changed our minds, therefore showing children this can be a good thing to do
- Be a genuine learning partner alongside children – it is very powerful for children to see ongoing learning happening to someone they may assume already knows everything!
- Demonstrate good subject knowledge and understanding of continuity and progression leading to building of knowledge through a unit of work.
- Sometimes withhold evaluative comments and feedback to encourage children to become more experienced in saying what they really mean/ feel/ want to say.
- Resist the urge to repeat children’s responses or reformulate them – this shows that we expect responses to be listened to the first time; alongside this, encourage children to question each other (you can model this, e.g. ‘I’d like to ask you something else about what you just said...’, ‘Does anyone else have a point they would like to make after hearing what X said?’).
- Draw children into the learning through mystery, suspense, an unusual angle or approach, including withholding learning objectives sometimes; this encourages interest and motivation, and can also help children to identify with the learning going on.

C. Key Approaches

These last sections comprise aspects of practice that can be worked on specifically by the teacher, either to develop their own competence and understanding, or with the children to give them experience, build up their confidence and help them to engage with learning through dialogue.

Guiding lesson flow

- Make sure you plan for different kinds of dialogue to take place at different stages in your lessons; e.g., presentational talk during plenaries, discussions to explore ideas gathered from group work.
- Set up focused pair discussions and use of mini (non-digital) whiteboards to record outcomes in preparation for IWB activity (e.g. creating a storyboard)
- Plan to use the IWB in a range of ways, especially involving pupils directly, e.g.:

- try not to always use the IWB to frame a lesson – use it flexibly as the learning dictates.
- relinquish teacher control of the IWB and give children experience in using it actively and developmentally during a lesson.
- use the IWB alongside other non-digital resources (books, artefacts, paper, ordinary whiteboard or chalkboard) in an integrated way, as a place to draw together and keep ideas which you can return to at a later stage.

Developing pupil questioning

We often work on our own questioning skills as teachers, but less so on helping pupils to develop higher order questioning skills. You could have short, focussed sessions to give pupils experience of approaches such as speculation, analogy, problem solving, debate, analysis, synthesis, evaluation, and ‘thinking outside the box’. There are many resources around which could be used (eg in the various ‘thinking skills’ programmes available), but the particular facilities of the IWB make it extremely valuable here, e.g. making it possible to use sound, video, images and text very easily to stimulate a focussed session. You can back this up with example open questions, key vocabulary etc., to support children in beginning to make contributions.

Encouraging evaluation and synthesis

- Make evaluation and synthesis explicit through the language you use with pupils to help them understand what is happening; guide discussion sometimes, or sustain it (asking strategic questions, encouraging children to ask each other questions), use neutral encouragement to extend an argument (‘Tell me a bit more about this...’, ‘Go on...’). If you are able to draw on saved, collective IWB work, you can make the synthesis and links very clear.
- Plan for thinking and talking time in your lessons – and allow enough time for this (too often we expect children to do a lot of thinking and talking in too short a time, and when they are not able to get to the point we want them to reach, we tell them what we wanted them to find out!); be sensitive and adaptive to all aspects of what is going on in the lesson, and keep the focus on the pace of learning, not just the pace of the lesson.

APPENDIX 8. CODING ADAPTED BY LLOYD BROWN AS A DRAFT
FRAMEWORK FOR LESSON OBSERVATION

Interaction/Communication

- Dialogic interaction - teachers and pupils share/explore ideas. Teacher mediates
- Dialogic class discussion - pupils respond to/build on each other's ideas. Teacher mediates, prompts if necessary
- Dialogic peer discussion - pupils spontaneously respond to/build on each other's ideas. Teacher is a participant
- Dialogic synthesis - drawing together/building on/elaborating different views. Can be teacher or pupil. Draws on whole class and/or group discussions and/or individual work
- Funnelling (authoritative interaction) - progressive focusing of pupils' responses/contributions to a particular answer
- Authoritative exposition - teacher led explanation/presentation/presentation of one particular view

Responsive Assistance

- Probing - eliciting knowledge/clarifying/diagnosing/developing/understanding
- Prompting - giving a push, e.g. to make links
- Explaining assistance - teacher assists pupil after request for help or misunderstanding
- Assistive questioning - teacher led questioning to help pupils develop knowledge/skill
- Scaffolding-supporting/pushing pupils to go further than they can go alone
- Avoiding alienation
- Reshaping thinking – e.g. by rephrasing/posing alternative perspectives/increasing sophistication of understanding/widening vocabulary
- Making suggestions

Increasing Pupil Participation, Interdependence and Responsibility

- Rapport develops
- Teacher enthusiasm towards pupil responses
- Teacher gives status to pupil contributions
- Encouraging expression of different ideas/views without criticism (making diversity of ideas legitimate)
- Vicarious involvement via guesswork
- Feedback - especially positive reinforcement
- Audible praise for pupil ideas - giving them a wider audience
- Pupil enthusiasm
- Pupil initiates interaction with teacher

- Pupil requesting assistance
- Pupils seeking reassurance
- Pupils making suggestions
- Pupils using technology themselves (e.g. interactive whiteboard)
- Paired/group discussion
- Facilitating whole class collaboration/sharing of ideas - for example, collective annotation of information on whiteboard
- Teacher as learner/co-construction of knowledge-developing the sense of a shared journey and equal collaboration

APPENDIX 9. TEACHING AND LEARNING POLICY GUIDANCE AND PROPOSED ACTION PLAN DEvised BY DIANE RAWLINS

Issues to be considered by Senior Management Team:

- Quick review of existing Teaching and Learning Policy
- How do dialogic teaching and the dialogue table in particular fit in with our approach to teaching and learning (or vice versa!)?
- Benefits for children
- Introducing this to staff
- Monitoring and evaluating

Work with staff (over a series of staff meetings/team meetings):

- Recap on dialogic teaching – what exactly is it?
- Dialogic teaching ‘audit’ – using 1st column of dialogue table – including discussion about evidence (‘How do we know?’)
- Share qualities of dialogic teaching already evident in our teaching (senior management team to be ready with positive examples from performance management observations, eg classroom displays, interactive teaching styles, comments boxes in classrooms etc.)
- Introduce dialogue table as the new ‘guidance’ element of our Teaching and Learning Policy – stress that actually very little of this will be new (this should be reassuring in terms of workload!). Explain how the table will serve as a framework to help us evaluate and enrich our approach to teaching
- Review use of IWB in classrooms – share examples of flipcharts/other IWB resources and how we used them, plus how children responded (opportunities for people to have additional IWB input if they want to)
- Team meetings: collect examples of learning styles/activities/approaches for the ‘You will see us...’ column of the table. Add these to the table to be used when planning
- Agree to try out something, eg use of images (link this to PSHCE/SEAL work and all classes use the same images) and feedback at staff meeting about how children in different year groups responded – differently or with some similarities?
- Team meetings: review of different types of dialogue we use in class, or could use. Link this to our work on improving writing and boosting speaking and listening throughout the school.

Monitoring and evaluating: discuss how we could evaluate our use of dialogic teaching. Possibilities include:

- peer observation (issues relating to release time);
- as part of performance management observations (by Head or Team Leader); some subject coordinators might like to focus their monitoring of teaching and learning on the impact of dialogic teaching approaches/strategies
- children’s responses: development of a checklist

APPENDIX 10. OUTLINE OF PROFESSIONAL LEARNING RESOURCE FOR
SUPPORTING DIALOGUE USING THE IWB

Hennessy, S., Warwick, P., Brown, L., Rawlins, D., & Neale, C. (Eds.). (2014). *Developing interactive teaching and learning using the interactive whiteboard: A resource for teachers*. Milton Keynes: Open University Press. <http://tinyurl.com/OUPIWB/>.

PART A. The Teacher Development Resource (printed)

Developing Interactive Teaching and Learning Using the IWB

1. Introduction and use of the resource
 - 1.1 What is this resource for?
 - 1.2 How might the resource be used?
 - 1.3 What kinds of activities are involved?
 - 1.4 Deciding where to start
2. Stimuli for professional development
 - 2.1 Getting started
 - 2.2 What is dialogue?
 - 2.3 Considering classroom dialogue
 - 2.4 What role can the IWB play in supporting whole class dialogue?
 - 2.5 Extending our understanding of IWB technology use in a dialogic classroom to small group work and computer-based activity
 - 2.6 Using the Resource Bank
 - 2.7 Reviewing your learning
 - 2.8 Sharing new ideas
 - 2.9 Further resources

PART B. Reader (printed)

- Chapter 1: Creating a supportive environment for classroom dialogue (Simon Knight)
- Chapter 2: Supporting dialogic teaching of personal safety with the interactive whiteboard in an urban primary school (Diane Rawlins)
- Chapter 3: Developing a dialogic approach to interactive whiteboard use in English: teacher reflections and student perceptions (Caroline Neale)
- Chapter 4: Using the interactive whiteboard to support dialogic teaching in history: The pupil perspective (Lloyd Brown)
- Chapter 5: Supporting dialogue by exploiting interactive features of the IWB (Sara Hennessy)
- Chapter 6: Effective group work at the interactive whiteboard (Paul Warwick)
- Chapter 7: Learning to learn together with ICT and with the Internet (Rupert Wegerif)

Reader Appendices

Appendices for Chapters 2–4: Original lesson flipcharts (*online*)

Appendix B6.1: Group interaction at the IWB - Light sources and reflectors (*printed*)

Appendix B6.2: Group interaction at the IWB - Food Chains (*printed*)

PART C. Resource Bank (Printed and Online)

Dialogue and IWB Activities

C1. Starting Simple

Displaying an open-ended prompt and/or a picture to stimulate discussion

Class brainstorm

Using pens to underline / circle key ideas

Sharing, discussing and comparing ideas in a whole class setting

Using ‘Assessment for Learning’ tasks in developing dialogue

Drag and Drop – The Plenary Circle

C2. Moving On

Highlighting and annotating texts or images

Recording a teacher voiceover

Focusing attention using the spotlight, magnifier or ‘cover and reveal’

Understanding a text: taking it apart

Getting students to build on each other’s contributions; constructing knowledge together

Drawing objects on the IWB together

Drag and drop, argue and explain

Students selecting their own words / pictures / scenarios from a given set and manipulating / discussing them in pairs/groups

Matched resources: Arranging objects on the board and at desks to show understanding

Discussing definitions: using hide-and-reveal tiles

Using a wider variety of digital media: “multimodal” interaction

C3. Revisiting IWB resources in later lessons

Repeated display of resources created by teachers before a lesson sequence

Revisiting objects that were annotated or constructed jointly by a class

Revisiting objects created by other classes

C4. Case Study: Caroline’s Lesson Sequence

Using text and pictures to stimulate interest and initial dialogue

Matching terms and definitions

“Square of truth” or “magic box/window” activity

Focusing on evidence – identifying key parts of the screen

Reviewing work and framing a written task

C5. Case Study: Diane's Lesson Sequence

- Using open-ended prompts and students' own recorded voices to stimulate discussion; use of tickertape/banner
- Group recording and explanation
- Negotiating classroom rules and procedures using the interactive whiteboard
- Working using class talk rules

C6. Students working semi-autonomously in groups at the IWB

C7. Further ideas

- Model mapping / mind mapping
- Generating and testing provisional ideas
- Use of a visualiser with the IWB
- Interactive multiple choice quiz ("Who wants to be a millionaire?" style) or drag-and-drop matching activity / vortex sorting activity
- Using subject-specific software interactively: GeoGebra

PART C Appendices: Downloadable Materials (Printed and Online)

Appendix A1: What do teachers use talk to do?

Appendix A2: Dialogue Table

Appendix A3: Expanded Dialogue Table

Appendix A4: Edited extract of whole class dialogue

Appendix A5: Creating a climate supportive for dialogue

Appendix A6: Teacher strategies for supporting dialogue with the IWB

Appendix A7: How can you engage all students in activity at the IWB?

Appendix A8: How can you find out what students think?

Appendix A9: Teaching and Learning Policy guidance and proposed action plan

Further Online Resources

IWB flipchart templates and instructions

ActivStudio ideas.flipchart

Notebook ideas.notebook

Screen & Sound Recording (ActivInspire).pdf

Geogebra IWB resources

adding_number_line.ggb

flower_symmetry.ggb

multiplying_fractions.ggb

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GLOSSARY

affordances

Affordances (Gibson, 1979) refers to perceived advantages, described by Conole and Dyke (2004, p. 204) as “what uses ICT invites and facilitates, what it lends itself to and what it can do well”; this refers to how the designed functions and features of technology can be effectively and creatively exploited and adapted for use in new settings.

aides-memoires

Memory aids often devised by pupils for their own future reference in order to recall earlier learning.

community of inquiry

A community incorporating reflective practice and peer learning whereby individuals look critically at their own practices and modify these through their own empirical trialling (Jaworski, 2006, p. 204).

community of practice

A community of practice (CoP) is a model of learning in which people, through a process of legitimate peripheral participation (Lave & Wenger, 1991), take up membership in and identity with a community which serves as the home of shared practices; learners gradually take up these practices. CoPs rely on situated theories of knowledge, i.e., the idea that knowledge is enacted by groups of people over time in shared practices, rather than the idea that knowledge resides in the head of an individual learner (Hoadley, 2012).

critical alignment

Within a community of inquiry, teachers align with aspects of practice while critically questioning roles and purposes as a part of their participation for ongoing regeneration of the practice (Jaworski, 2006, p. 190).

critical episode

‘Critical events’ are defined by Powell, Francisco and Maher (2003) as connected sequences of utterances and actions that, within the context of a priori or a

posteriori research questions, require explanation. An event is called critical when it demonstrates a significant or contrasting change from previous understanding. In our study, critical episodes were similar, longer sequences of action that included actions, teacher interventions, or pupil-initiated interactions that were key in using technology effectively and/or promoting learning of the topic.

In the Dialogue and IWBs project, critical episodes were defined in more detail as (a) collectively illustrating a range of IWB uses, and (b) including dialogue that is: stimulated by well-selected resources that are engaging and/or meaningful to learners; linked with any level of IWB use but including some pupil ownership of the board; arising from opportunities for focused, cumulative, open-ended discussion in whole class, pairs, or groups; moving forward pupils' learning.

cumulative

A key characteristic of dialogue: participants construct meaning through chained sequences of questioning and responding (Bakhtin, 1986, p. 91) and chained lines of thinking and inquiry (Alexander, 2008). This is termed 'addressivity' and 'responsivity' by Bakhtin, referring to how an utterance is shaped in anticipation of a certain kind of response from the intended listener, as well as responsive to previous utterances and meaning making.

dialogue / dialogic interaction / dialogic teaching

Dialogue or dialogic interaction refers to discussion-based, open-ended discourse in which participants share and evaluate ideas and build upon each other's views, with willingness to change their minds.

In dialogic teaching, the teacher recognises and clarifies pupils' existing understandings and builds upon these to formulate joint understanding; intentional sharing / exploration of ideas, collaborative meaning making with pupils contributing ideas, teachers helping take ideas forward; may involve open-ended questioning, talking through answers, reflecting, interpreting, evaluating; contrasts with 'authoritative' discourse (Mortimer & Scott, 2003).

focusing

Directing attention towards salient concepts or aspects of a task; may involve both pre-structuring activities or responding contingently during lesson, for example by use of questioning (e.g. T Wood, 1994). Ideally support is more responsive to learners than directive (e.g. Anghileri, 2002).

generative dialogue

Dialogue that creates unprecedented possibilities, new insights and levels of interaction; produces a collective flow (Isaacs, 1999, p. 41).

interactive whiteboard (iwb)

The IWB is a system comprising a computer linked to a data projector and a large electronic board displaying the projected image. The touch-sensitive board allows direct input via finger or stylus so that objects can be easily moved around the board ('drag and drop') or transformed by teacher or pupils. They offer the unique advantage of one being able to annotate directly onto a projected image, text or software display and to save the annotations for re-use or printing. The software can also instantly convert handwriting to more legible typed text and it allows users to hide and later reveal objects. It can be used with remote input and peripheral devices including a visualiser (eg to display and annotate student work or experimental results).

intermediate theory

Theory that bridges between scholarly theory and a specific practical educational setting, whilst specifying the conditions in which the theory applies; the notion of intermediate theory in this book draws on diSessa's idea of an intermediate theoretical scope (diSessa, 1991). It was developed through accommodating the different perspectives of university researchers and classroom teachers as we engaged with each other's practices. The iterative process of intermediate theory building culminated in recontextualised, validated or refined concepts. Intermediate theory is framed in language accessible to practitioners as well as academic researchers.

mediation

How the (mental and physical) activity of students is shaped by the teacher's plans, actions and interpretations of objects and processes (Tharp & Gallimore, 1988).

practical theory

A practitioner's model of practice – including beliefs about how pupils learn and how technology facilitates learning – that is capable of articulation and is made explicit through testing (Deaney, et al., 2006).

reflective dialogue

Existing ideas and practices become more explicit and clear through exploring – and critiquing – underlying causes, rules and assumptions to get to deeper questions and framing of problems (Isaacs, 1999, p. 41).

reflective practice / practitioner

A concept first introduced by Donald Schön (1991) in his seminal book *The Reflective Practitioner*. In education, it refers to an educator actively, persistently

and thoughtfully examining his or her own teaching methods in light of how well students are learning, determining in collaboration with colleagues or coaches how to improve one's practice, examining the results of an intervention and making any necessary changes (Teacher Leadership Exploratory Consortium, 2011).

scaffolding

Providing assistance (in varying forms) that enables learners to engage in activity at the expanding limits of their competence (D. J. Wood, Bruner, & Ross, 1976). Scaffolding may involve both preparing/structuring appropriate tasks and materials (e.g. Anghileri, 2002) and interacting with learners responsively during the lesson (e.g. Bliss, Askew, & Macrae, 1996).

script

A cognitive psychology term for a plan for a typical sequence of actions: (Schank & Abelson, 1977).

teaching schools

Teaching schools in the UK have a responsibility to form an alliance with other schools and strategic partners such as local authorities and higher education institutions. The purpose of this is to build their capacity to support other schools in the wider network – in promoting high quality teaching and learning from initial teacher education through to senior leadership.

zpd / zone of proximal development

“The zone of proximal development is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers” (Vygotsky, 1978, p. 86).

ABOUT THE AUTHOR

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Chris Tooley (BEd Cantab – Natural Sciences, MEd Cantab) has been Deputy Headteacher at Bottisham Village College since September 2005. One of his key areas of interest is the use of ICT to enhance teaching and learning across the curriculum. He worked as an Advanced Skills Teacher from 1999–2005, as well as being a Lead Science Teacher for Cambridgeshire (IWBs) during which time he received a commendation in the Innovation category of the National Teaching Awards. Prior to this Chris taught for 15 years at Soham Village College and was central in the introduction of the use of ICT across the curriculum. He also has a particular interest in the development of pedagogy through practitioner research and the development of a knowledge-creating school.

Paul Warwick (BEd, BSc, MEd) is a Lecturer in Primary Science and ICT at the University of Cambridge. Paul is engaged in a range of research and teaching activities in the Faculty of Education that link directly with his interests in primary science education, the uses of ICT in teaching and learning, and the professional development of trainee and beginning teachers. He has worked closely with Local Authority ICT advisors in the UK to develop courses for ICT coordinators in schools, and he manages the ICT element of the Early Years and Primary PGCE course at the Faculty of Education. Paul's most recent research work has centred around an ESRC-funded project on pupils' use of the IWB during group work in science in primary classrooms. Some of the outcomes of this work can be found at <http://iwbcollaboration.educ.cam.ac.uk/>.