Thriving in a colder and more challenging climate

ALT-C 2011
18th international conference
University of Leeds, UK, 6–8 September 2011
www.alt.ac.uk/altc2011

ASSOCIATION FOR LEARNING TECHNOLOGY

ALT

Thriving in a colder and more challenging climate

Conference Proceedings

Acknowledgements

Production editing by Co-Action Publishing http://www.co-action.net/

Produced with the assistance of John Slater, Anna Davidge and ALT

Cover design by Jamie Shaw

Printed by Fine Print Services

Referencing

Please use the following format for referencing:

Author name(s) (2011). Paper title. In, Hawkridge, D., Ng, K., Verjans, S. (Eds). Thriving in a colder and more challenging climate. The 18th annual conference of the Association for Learning Technology (ALT-C 2011). Held 6-8 September 2011, University of Leeds, England, UK.

ISBNs: print - 978-91-977071-4-5; online - 978-91-977071-5-2.

This document is available online as a PDF at repository.alt.ac.uk/2159/
Individual papers are available online in HTML, PDF, EPUB, and MOBI format at http://www.alt.ac.uk/alt-conference/alt-c-2011/conference-proceedings

ALT-C 2011

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Conference Proceedings

Editorial for proceedings papers

Here are the proceedings of the 2011 ALT Conference "Thriving in a colder and more challenging climate". Proceedings papers report on a piece of research, possibly in its early stages, or they can be "thoughtpieces" which state a point of view or summarise an area of work, perhaps giving new insights.

The conference has six themes:

- **Research and rigour**: creating, marshalling and making effective use of evidence
- **Making things happen**: systematic design, planning and implementation
- **Broad tents and strange bedfellows**: collaborating, scavenging and sharing to increase value
- **At the sharp end**: enabling organisations and their managers to solve business, pedagogic and technical challenges
- **Teachers of the future**: understanding and influencing the future role and practices of teachers
- **Preparing for a thaw**: looking ahead to a time beyond the disruptive discontinuities of the next few years.

Interestingly, there were very few proposals for the conference as a whole against the sixth theme: and no proceedings papers. Perhaps the thaw is still perceived as being too far away to warrant any preparation yet!

Unsurprisingly, *research and rigour* is well represented in the proceedings but there is a problem-solving practical flavour relevant to the title of the conference. Garnett and Ecclesfield (2011) look at Boyer's often cited model of scholarship and update it for the current more open and networked environment. Jones and Kennedy (2011) argue for a more problem-driven approach to social science and specifically educational research using a pluralist approach combining quantitative and qualitative methodologies and tools. Bain (2011) revisits the role of online discussion in learning for all learners and produces a framework. Kerrigan et al. (2011) report on the successful use of a tool to support and indeed require student reflection on the feedback they have been given. It is now in use in several universities and colleges.

These four general papers are balanced by two that are specifically subject-based. Abadi and Alsop (2011) use a formal combination of activity theory and grounded theory in a practical way to improve learning of initial Java programming,

ISBN 978-91-977071-4-5 (print), 978-91-977071-5-2 (online)

DOI: 10.3402/rlt.v19s1/7816

a high-volume area with considerable payoff. Bacon, Windall, and MacKinnon (2011) discuss using emotional effects in the multimedia training of executives responsible for safety critical services such as fire or police, a lower volume area but again with high payoff in the light of the important role for which training is being given, and the expense of traditional methods.

Making things happen through problem solving with significant actual or potential payoff is also important, especially in the current environment. Collins et al. (2011) report on the successful use of short "photomarathons" in engaging primary school children in learning on a visit to an historical site. Kohl (2011) discusses the deployment of a voluntary plagiarism checking system which addresses this serious problem through prevention rather than post hoc detection. Smith (2011) reports on the use of a "virtual internet" to solve some of the security problems of group work in learning computer networking concepts and techniques. Gorjian (2011) describes and discusses a very carefully designed experiment that suggests that hypertext annotations in second language teaching, while improving vocabulary learning, so do primarily in the short term only. This result is sufficiently disturbing to generate an interesting discussion of the context of the experiment and why the result might not generalise.

Several papers involve collaborations but only Tan and Pearce (2011) major in *scavenging* in their use of YouTube videos in teaching sociology. Their discussion of the barriers to and advantages of such use has wide applicability.

At the sharp end, Strachan et al. (2011) discuss the results of a questionnaire that looked at Workplace-Based Learning from the points of view of not just learners and teachers but also from those of the workplace and external stakeholders. The results are of wide relevance in the current environment. Stewart, McKee, and Porteous (2011) discuss an integrated system for lecture capture that does not require heavy hardware or software and can be accessed from simple hand held devices.

Finally, what of the *teachers of the future*? Two papers offer very different approaches to teacher professional development. Cochrane and Naryan (2011) describe a new approach at a single site, for lecturers through a "social learning technologies" course which aims to produce a community of practice in the use of mobile Web2.0 technologies. In contrast, Arati, Todorova, and Merrett (2011) are looking to bring together the strange if not completely incompatible, bedfellows of government in Germany, France and the UK, in public/private partnerships with Intel. The project supports the professional development of teachers to help them use technology more in their teaching and to enable them to facilitate the acquisition of twenty-first century skills by their students.

We thus see the effects of the cold. To thrive in the current climate, research needs to be more focused than in the past on solving problems, preferably in a scalable way: that is where the payoff lies. Nevertheless, the papers remain solidly grounded in

theory, properly constructed and well argued. ALT's field overall has an important role to play in "bringing on the thaw".

David Hawkridge
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Towards a framework for co-creating Open Scholarship

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(Received 13 June 2011; final version received 20 June 2011)

A recent edition of ALT-J made a call for papers that looked at 'theoretical approaches in digitally mediated environments'. A key part of this call was to use the Boyer Model of Scholarship as a frame of reference. The authors felt that there were limitations to this model which could be addressed in light of the recent moves to develop Open Scholarship.

Our concern with Boyer is that he suggests a separation between researchers, who 'build new knowledge through traditional research' and teachers who 'study teaching models and practices to achieve optimal learning'. Boyer identifies four 'Types' of Scholarship, those of Discovery, Integration, Application and Teaching (DIAT), but places the responsibility for 'creative work in established field', with the traditional researcher role (Discovery). Furthermore this model implies a linear flow concerning how new knowledge becomes a part of teaching, implying that the teaching is mostly instructional, with a limited view of how new and emerging pedagogies might be utilised.

The Learner-Generated Contexts Research Group has been concerned to develop a co-creation approach to learning and find this separation curious. We argue that using the Pedagogy, Andragogy, Heutagogy (PAH) Continuum enables more flexible approaches, through a mix of PAH, allowing for a wide range of technology uses, which also changes the relationship to research.

We look at how we might both apply a co-creation approach to Boyer's model, inspired by the Open Scholar movement, and also make DIAT more iterative and less discrete. Consequently we have both extended Boyer's DIAT system to include Co-creating as an additional type and changed some 'measures of performance' to enable an iterative process of scholarship to emerge which also involves learners. We also examine how network effects 'enable generative network effects to occur' on scholarship and how applying Epistemic Cognition to evolving subject frameworks might enable the co-creation of research agendas.

The co-creation model of Open Scholarship is presented in a table designed to simulate debate on this subject.

Keywords: open scholar; scholarship; research; co-creation; contexts; teaching; PAH Continuum; epistemic cognition; open education resources; OER; networked learning

Introduction

A recent edition of ALT-J made a call for papers that looked at 'theoretical approaches in digitally mediated environments'. A key part of this call was to use the Boyer Model of Scholarship Boyer (1997) as a frame of reference upon which to base

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ISBN 978-91-977071-4-5 (print), 978-91-977071-5-2 (online)

DOI: 10.3402/rlt.v19s1/7795

such new theoretical approaches. The authors felt that there were limitations to this, perfectly valid, model which could be addressed in light of the recent moves to develop a model of Open Scholarship (Anderson 2009), and other theories reflecting the 'networked age', such as Haythornthwaite in New Forms of Doctorate (2009) and our own Open Context Model of Learning and the Pedagogy, Andragogy, Heutagogy (PAH) Continuum (Luckin et al. 2010).

Our concern with Boyer's Model lies in the fact that it suggested a separation between researchers, who 'build new knowledge through traditional research' and teachers who 'study teaching models and practices to achieve optimal learning'. Boyer usefully identifies four 'Types of Scholarship', those of Discovery, Integration, Application and Teaching (DIAT), but arrogated the responsibility for 'creative work in established fields' solely to Discovery scholarship (the 'traditional researcher role'). Furthermore this model also implies a linear flow concerning how new knowledge becomes a part of teaching, which suggests that the type of teaching that results is more instructional. In our opinion this reveals a perhaps limited view of how pedagogies, both existing and emerging, might be deployed by an experienced teacher.

The Learner-Generated Contexts Research Group has been concerned to develop a co-creation approach to learning and consequently find this separation curious. We would argue that using the PAH Continuum, in ways described by for example Cochrane (2010a), enables more flexible approaches to learning and teaching by using a mix of PAH (which also allows for a wide range of technology uses). This also changes the teacher's relationship to 'research' through the development of 'epistemic cognition' in the learner (Avramides and Luckin 2007), or action research strategies (Cochrane 2010b).

So, in part inspired by the Open Scholar movement, we shall look at how we might both:

(1) apply a co-creation of learning approach to Boyer's model,
(2) make the four-stage process more iterative and less discrete.

In so doing we will propose a framework for the 'Co-creation of Open Scholarship' as a way of taking forward the strengths of each of the models under review as we perceive them in 2011. We will do this by examining each 'type of scholarship' in Boyer's DIAT model through reviewing the descriptors in detail before adding an additional type that we will propose calling 'co-creating'.

We hope therefore in this paper to re-examine the notion of scholarship in the age of social media, update our view of learning theory in light of the developments of learning technology and deepen our views of the notion of co-creation in learning and research in the emerging 'networked society'.

Background

Marta Nibert (2001) in her analysis of Boyer's modelling of the professional role of the academic within American 'college faculty', in their terms specifically the 'professoriate', explains that for both her and Boyer the concern is with defining 'scholarly pursuits' with a 'balanced focus on all forms of scholarship necessary to meet the demands of the *information age'*. The beauty of Boyer's model is indeed this

clarity; its limitations are that it perfectly describes a situation that had validity over a decade ago, since when we have had thorough-going changes, often in response to the aforementioned 'demands of the information age'. These are mostly around notions relating to the various concepts of 'Open' ideas that were not available to Boyer and Nibert. However Boyer's use of a clear structure of 'types' of scholarship, and the use of descriptors to define the related actions of professionals, enables the kind of discussion and review we are undertaking here. We are calling this the DIAT structure;

Discovery; the traditional researcher role,

Integration; focusing on making connections across disciplines,

Application; focusing on using research findings and innovations to remedy societal problems,

Teaching; which Boyer considers a central element of scholarship.

This provides a useful framework from which to review scholarship in the more 'Open' era of 2011. The DIAT model offers clear descriptors within each type of Scholarship and also defines what constitutes a scholarly career whilst attempting to create some balance of recognition across the phases of scholarship described. See

Table 1. Boyer's Model of Scholarship.

Type of scholarship	Purpose	Measures of performance
Discovery	Build new knowledge through traditional research.	Publishing in peer-reviewed forums Producing and/or performing creative work within established field Creating infrastructure for future studies
Integration	Interpret the use of knowledge across disciplines.	Preparing a comprehensive literature review Writing a textbook for use in multiple disciplines Collaborating with colleagues to design and deliver a core course
Application	Aid society and professions in addressing problems.	Serving industry or government as an external consultant Assuming leadership roles in professional organisations Advising student leaders, thereby fostering their professional growth
Teaching	Study teaching models and practices to achieve optimal learning.	Advancing learning theory through classroom research Developing and testing instructional materials Mentoring graduate students Designing and implementing a programme-level assessment system

Table 1 for a full description of each of these types of scholarship.

Open Scholarship in a network society

Terry Anderson's discussion of Open Scholarship was given as a keynote talk at the ALT-C Conference (2009) as part of a broader discussion of trends in learning and technology practices in the twenty-first century. He talks of moving from Communities of Practice to Networks of Practice, arguing that 'we are all in the change business', capturing the sense of flux that we are now trying to analyse here. Caroline Haythornthwaite in New Forms of Doctorate (2009) also discusses the impact of network effects on learning and scholarship. Building on the Taxonomy of the Many (Dron and Anderson 2008) Anderson looks at how learning is moving from the group to the collective, challenging Boyer's institution-centric approach. Anderson argues for a move to being an Open Scholar arguing that quality scholarship 'is peer and public reviewed, accessible, persistent, syndicated, commented and transparent' picking up on how the network effects of learning are being impacted upon by a range of social media, both generic and also dedicated to scholarly practice. Anderson additionally sees a key function of Open Scholarship as being 'empowering learners as future teachers'. Haythornthwaite amplifies this by defining 'learning is a relation that connects people', emphasising the relational and networked qualities of learning.

Anderson is focusing on the affordances of learning in the emerging world of Open Learning and examining its possibilities, whereas Boyer is looking at how professional scholarship can be embedded institutionally, whilst broadening its value by re-asserting the value of teaching, for example. Haythornthwaite (2009) looks more deeply and precisely at the effects that a range of networks are having educationally and sees the future as being characterised by ubiquitous learning in society. So we have three approaches, respectively focusing on institutions and professionalism, open learning and social media and ubiquitous learning and network effects.

Boyer is concerned to clarify the current role of professional scholarship within institutions whilst Anderson is arguing from a scholarly perspective for a move to a deeper view of networks as collectives, occurring simultaneously within and outside institutions. Haythornthwaite takes the rise of networks as a given and discusses learning in the 'networked age'. Indeed she prefers to see learning as an epiphenomenon of networks, with technology as a critical enabler of this or, as she puts it, 'technology is a mediator for network relations including the vital relation of learning' in a networked society. She sees learning as a networked relation consisting of learning relations, production, outcomes and spaces in an emerging participatory culture (*pace* Jenkins 2006).

Indeed, Haythornthwaite sees 'contributory, open and participatory practices' as signifying trends in learning which signify the 'emergent work' that 'teachers, learners, educators and researchers' should currently be engaging in. She draws her work together more coherently, as a summative social vision of future learning in a networked society, than Anderson. However Anderson is more discursive in his observations on Open Scholarship flagging a range of emergent practices which an Open Scholar might respond to, into which he adds Personal Learning Environments and social learning, amongst many others. He quotes Gideon

Burton 'the Open Scholar is someone who makes their intellectual projects and processes digitally visible and who invites and encourages ongoing criticism of their work and secondary uses of any or all parts of it – at any stage of its development'.

For Anderson, being an Open Scholar represents a new type of education work which maximises: Social learning, Media richness, Participatory and connectivist pedagogies, Ubiquity and persistence, Open data collection and research processes and Creating connections.

However for Anderson the *sine qua non* of this process is the production of Open Education Resources (OER), which is perhaps both a little reductive and limiting on how we might usefully characterise being an Open Scholar.

As 'change agents for the future' Open Scholars are both 'empowering learners as future teachers', and also inducting their charges into being Open Students, which we read as the inter-generational work of developing co-creative practices in learning.

So Anderson's work is concerned to identify a range of cutting-edge scholarly practices without fully detailing how they might be embedded within the institution, but perhaps with more of an emphasis on Gideon Burton's notion of their 'ethical value'. Haythornthwaite, however, is concerned to identify the emerging affordances of a range of networks and how that might affect ubiquitous learning within society. Boyer however is interested in the professional role of the researcher within an institutionalised 'professoriat'. Our interest is in how we might synthesise these approaches, starting with the PAH Continuum as a model of co-creation that might prove useful.

PAH Continuum

The PAH Continuum is part of the Open Context Model of Learning (Luckin et al. 2010), and like Anderson and Haythornthwaite, it is cognisant of the affordances of new, networked, web 2.0 and later technologies for learning and is consequently designed to enable their emergence within the practices of teaching and learning.

We have argued in the Open Context Model of Learning that the PAH Continuum allows for a teaching and learning process to be developed which delivers good subject-based learning, the prime concern of educational policy-makers, whilst enabling collaborative learning strategies and creative forms of assessment to be deployed. Cochrane has demonstrated how this might be done using mobile technologies on the Product Design degree at Unitec, NZ (Cochrane 2010a) by incorporating it into the design of technology use, and into supporting the increasing self-management of learners. So we believe the PAH Continuum helps in incorporating open learning affordances and networked effects into institutional contexts, given appropriate institutional-readiness (Cochrane 2010b).

Developing Boyer's types of scholarship

So let us look at how we might review Boyer's four types of scholarship in light of the approaches mentioned earlier, inspired variously by social media, digital tools, open learning and network effects.

Discovery	Build new knowledge through traditional research.	Publishing in peer-reviewed forums Producing and/or performing creative work within established field Creating infrastructure for future studies

Figure 1. Discovery 'type' of Boyer's Model of Scholarship.

Discovery

For Boyer this is the phase of scholarship where new knowledge is built through traditional research. Whilst this is a reasonable description of subject-based research where new knowledge about say plant cells can be discretely studied and identified, it is less relevant to learning/interdisciplinary research. What it clearly identifies is how new knowledge that will be used in subject-based teaching will be determined. So for the moment we will leave the descriptors relating to Discovery as one type of scholarship unchanged as that is not our immediate concern. However, we will review them at the end of the article as part of considering how we might develop scholarship as an ongoing iterative process, after examining the whole of Boyer's DIAT model (see Figure 1).

Integration

The Integration phase of Scholarship in Boyer moves beyond the professional orientation of the traditional researcher, as described in the Discovery phase, to look at a narrowly defined notion of an 'interpretation of knowledge', including descriptors of practice and also with a focus on the production of learning materials. These are identified very practically, as literature reviews, textbook creation and course design, but somewhat traditionally. This ignores developments coming from the Learning Technology community over the past 15 years as described by, for example, Conole and Alevizou (2010) and the newer affordances of social media and its network effects (Haythornthwaite 2009). In our view, literature reviews themselves have also been supplemented by data mining techniques using a range of social media tools (Kelly 2011) A number of groups are also examining digital research practice in the age of social media and are producing fresh taxonomies in this field from the librarian's perspective (British Library 2011) More importantly the process of learning content production is being transformed rapidly, most notably by the OER and Open Courseware (OCW) movements, so much so that Anderson in particular sees this as a key descriptor of being an Open Scholar. Additionally we are seeing a number of syllabus-free approaches to learning, such as those proposed by Sugata Mitra (2009) and Ian Cunningham (2005), who separate learning content from

Integration	Enable the use knowledge across disciplines.	Preparing comprehensive literature reviews Undertaking data mining analysis Producing Open Education Resources (OER) & Content Creation Tools Enabling generative network effects to occur

Figure 2. Integration 'type' of Boyer's Model of Scholarship (modified).

learning process, something Cochrane has also developed using the PAH Continuum in course design (Cochrane 2010a).

A more complex dimension is that of enabling 'network relations' (Haythornthwaite) to 'emerge', which might mean allowing new social groupings to emerge around new contexts, as suggested in the Emergent Learning Model (Garnett 2010), or by enabling 'flocking' (Dron and Anderson 2008). This suggests that we need an approach reflecting the divergent design of resources for appropriation and use in multiple contexts, rather than a convergent design process concerned with educational instruction within an institution. An integration phase of scholarship might be better served by a process of enabling knowledge to be opened out by networked effects and used in a more inter-disciplinary way in a range of contexts. So we suggest the set of descriptors as highlighted in Figure 2 (changes highlighted in red).

Application

In the 'Application' type of scholarship Boyer's looks for the external validation of the scholar through the application of their knowledge in other communities. Whilst this is certainly a valuable social process, we would rather the research professional started with developing their professional communities of practice through a collaborative mentoring process, as described by Cochrane (2010a) in his description of educational communities of practice as course teams. Whilst becoming sufficiently expert as professionals to be able to advise industry and government is clearly of value to the scholarly academic, and also to their host institution, a broader notion of public engagement should also be considered as we move to a more networked society, with more of a peer-to-peer focus (Shirky 2008) and away from the more traditional notion of institution to institution linkages to promote the career of one individual. This is closer to what Dron and Anderson call the 'Taxonomy of the Many' (2007) shifting the range and character of institutional linkages whilst adding in concerns with public engagement of HE Institutions as they evolve (NCCPE 2009).

The collaborative affordances of social media mean that possible new, networked effects (new partnerships, institutional models, new models of learning and teaching, new modes of innovation) need to be positively designed for institutionally, enabling what Garnett and Ecclesfield (2008) call 'adaptive institutions working across collaborative networks'. So Boyer's institutional descriptors in 'Application' need

Application	Aid society and professions in addressing problems through serving community and public needs and purposes	Mentoring colleagues collaboratively Serving industry or government as an external consultant Assuming leadership roles in professional organizations Empowering learners through co-creation to become future scholars Working with community groups and on public engagement strategies Using network effect to transform practice

Figure 3. Application 'type' of Boyer's Model of Scholarship (modified).

to be broadened beyond direct linkages just with industry and government, both of which are going through their own transformations anyway in the post web 2.0 world (Enterprise 2.0 and Gov 2.0). They need to be made adaptive, to be reflective of a broader range of stakeholder interests (as developed in the recent JISC Curriculum Development and Design initiatives 2010) and also to incorporate community responsibilities and ethical approaches, like those defined by Michael Gurstein concerning Community Informatics (2007) × (see Figure 3).

Teaching

We feel that the existing descriptors in the Type 'Teaching' mostly reveal how little Boyer's model reflects the range of transformations in scholarly practice effected by learning technologies and social media in recent years. This might best be exemplified in the five-year-old self-organised TeachMeet programme (2006). Again, whilst this has the merit of clarity in how it describes teaching responsibilities, the descriptors have been overtaken by events. For a start it is now not unusual to link together the processes of learning and teaching, and not just in Vygostky-based constructivist approaches, so it is impossible to discuss this Type without incorporating a greater degree of issues concerning learning and the role of the student, thus capturing the more participative approaches to education that have been emerging in recent years (Anderson 2009; Conole and Alevizou 2010; Cochrane 2010a).

In order to reflect this we have added the descriptor 'Teaching as a reflective and dialogic practice promoting learning', which also mirrors the work we have done on developing the PAH Continuum in the 'Craft of Teaching' (Ecclesfield and Garnett 2010). This more dialogic approach to teaching and learning as practice means that the notion that a teacher would merely 'study' a pre-defined approach to teaching in the classroom has been replaced by the potential for more andragogic, or negotiated, approaches to the process of learning. As Mitra (2009) has shown, resources can now be introduced from a range of contexts via the Internet so teachers need to be capable of 'brokering' learning (Jennings 2010) as resources can be introduced on the fly within the learning process by learners themselves. As Anderson indicates, learners now have personal learning networks extending beyond their immediate learning environment, so teaching needs to be capable of negotiating a range of learning contexts (see Figure 4).

Teaching	Promote Teaching as a reflective and dialogic practice promoting learning	Advancing learning theory through contextual research and practice Collaborating in the design and delivery of courses & learning programmes Brokering new learning processes Developing Open Students Designing and implementing responsive assessment systems

Figure 4. Teaching 'type' of Boyer's Model of Scholarship (modified).

Co-creating

Finally we look at the proposed additional 'type of Scholarship', that of co-creating. A key phrase in O'Reilly's description of Web 2.0 (2005) is that it is in 'permanent beta' which might be highlighted as a factor in why some teachers resist new approaches to teaching, but which has transformed the way we now view a range of processes. We would argue that we are now in a world in which knowledge creation itself is in permanent beta, what Weinberger describes as Everything is Miscellaneous (2008), or the 'post-digital disorder'. Consequently the notion of a linear process of knowledge creation with knowledge discovery as the role of researcher and knowledge transmission as the role of the teacher, as separate scholarly practices, has been replaced by a more fluid and dynamic process which we are only just beginning to understand. The emerging knowledge networks are no longer something about which we receive information from researchers, they are processes in which practitioners participate, and we need to design scholarship practices that reflect this.

The dynamic outline of Open Scholarship that Anderson has presented (2009) provides an insight into the ethical issues in developing this approach, whilst also indicating the ongoing range of initiatives in development that support an Open Scholarship approach, which will need to be adapted to as their mature and prove their scholarly value. Haythornthwaite's more synthetic vision of scholarly practice anticipates some of the cultural shifts that might change that practice in more participatory, networked societies.

We see these as differing ways of addressing the positive aspects of the emerging 'permanent beta' world of knowledge resources and knowledge creation, but what we are trying to do here is to evolve the traditional notions of scholarship in light of these emerging theories of teaching and learning, post web 2.0, and integrate the worlds of scholarship, along with teaching and learning to reflect the changing qualities of knowledge in a networked world where the ubiquity of social media is a quality that also challenges our traditional notions of academic institutions. We think the essence of this lies in the notion of co-creating learning and so we have added this as an additional type of Scholarship, namely 'Co-creating'.

We see the dimensions of this new view of scholarship emerging from the process of engaging in collaborative peer-to-peer networks, which would also practice inter-disciplinary approaches, which might also be disruptive of existing subject disciplines. This disruptive quality is what we describe as heutagogy and we have indicated how that can be deployed in the learning and teaching process in the PAH Continuum (Luckin et al. 2010). The PAH Continuum is a framework of teaching and learning that allows for epistemic cognition to emerge by co-creating learning, and it is

Co-creating	Participating in the perpetual Beta of knowledge creation through the co-creation of learning	Engaging and collaborating in peer networks Engaging in activity to develop, disrupt or join up established fields Enabling Epistemic Cognition to be a part of evolving subject frameworks Creating infrastructure for future learning and research

Figure 5. Co-creating 'type' Scholarship (proposed).

through epistemic cognition that new knowledge can be forged (Avramides and Luckin 2007), see Figure 5.

Reviewing discovery

The discussion of the co-creation of Open Scholarship presented here, where we have also presented a deeper notion of the role of the co-creation of learning together with the learner, or the Open Student as Anderson puts it, also enables us to incorporate epistemic cognition into the learning process. However the inclusion of epistemic cognition also changes the description of Discovery as a type of scholarship because epistemic cognition, within the co-creation process described in the PAH Continuum, is capable of stimulating research agendas *within* the learning process. In which case we might wish to redefine Discovery as the 'co-creation of research agendas'. So that Discovery as a type of scholarship might be better described as in Figure 6.

Conclusion

So through examining Boyer's traditional approach to scholarship and by contrasting it to a range of emerging practices, admittedly driven by new web and social technologies and the early responses of Anderson in his reflections on Open Scholarship, and Haythornthwaite in her reflections on networked societies, we believe that we can outline a framework in which a co-creation model of scholarship can be developed and recognised professionally. What is presented here is merely a proposed outline, which we hope will be discussed, torn apart and further developed. For now here is our proposition of what a co-creation model of Open Scholarship (Table 2) might look like in light of the above discussion.

Caveat

We have not discussed many new pedagogies, such as Connectivism in this article, nor new approaches to scholarship, such as e-science or Technology-Enhanced Research. This is not because we think they have nothing useful to say: obviously they do. However, our starting point was to find a bridge between Boyer's Model of Scholarship and Open Scholarship whilst taking account of relevant work, concerning the co-creation of learning. This then lead to a broadening out of the debate and the references used such that this might appear as an overview of networked learning theories, which it is not. We view this as perhaps the start of process of discussion and would obviously welcome the views of for instance Siemens (2005) and Downes (2005) from both their Connectivist and E-learning 2.0 perspectives, amongst many others.

Discovery	Aggregate new forms of knowledge through the co-creation of research agendas	Identifying useful domains for research Publishing collaboratively in peer- edited fora *Performing creative work in education* Dynamically supporting new infrastructures for learning

Figure 6. Discovery 'type' Scholarship (proposed).

Table 2. Co-creation model of Open Scholarship.

Type of scholarship	Purpose	Measures of performance
Discovery	Aggregate new forms of knowledge through the co-creation of research agendas.	Performing creative work in education Identifying useful domains for research Publishing collaboratively in peer-edited fora Dynamically supporting new infrastructures for learning
Integration	Enable the use knowledge across disciplines.	Preparing comprehensive literature reviews return Undertaking data mining analysis Producing Open Education Resources (OER) & Content Creation Tools Enabling generative network effects to occur
Application	Aid society and professions in addressing problems through serving community and public needs and purposes	Mentoring colleagues collaboratively Serving industry or government as an external consultant Assuming leadership roles in professional organisations Empowering learners through co-creation to become future scholars Working with community groups and on public engagement strategies Using network effects to transform practice
Teaching	Promote Teaching as a reflective and dialogic practice promoting learning	Advancing learning theory through contextual research and practice Collaborating in the design and delivery of courses & learning programmes Brokering new learning processes Developing Open Students Designing and implementing responsive assessment systems
Co-creating	Participating in the perpetual Beta of knowledge creation through the co-creation of learning	Engaging and collaborating in peer networks Engaging in activity to develop, disrupt or join up established fields Enabling Epistemic Cognition to be a part of evolving subject frameworks Creating infrastructure for future learning and research

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Stepping beyond the paradigm wars: pluralist methods for research in learning technology

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(Received 2 March 2011; final rersion received 12 June 2011)

This paper outlines a problem we have found in our own practice when we have been developing new researchers at post-graduate level. When students begin research training and practice, they are often confused between different levels of thinking when they are faced with methods, methodologies and research paradigms. We argue that this confusion arises from the way research methods are taught, embedded and embodied in educational systems. We set out new ways of thinking about levels of research in the field of learning technology. We argue for a problem driven/pragmatic approach to research and consider the range of methods that can be applied as diverse lenses to particular research problems. The problem of developing a coherent approach to research and research methods is not confined to research in learning technology because it is arguably a problem for all educational research and one that also affects an even wider range of disciplinary and interdisciplinary subject areas. For the purposes of this paper we will discuss the problem in relation to research in learning technologies and make a distinction between developmental and basic research that we think is particularly relevant in this field. The paradigms of research adopted have real consequences for the ways research problems are conceived and articulated, and the ways in which research is conducted. This has become an even more pressing concern in the challenging funding climate that researchers now face. We argue that there is not a simple 1 to 1 relationship between levels and most particularly that there usually is not a direct association of particular methods with either a philosophical outlook or paradigm of research. We conclude by recommending a pluralist approach to thinking about research problems and we illustrate this with the suggestion that we should encourage researchers to think in terms of counter-positives. If the researcher suggests one way of doing research in an area, we suggest that they should then set out an opposing research approach from another perspective or paradigm. We link this conclusion to the provision of research training and the kinds of curricula that might be offered and we argue against the superficial and box ticking 'coverage' of different standard research perspectives e.g. 'qualitative methods' – 'qualitative methods'

Keywords: qualitative methods; quantitative methods; mixed methods; paradigms; methodology

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ISBN 978-91-977071-4-5 (print), 978-91-977071-5-2 (online)

DOI: 10.3402/rlt.v19s1/7798

The learning technology landscape

Learning technology is a developing field of study and an emerging area of work (for two recent reviews see Czerniewicz 2008, 2010). The field is an emerging profession with its own community of workers and a pattern of employment (Beetham, Jones, and Gornall 2001). It is also an area of academic interest, and the field has its own journals, conferences and related postgraduate qualifications. These two aspects are closely related to each other, for example through the accreditation of learning technologists (Oliver et al. 2004). The emerging professional field around learning technology is also the audience for much of the research output from the academic world concerned with learning technology. This audience for research is also the source for much of the demand for qualifications at post-graduate level supporting the successful development of a variety of Masters and Doctoral level programmes. Learning technology is a domain that has a boundary with other professional groups, including educational developers who have their own community and an overlapping area of interests (Hudson 2009).

Diversity remains in the terms used to describe this still emerging field and there are also arguments about whether the field, for many refuse to call it a discipline, remains amorphous and disjointed or is now growing up and attaining a kind of intellectual unity (Czerniewicz 2008). A unifying factor in the field is its location in relation to new technology. Jones (2004a) has argued drawing on Barley and Orr (1997), that learning technologists, in a similar way to other technologists, have a distinct relationship to theoretical and scientific knowledge because they are largely consumers rather than producers of basic knowledge. The growth of scientific and technical knowledge has had an impact on education in two distinct ways.

(1) The growth in demand for basic and applied scientific knowledge has led to the proliferation of new fields and disciplines, such as the learning technologist. In technical disciplines it is increasingly difficult for individuals to master the breadth of knowledge required and there is an increasing pressure to re-combine specialist technical functions created through a division of labour, that were once integrated in the person of the lecturer.
(2) The second impact is in the contradictory process of re-skilling and de-skilling in which routine duties are reallocated to less well trained staff alongside an increased demand for fully trained professional staff. In this context the demand for learning technologists comes in part from an increasing technical division of labour arising from the application of new technologies to teaching and learning.

The application of new technologies in an educational context means that design has become a key term for research in learning technology. Because design can be viewed as a social practice, which may be explicitly informed by scientific theory, it is a form of practical and ethically informed work. Design involves both a systematic approach, which may involve rules and protocols derived from research, and an art applied in a set of local and context based practices. Design, thought of in this way, is a skilful and creative activity which is open to improvement and development from the application of research and scholarship (Jones and Dirckinck-Holmfeld 2009). Because of the applied nature of learning technology and the

multi-disciplinary nature of the intellectual resources for the field there are those that have drawn an analogy with design in other fields:

> Understanding the character and limits of *design* is important in networked learning. I originally used analogies with ergonomics and especially with architecture to rethink educational design and I still find them useful sources of insight. Architecture involves the crafting of affordances, rather than deterministic logics of human control. Architecture has methods for managing complexity – not just complexities of construction but also complexities of representation and design. Architecture draws on multiple sources of knowledge and combines ways of knowing. It understands people from – at least – the perspectives of biology, psychology and culture. It understands – at least – the physics, geometry, economics, aesthetics and history of buildings. Its practices are imbued with epistemic fluency, to a degree that makes many educationalists look, unexpectedly, like members of the Spanish Inquisition. (Goodyear 2009, viii)

Unlike Goodyear, there are those who define the field (in this case described as 'instructional technology') more narrowly as a 'design field' (Reeves, Herrington, and Oliver 2005, 7). The suggestion these authors make is that 'design-based' research is the primary solution for research deficiencies in the field. In our opinion this kind of restriction limits the responses of researchers in the field of learning technology. We suggest that researchers pursue a variety of research goals using high quality educational technology investigations. Ross and Morrison (1989) differentiate between 'developmental' research, which "is oriented toward improving technology as an instructional tool", and 'basic' research, which is "oriented towards furthering our understanding of how these applications affect learning and motivation" (20). More recently Ross, Morrison, and Lowther concluded that:

> we encourage researchers to reduce efforts to prove the "effectiveness" of technology, while focusing on conducting *rigorous* and *relevant* mixed-methods studies to explicate which technology applications work to facilitate learning, in what ways, in which contexts, for whom, and why. (Ross, Morrison, and Lowther 2010, 31)

In essence what Ross and Morrison (1989) and Ross, Morrison, and Lowther (2010) are arguing for is that different types of inquiry, with a range of approaches and foci, should be possible under the banner of 'learning technology research'. This argument, and conflicts that have surrounded it, have to a certain extent been captured in the term 'paradigm wars' (Gage 1989).

Paradigms in learning technology research

The term normal science and the linked concept of paradigm are most commonly associated with Thomas Kuhn and his book *The Structure of Scientific Revolutions* (1970). Kuhn is remembered for providing an account of scientific progress that emphasised a form of punctuated equilibrium in which periods of normal science were occasionally disrupted and existing ways of thinking were replaced by new revolutionary changes. Kuhn described paradigms as being closely related to the idea of normal science and exhibiting two characteristics:

(1) A scientific achievement that was so unprecedented that it could attract an enduring group of adherents from other competing modes of scientific activity.
(2) It was sufficiently open-ended as to leave many problems for the new group of adherents to resolve (Adapted from Kuhn 1970, 10)

Paradigms are social phenomena in which "accepted examples of actual scientific practice – examples which include law, theory, application, and instrumentation together – provide models from which spring particular coherent traditions of scientific research" (Kuhn 1970, 10). The effect of paradigms for students is that because they join others who learned the basis of the field from the same concrete models, their subsequent practice will seldom evoke overt disagreement over fundamentals (Kuhn 1970, 11). Consensus is a pre-requisite for normal science and, by adopting a paradigm, students "are committed to the same rules and standards for scientific practice" (11).

Traditionally two separate paradigms of inquiry dominated research in education. The early years of educational research were dominated by psychology and a largely positivist understanding of scientific method. More recently a powerful counter current concentrated on the development of qualitative research using a largely interpretivist approach to analysis. These two research approaches have traditionally been seen in opposition which is well reflected in debates that took place many years ago in what have been described as the 'paradigm wars' (Gage 1989).

The paradigm wars saw researchers with particular philosophies and methods of inquiry arguing strongly that 'their way' was the most appropriate. In 1989, Gage fittingly imagined the situation 30 years in the future; hence in our recent past in 2009. He argued that there were three possible outcomes available:

- The positivist, establishment, mainstream, standard, objectivity-seeking and quantitative approach had died of the wounds inflicted by its critics.
- Peace had broken out in an earnest dialogue, lifting the discussion to a new level of insight, making progress toward workable solutions of and generating theory that fitted together.
- Nothing that was true in 1989 had really changed, and the wars were still going on.(Adapted from Gage 1989, 10)

By 2009 peace had broken out, but not in the earnest and productive way that was envisaged, rather as Kuhn might have anticipated, it had become peaceful with the restoration of a period of 'normal science' in which a single dominant paradigm settled the basis for major disputes through a division of spoils. So rather than being settled or resolved in favour of a clear winner, the paradigm of research in the social sciences embedded the distinction between quantitative and qualitative methods in a way that often implies that they are incommensurable approaches. Jones (2004b) has argued previously that the division between quantitative and qualitative methods has become overdrawn and rooted in an excessively theoretical approach to social research. One result of the division between two distinct research methods has been that, increasingly, commentators on social science research, including that undertaken by educational technologist, advocate mixed-methods and pragmatic approaches to research (e.g. Johnson and Onwuegbuzie 2004; Salomon 1991; Shulman 1988). We argue that the research agenda embraced by learning technologists should indeed be pluralistic but perhaps more importantly that the field needs to step beyond the form of 'normal science' that has become institutionalised since the paradigm wars into the quantitative-qualitative divide in social science and hence learning technology research.

Students' exposure to research and use of opposing paradigms

When students begin their research training they are often confused between the different levels of analysis when thinking about methods, methodologies and research paradigms. For example students regularly conflate quantitative methods with a positivist approach to research. These confusions arise from a number of sources, one of which is a desire or requirement to make their research plans consistent with what is often described as an overarching philosophical position in terms of ontology or epistemology. An example of this type of confusion is seen when students feel it is necessary, in their discussion of the methodology underpinning their research, to show that they have considered deep philosophical questions concerning the nature of phenomena and come to a definite conclusion. These students are frequently untrained in philosophy and are addressing profound and intractable problems, yet they feel obliged to make definitive statements. Having engaged with and 'covered' the philosophy, students often take the argument forward by the selecting an appropriate paradigm for research prior to clarifying the research problem.

When seen in this way, approaches to research become simple recipe-following, leading to a mechanical selection of a specific method. An example would be the choice of a qualitative approach to research and the adoption of one or other forms of Grounded Theory as the methodological outcome of the choice of paradigm. This kind of development in a research project is not simply the outcome of poor student choices; rather it often reflects implicit and explicit commitments within particular departments and research groups. It can be the influence of individual faculty members and the outcome of historical recruitment patterns of staff reflecting specific kinds of expertise in particular methods and research approaches.

Pathways in learning technology research training

Research training in the social sciences currently enforces the single dominant paradigm highlighted above in the agreed binary division of spoils into quantitative and qualitative research. The Economic and Social Research Council in the UK, the main funding body for social science research has until recently accredited research training in what are termed 3+1 PhD programmes. The +1 element of the four year programme is a Masters in research which provides a curriculum that generally includes modules called Quantitative and Qualitative research methods or variants on this distinction, for example Qualitative Research Practice and Introduction to Statistical Analysis. This conventional framework for research methods training is not confined to the UK. For example from the Australian context, the 2010 Charles Sturt University handbook of subject offerings, available online, shows that postgraduate students can enrol in (our emphasis).

> **Qualitative research methods** This subject introduces students to the field of qualitative research. The first half of the subject requires students to critically engage with some of the major theoretical debates, which both define the field and delineate between different kinds of qualitative research. The second half of the subject asks students to apply the ideas discussed in the first half by conducting a piece of qualitative research in an area of their own choosing... Using a structured and sequential list of readings, stimulus questions and spaces for student reflection, the subject prosecutes a single objective; *that all research method choices should derive from philosophical and theoretical principles*

which can be explained and defended, as opposed to simply conforming to taken-for-granted ideas about how research should be done.

Quantitative research methods This subject is designed to introduce students to research methodologies and statistical procedures that are commonly used in quantitative research. As the central aim of the subject is to enable students to become intelligent and critical readers of research literature, the emphasis is on the purposes and constraints of selected statistical procedures. This requires a basic understanding of fundamental constructs that underpin data collection procedures and data analysis in quantitative research. Considerable emphasis is given to statistical procedures including univariate and bivariate analysis, as well as more sophisticated multivariate techniques. From this foundation, students are required to submit a proposal for quantitative research study, which asks students to identify a problem in the broad field of education, develop a research question or hypothesis, define the inherent constructs, select appropriate methods to investigate these constructs, and determine an analysis plan.

A clear implication of our argument thus far is that graduate students undertaking research training in learning technology need to be exposed to a range of approaches to learning technology research. The standard approach to this area within postgraduate studies at university would be familiar to many: the unit, subject or course that provides students with discrete explanations of the popular historical and contemporary approaches to social science research. Many of these courses will give students an opportunity to apply the research methods they have covered in the course to their own research project or problem. Often this will result in students – perhaps after a period of reflection and consideration, perhaps after asking what their student colleagues "are using" for their research and even in consultation with their research advisors – adopting a research method that is consistent with their department, research group or advisor. In many cases this will result in research questions and aims being investigated using appropriately framed paradigms, methodological approaches and methods.

But what is often missing from this approach is a genuine consideration of alternative framings and approaches to learning technology research. When asked to apply what they have learnt in 'Research Methods' courses to their own research problems, unsurprisingly students typically gravitate towards what they, their advisors or their departments, 'know', advocate and feel comfortable with. So while students are exposed to – or told about-different flavours and styles of learning technology research, they are often not, in our experience, encouraged to think deeply about the implications of these approaches when it comes to the actual conduct of learning technology research. Given this, we offer an example of an approach to research training in learning technology that actively encourages students to consider alternative perspectives or pathways that can be taken in learning technology research. An approach Kennedy has used in advising higher degree research students is the use of *counter-positives*.

When students are describing and defining their investigations within a research project he will often ask them to clearly articulate their aims, goals or questions, their methodological approach to these questions and how they will actually go about collecting or generating data. While many students will need help in this, most will be able to come up with workable research approaches. In fact, some students are able to quickly articulate their methodology and method on the basis of their previous academic experiences. A common example of this from work in the health sciences is that students propose a clearly articulated experimental method as an approach to

investigating what are fundamentally exploratory research questions in the area of learning technology.

Regardless of what students propose in the first instance, we often find it useful for students to actively consider alternative approaches to their specific research investigation and problem. So the student who proposes an experimental method will be asked to consider how the same or similar question could be investigated using a contrasting paradigm, methodology and method. In doing this, students will see how the nature of their research aim or question may change, often quite subtly, in response to an alternative investigative approach. They will also see how an alternative methodological approach to a research question might generate data that would be neglected with the approach originally advocated; and the new type of data might seem more useful in responding to the question. This would often result in thinking more deeply about how the original question might be changed or how the methodology and approach to the research might be changed. By discussing and reflecting on *counter positive* research approaches, we hope students come to understand, whatever approach they ultimately choose, there is a need for pluralism in learning technology research.

Pressures on the current paradigm

While we are in a period of normal science there are several pressures on the current paradigm, which embeds the division between qualitative and quantitative research in learning technology. Firstly new technologies have opened up new kinds of research relevant to the field. Some of these, such as Virtual Ethnography (Hine 2000; Wittel 2000) extend the range of possibilities for researchers, but pose no great challenge to the existing paradigm of normal research in learning technology. However there are other developments that threaten to undermine existing divisions into neat methodological categories. Flyvbjerg (2004) argues for a proper and full place for case studies in social science research but notably in his conclusion he makes the point of arguing that this approach does not exclude whole population survey research, which he argues has a complimentary role to play. Herring (2008) suggests integrating discourse analysis with Social Network Analysis in an expanded form of Content Analysis and Judd and Kennedy (2010) used computer logs over a five year period to monitor students' actual rather than reported technology use and the variation in that usage over time. Commenting on the impact of internet technologies on qualitative research Baym and Markham (2009) note that:

> the internet brings into sharp relief previously assumed and invisible epistemologies and practices of inquiry. In fact, challenges of conducting internet research have prompted its researchers to confront head-on, numerous questions that lurk less visibly in traditional research contexts. Consequently internet researchers have been compelled to reconsider basic principles and practices of qualitative inquiry, with important critiques of a priori methodological certainties (Baym and Markham 2009, viii)

All these examples show how current research, especially that engaged with new technologies, questions the taught division between quantitative and qualitative research and these minor challenges to the joint quantitative-qualitative paradigm are amplified in a range of new types of research that rely on the naturally occurring data collected by computers and computer networks and access to new kinds of data.

Some of the emerging methods of research may pose a more fundamental challenge to the current paradigm. To illustrate these potential challenges we have chosen two emerging research areas.

1. Network analysis (Barabasi 2002), including SNS (e.g. Haythornthwaite 2005), learner analytics (Retalis et al. 2006) and visualizations.

Large data sets can be mined for naturally occurring data that describe patterns of interaction that have stable features in aggregate even though individual interactions remain contingent. For example Barabasi's work points to the prevalence of scale free networks in a variety of phenomena including mobile phone links, Internet and Web connections. Social Network Analysis has developed a language for research and a set of techniques as well as stable results, for example about the approximate size of personal networks. The techniques of SNS can also be applied to generate powerful visualisations (Dawson, Bakharia, and Heathcote 2010)

2. Neurological studies e.g. studies on the brain in relation to the effects of immersion in new technologies (Bavelier, Green, and Dye 2010; Dalgarno, Kennedy, and Bennett 2009; Meyler et al. 2008)

Neuroscience has an obvious connection to education but it has a specific relationship to ideas in learning technology through the claims made by authors such as Prensky (2001) about the effects of technology immersion on the brains of young people.

The suggestion to which our argument gives rise is that normal science, conducted within an overall paradigm of research allowing two different traditions to co-exist, is being challenged by a major shift in the research environment related to digital and networked technologies. There is a danger that the co-existence of two research approaches in one research area leads to a dialogue of the deaf with researchers only listening to research conducted within their own research domain and ignoring research using other approaches. It is the pressing issues and challenges that face learning technologists that will drive students and researchers to explore existing problems in new ways, using the new technologies as research instruments and platforms, and examining the novel problems that arise alongside the developing technological environment.

The drive for change in research training is most likely to be driven by research students challenging existing training and research practices. The second potential source of challenges to the existing paradigm in learning technology research lies in the topics we address. Both authors have engaged in recent years with issues concerning the relationship between new technologies and students' attitudes and behaviour, often characterised using the terms Net Generation and Digital Natives. The kinds of claims made by Prensky (2001) with regard to the brain, cannot be answered by the standard repertoire of educational research methods and require the use of additional techniques (Bavelier, Green, and Dye 2010), such as Magnetic Resonance Imaging (Dalgarno, Kennedy, and Bennett 2009). This research topic requires complex approaches incorporating standard methods, including surveys, to describe what is happening and qualitative work to explore why students act in the ways that they do, but extending beyond this normal repertoire researchers have been engaged in exploring novel methodological approaches that stretch existing

boundaries (Judd and Kennedy 2010; Dalgarno, Kennedy, and Bennett 2009; Jones and Healing 2010).

Conclusion

We have argued that learning technology research is currently dominated by a paradigm that divides research into qualitative and quantitative types. We are by no means original in suggesting that the division is no longer useful and possibly false (Layder 1993). We go on to argue that the division has become 'normal science' in learning technology and it has provided a consensus that has allowed researchers to avoid disagreements over fundamentals. It has also provided the framework for standard research training. We have argued that this standard framework is coming under pressure from developing research techniques which are particularly relevant to learning technologists. Some of these, for example neuroscience methods, stand in a more or less traditional scientific paradigm. Others such as the use of naturally recorded log data and data mining techniques applied to large corpuses of data sit less clearly within the standard framework. It is not yet clear if these new techniques will undermine the existing paradigm or simply be absorbed by it.

In practical terms we have explored ways to focus more explicitly on the tension between research approaches through the use of the example of using counter positives in postgraduate students' research training. This suggestion illustrates ways that we think it is necessary to develop research training that address the problems and confusions arising from adherence to a strong notion of the linkage between individual research methods and overall research philosophies. We argue for a pragmatic approach to method which pays greater attention to the research question being addressed rather than to any overall philosophical tradition. We conclude by highlighting that the current consensus about research methods in learning technology research may very well be under threat from the development of methods enabled by new technologies that do not fit within 'normal science' as practiced in learning technology research.

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Learning through online discussion: a framework evidenced in learners' interactions

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(Received 14 June 2011; final version received 22 June 2011)

Online learning, often supported through online discussion, is not only a popular means of supporting off-campus learners, but increasingly has a place within campus-based learning courses. Laurillard and others suggest that there are assumptions being made about learning through online discussion that have yet to be fully tested, and therefore there is a need to examine this area further. Tutors and learners may benefit from having a greater insight and understanding of how engaging in asynchronous online discussion presents opportunities for learning on an individual and a collective basis. This research study focused on learners' engagement with online discussion and their perceptions of how engaging in online discussion impacts on learning. This paper revisits learning through online discussion and proposes a framework, which emerges from the analysis of learners' experiences. A grounded theory approach was used in the collection and analysis of six learner case studies within a higher education setting, exploring learners' interactions in online discussion, and their perceptions of learning through online discussion. Insights into the learners' interactions were provided by the learners themselves through semi-structured interviews. The grounded approach to the analysis of the interviews enabled the learners' voices to be heard in terms of what they thought about learning through online discussion. The insight enabled through the depth of description from the learners and the examination of the online interactions led to the development of a framework for learning through online discussion. The framework raises the importance of articulation as a key process in learning whilst highlighting the opportunities for collaborative informed thinking by engaging with the ideas of others. The focus given to the learning process through the framework will be of interest to tutors and learners who use online asynchronous discussion environments for learning.

Keywords: computer mediated communication; learners' experiences; asynchronous discussion; grounded theory.

Introduction

The potential of computer mediated communication (CMC) as a means of enabling interactions and sharing of ideas between learners, wherever and whenever the learner is situated, has been extolled for more than two decades now.

> "*CMC has the potential to provide a means for the weaving together of ideas and information from many people's minds, regardless of when and from where they contribute.*" Kaye (1989, 3)

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ISBN 978-91-977071-4-5 (print), 978-91-977071-5-2 (online)

DOI: 10.3402/rlt.v19s1/7779

However, these benefits are not always realised by learners and there is much still to know about learning within an online discussion environment, as has been identified in other studies such as Downing et al. (2007) who recognise the need to know more about effectively supporting and sustaining learner engagement in online environments. Peters and Hewitt (2010) note that there is a need to know more about the online behaviours of students in asynchronous discussion and a need to focus more on learning outcomes. The need to know more about learning, and the experiences of learning, in online discussion is highlighted within this paper.

The paper reports on a qualitative, phenomenographic study which focuses on six learners' experiences in a Higher Education setting in Scotland, within two different subject disciplines. A grounded approach to analysing the learners' interactions and their perceptions of their experiences, offers an insight of learning in these discipline settings. The findings from the study led to the development of a framework for learning through online discussion. The proposed framework draws together the experiences of the learners with insight available within research literature about learning through the processes of writing, as may be applicable to posting messages in an online discussion environment. Implications for tutors and learners in asynchronous discussion are discussed.

Background

Mayes and de Freitas (2007), and more recently Laurillard (2009), expressed the view that there is nothing new to know about learning, with the implication that what is known about traditional modes of learning will transfer to learning in online environments. Despite the increasing availability of guidelines relating to tutoring online (e.g. Salmon 2000; Laurillard 2002; Garrison and Anderson 2003), the guidance offered does not seem to transfer into consistent approaches to learning online. McConnell (2006) highlights that not all learners are enthusiastic about engaging in online learning. Other studies raise other issues in relation to the use of learning through online discussion, such as some learners not having the skills required to work in collaborative social constructivist environments (Murphy et al. 2005). Sharpe et al. (2006) and Ellis et al. (2007) caution that some students do not know how to engage effectively in face-to-face discussion and that this may impact on them being able to benefit from the online discussion. Kim and Bateman (2010) likewise consider that there is a need for students to be helped in developing skills to engage with discussion. Therefore, tutors need to know more about supporting online discussion, and there is a need to understand more about learners' engagement with online discussion, as suggested by Ravenscroft (2005) and Goodyear and Ellis (2008).

Engaging in asynchronous discussion potentially benefits learners by enabling them to take time to reflect on messages previously posted before making their own contribution. Browne (2003) and Macdonald (2006) consider that the time delay affords thinking time. Others such as McConnell (2000) and Andrews and Haythornthwaite (2007) highlight that the permanent nature of the messages posted provides opportunities to reflect on the messages as and when required by the learners. However, the extent to which message posts are actually used for reflection is questioned by Ellis et al. (2007). The potential benefits of learning through online discussion are well documented but not always evidenced in practice, and current research suggests that there is a need to know more about how learners actually

spend their time online. Gilbert et al. (2007) and So (2009) call for further research about student interaction in online environments.

However, further consideration needs to be given to the nature of online discussion in that it is neither like oral discussion nor individual writing. Andrews and Haythornthwaite (2007) draw attention to the differences in modes of communicating in an asynchronous discussion environment, citing Erickson (1999) who considered online discussion to be sometimes like formal published text and at other times to be like informal chat. The text-based medium of online discussion creates opportunities for enhancing learning by engaging in writing as a process of learning. Bereiter and Scardamalia (1987) consider that the act of composing helps to shape and develop understanding whilst writing, if the writing is consciously reviewed whilst composing. Ritchhart and Perkins (2008) further consider that the process of articulation or externalising thinking either by writing or by talking helps deepen thinking. In asynchronous discussion, there is an opportunity to use writing to articulate thoughts and therefore externalise thinking for others, and to respond to the thinking that is articulated by others. Mercer (2000) suggests that group interactions, which are as a result of paying attention to others' contributions, create opportunities for collective, shared thinking in which the individual thinking of a learner may be shaped by engaging with the thinking of others.

Therefore, there is recognition within the literature on the process of writing to shape thinking, and for individual thinking to be informed by collective thinking. However, the possible lack of skills to engage in discussion or the lack of attention to the messages posted by others means that the opportunities are not fully understood or recognised by learners.

The learners' contexts

The study reported in this paper aimed to explore how learners engage with online discussion. In particular, the study sought to examine the approaches used by the learners and their perceptions of learning with others within an asynchronous discussion environment. The learners were studying at an undergraduate level within a higher education institution in Scotland and from two different subject disciplines. A total of six learner case studies informed the research. Three learners were studying a Scottish Degree level 3 (third year) History of Art campus-based blended learning course; two learners were studying a Scottish Degree level 2 (second year) online Theology course and one learner was studying a first year online Theology course. All six learners were female with a range of prior educational experience.

The History of Art courses were taught on campus but had an online discussion component in the form of a virtual seminar which contributed 20% of the total course assessment. During the online component of the course, the usual class contact time was suspended for a period of two weeks. Learners engaged in discussion about a given virtual seminar topic in groups of four learners. Each learner in the group had a different topic for which they had to write a 2000-word essay prior to the start of the virtual seminar. The essay had to be uploaded in the form of a web page making it publicly available to the others in the group. Learners were explicitly told to engage in the online discussion as an interview format, by asking a minimum of three questions about their peers' essays and responding to questions asked of them within 72 hours. Within these guidelines, they could engage in the discussion wherever and whenever was suitable to them. The learners undertook this course as

part of an honours degree in History of Art. As this was the third year of study in this discipline setting, they were used to engaging in oral discussion within campus-based seminars, and writing about History of Art, but this was the first time that the learning experience required engagement in asynchronous online discussion.

The Theology courses were totally online, and had no campus-based learning component. The course learning materials were available within the online environment. There were six different topics in which the learners were expected to engage in discussion for a period of two weeks per topic. In the first week the asynchronous discussion of the topic was within a small group. In the second week the groups then contributed to a whole class asynchronous discussion. Each learner was at a geographical distance from the campus and was studying the course as part of a Certificate, Diploma or Degree in Theology. Each of Theology case studies was a mature learner and had used online learning and asynchronous discussion in a previous course, with the same tutor and with the same organisation of the learning environment and the learning activities. Engagement in the online discussion for the Theology courses was not compulsory. However, participation in the online discussion was clearly expected. The course study guide highlighted that the learners were to engage with each other and to contribute to the online discussion, and noted that each learner would take on the task of summarising the group discussion at the end of a week.

The case studies

Case studies were selected from learners who had agreed to have their interactions tracked and had been interviewed about their perceptions of learning through online discussion. Preference was given to learners who were in the same online discussion group. The three History of Art case studies were drawn from a class of 24 learners. In the Theology settings, the three case studies were self-selecting as they were the only volunteers from two classes (of a total of 15 learners).

The researcher was an observer of the online interactions and had no tutoring role in either of the discipline settings. The setting for the study was naturalistic (Gubrium and Holstein 1997) as the data were gathered from the online discussion areas, which were part of the intended course learning processes for the learners. There has not been any attempt to try to impose a particular structure or approach to the online discussions to satisfy a research requirement.

Methodology

The research study aimed to examine the learners' perspective of their experience of online discussion and how they engage with online discussion. This required a qualitative research methodology which, in this study, takes a phenomenological and interpretative approach to the analysis of semi-structured interviews with the learners. In order to do so, the study adopted a grounded approach to deriving a theory from the data (Glaser and Strauss 1967). A case study approach (Yin 2003; Stake 2006) was used to focus on the individual learners, to gather in-depth data about the learner and her experiences of engaging in online discussion.

Data were gathered from one institution, two different discipline contexts each with a different mode of delivery of learning, and from three different learners in each of the discipline contexts. Participants were invited to take part in the research before

the online discussion activity took place. For each case study, tracking tools available within the WebCT online environment were used to gather data about the learner's online interactions; discussion posts were captured to explore the nature of the contributions made; and a semi-structured interview was used to gain insight to the learner's perceptions of her engagement in, and with, asynchronous discussion. The interviews took place after the discussion activity was completed and made use of the tracking detail to prompt recall of activity and discussion of the online interactions. Visual timelines of interactions were manually created (see Figures 1 and 2). Gibbs et al. (2006) have created a tool for online discussion which will generate visual timelines, but this was not used in this study.

The grounded approach to analysing the interviews highlighted themes within students' comments in relation to the need to articulate clearly for others; engaging with the ideas of others; temporal aspects of using the time delay to research and prepare responses; and the impact of assessment for example. An iterative process was involved in creating the framework by examining the interview statements, exploring the interactions that took place, making connections between students' perceptions and their online behaviours, and reconsidering what could be understood about the learning processes from the research literature.

Learners' interactions

The tracking data revealed differences in how learners engaged with each other in the online discussion environment. A visual timeline was created to show the pattern of interactions. For example, in the History of Art contexts, two of the case studies, Camille and Rosalba (pseudonyms) regularly logged on to the learning environment, but had different time-scales for engaging with others.

Camille was shown to respond regularly within 24 hours of questions being asked of her, as shown in Figure 1, which shows the date and time of posting of a particular message (number), and the length of response given (words) for two of the discussion threads.

Rosalba chose to delay her responses as shown in Figure 2. This resulted in a more restricted engagement with her peers as there was very little time left for peers to ask anything further about the responses given by Rosalba. The pattern of interaction in Rosalba's discussion forum shows a pattern of question–answer only with no follow-up, whereas Camille's interactions show a more extended question–answer engagement with the interactions in the third thread (Figure 1, Thread 3: Social Viewpoint). Rosalba's experience supports the views expressed by Jeong and Frazier (2008) and Dringus and Ellis (2010) that late posts are less likely to receive a response, as can be seen in Figure 1 when the late post by Rosalba does not receive a response from Camille.

Further insight was gained from the semi-structured interviews with the learners, which revealed for instance that Rosalba was unaware of restricting her opportunities for engaging with others. Her perception was that the time delay allowed for further research on a topic and that "*you're more likely to sort of interact and have a longer sort of discussion about something*". She also made reference to the convenience of being able to engage in discussion as anytime-anywhere learning (Hiltz and Goldman 2005), commenting that:

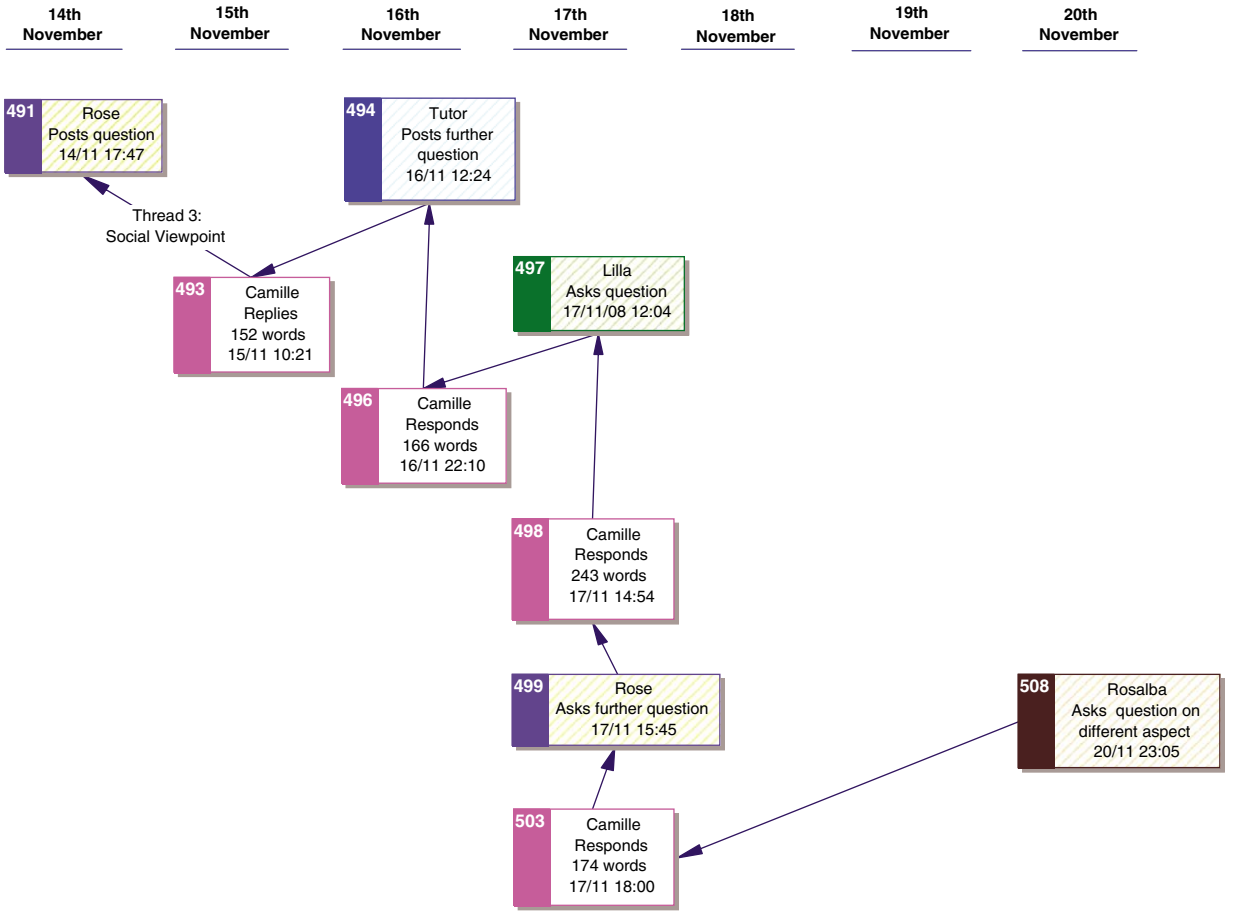

Figure 1. Visual timeline of Camille's interactions.

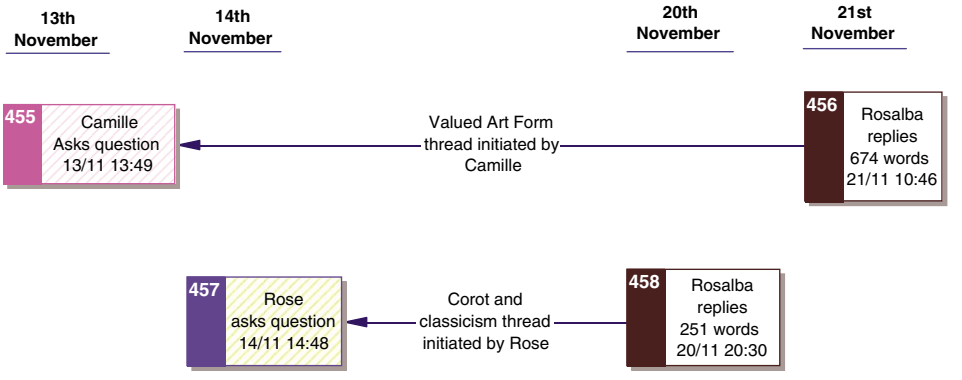

Figure 2. Visual timeline of Rosalba's threads 2 and 3.

> They are more likely to get involved because you don't have to turn up anywhere really I mean you could just sit in bed and do it. . . . if you've got something else to do you can go and do it and it's learning in your time. [Rosalba]

Rosalba's perceptions of engaging with others did not necessarily match up with the reality of her engagement with others.

The History of Art online discussions formed part of the course assessment and that may have impacted on how the learners interacted with each other. Rosalba and other learners commented on engaging with others because it was assessed and they wished to get a good mark. Marguerite for example noted that:

> people want to get the best marks they can and I think that probably shapes how people do things. [Marguerite]

However, the assessment was not necessarily enough of a motivator for all participants, as in one discussion forum it was observed that three learners did not engage with the fourth member of the group.

In the Theology course settings, there was no compulsion to participate and no assessment of the online contributions. In the Theology settings, there were very low levels of interaction between learners. The lack of engagement with others meant that a sense of frustration developed as learners realised that this could have impacted on their learning. For example, in the level 2 course, Martha noted her frustration at the lack of interaction by others:

> I found it very frustrating.. the lack of input from people, so whenever there was a contribution, I would have replied to it. [later in the interview] I think I could have got more out of it if, other people had contributed a bit more... I was a bit frustrated that folk didn't take part. [Martha, level 2 Theology]

Ruth for instance, relied on interacting with the tutor mainly. In her interview she too commented on the lack of presence of other learners:

> I felt sometimes, you were putting your answers and you were almost, well, forgetting about the others that were there. [Ruth, level 1 Theology]

This was clearly not the level of interactive discussion that the tutor had planned for the course.

The lack of response, or delayed response, was experienced in both disciplines and impacted on learners in different ways. In the Theology course, Martha commented

on realising that the lack of engagement may have impacted on what she could have learned. In the History of Art course, Camille commented on losing her thought processes when peers did not respond in a timely manner:

> There was one person in my group who I answered I asked two questions and it was about four of five days before they bothered to reply which was a bit annoying because by the time when I went back to read their thing I'd forgotten what my first thought was. [Camille, History of Art]

Her comment is a reference to the interactions shown in Figure 2, in which Rosalba takes several days to respond.

The interactions of learners were not necessarily matched with the learners' perceptions of how they engaged with other. The negative impact that the lack of engagement can have suggests that for small group discussion there is a need to ensure that all are actively involved. Studies, such as Romiszowski and Mason (2004) and Beaudoin (2005), highlight that lurkers (those who read messages but do not post) are engaged in learning through reading the contributions of others. However, the potential impact of their lack of overt engagement should be noted.

Insights to learning

In the interviews the learners commented on broadening and deepening their understanding of a topic within their subject discipline. For instance, Camille commented that her engagement with others in the discussion area and with reading other people's essays helped her broaden her thinking about her own essay. Marguerite spoke of developing a more critical approach to examining someone's work as a result of reading her peers' contributions. Marguerite considered that her engagement in the discussion, and the questioning of her peers, and articulating her thoughts for others helped clarify her understanding about a topic. Marguerite (in History of Art) and Martha (in Theology) each raised the aspect of writing for an audience, being aware that their responses would have to be constructed carefully to try and get an argument across without misinterpretation by others which helped articulate their thinking.

Whilst there are contradictions in the literature about whether the participants of asynchronous discussion actually use the time delay for reflection, there was evidence of reflection in these case studies. Reflection was implied by Camille, who made reference to having time to collect her thoughts; whilst Ruth (in Theology) spoke of using time to reflect on reading. The learners benefited in some way by engaging in reflection, by taking time to shape and develop their messages and in articulating their thoughts for others to understand.

Contribution

From the learners' experiences, it seems that there is a need for learners to understand more about the processes involved in learning through online discussion so that they can maximise the opportunities that are presented. There are opportunities to develop learning through online discussion, but these are not fully recognised or acted upon by learners. Drawing from the learners' experiences and the literature, a framework for learning through online discussion emerges.

The learners provided evidence of making use of the asynchronous nature to reflect and to think some more about the topic of discussion in order to further shape their understanding of the topic. These activities are covert activities, not evident to others unless some tangible output of this is shared with others. Figure 3 represents the hidden (covert) processes involved.

As identified by the learners, there are benefits to be gained from articulating their thinking for others to read. The act of writing can help develop understanding of the subject itself (Bereiter and Scardamalia 1987; Mercer 2000). Figure 4 highlights the role of articulture in learning.

When a learner chooses to post a message, she/he may choose to make overt connections with the thinking of others by making a response which has connections with the previous messages posted and adding to the thread of discussion (e.g. as happened in Camille's interactions in Figure 1). Alternatively, a message may be posted that has no connections with other messages, and is posted as an isolated, unconnected message Figure 5 represents the overt articulation which occurs when posting a message.

Figure 6 highlights the potential benefits to an individual learner from being informed by others through reading and reflecting on the messages posted by others, from composing a written response and articulating thinking to make thinking 'visible' to others (Ritchhart and Perkins 2008).

This is not a one-way process, however, and just as an individual can be informed by the contributions of the group, the individual can inform the thinking of others in the group, potentially building up collective thinking. The individual's learning may be prompted by, and contribute to, the thinking of others if she/he chooses to read and take account of the messages posted by others. Thus, there are reciprocal learning opportunities for an individual and for the others in the group. Figure 7 summarises this reciprocity of learning opportunities created when learners engage in learning through online discussion. The top half of the figure represents the opportunities for an individual learner whilst the bottom half represents the opportunities of others that arise as a result of their articulation of thinking and their reflections of the contributions made by other individuals. Thus all learners have the opportunities to benefit from the thinking of others, and from articulating their own thinking.

Articulation is at the heart of making thinking known to others. Articulation of thoughts may be connected with the thinking of others (overt collective informed

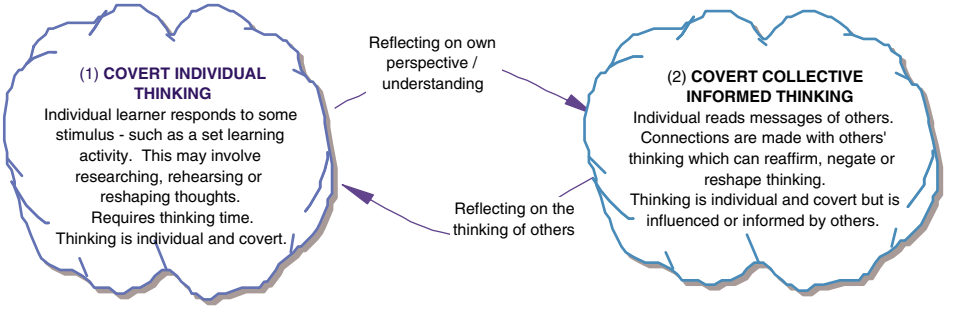

Figure 3. Covert processes.

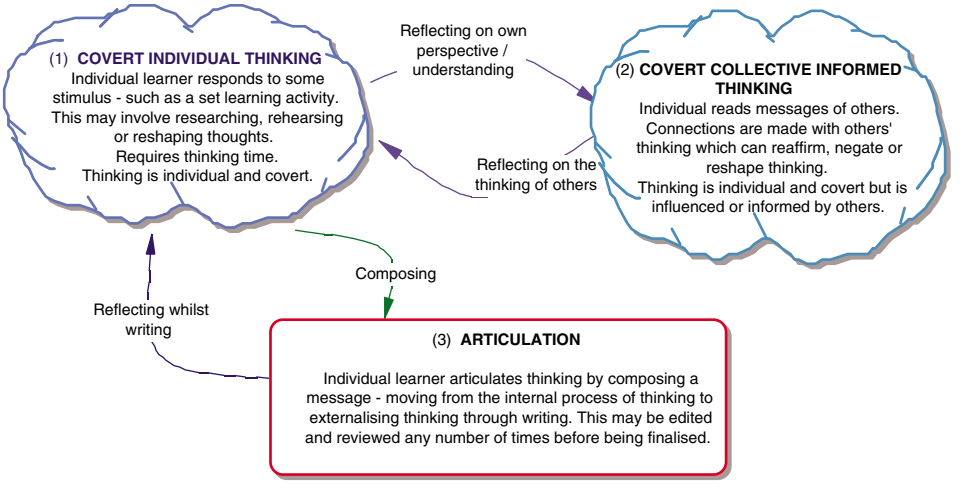

Figure 4. Articulation as a process of learning.

thinking) when the message posted draws from, or is openly influenced by, the messages of others. Articulation may be unconnected to others (overt individual thinking) exemplifying individual thinking shown as isolated posts. To move from individual thinking to collective, shared thinking requires the individual learners to read, reflect and make connections which are then articulated in messages posted. The overt articulation of thinking creates possibilities for individual thinking to develop into new, collective and shared thinking.

Mercer (2000, 129) cautions that: "*CMC will only be as good for collective thinking as its users make it*". If learners are not fully aware of the opportunities for developing learning through CMC then the result may be a lack of overt engagement which impacts on the individual and other learners in the group.

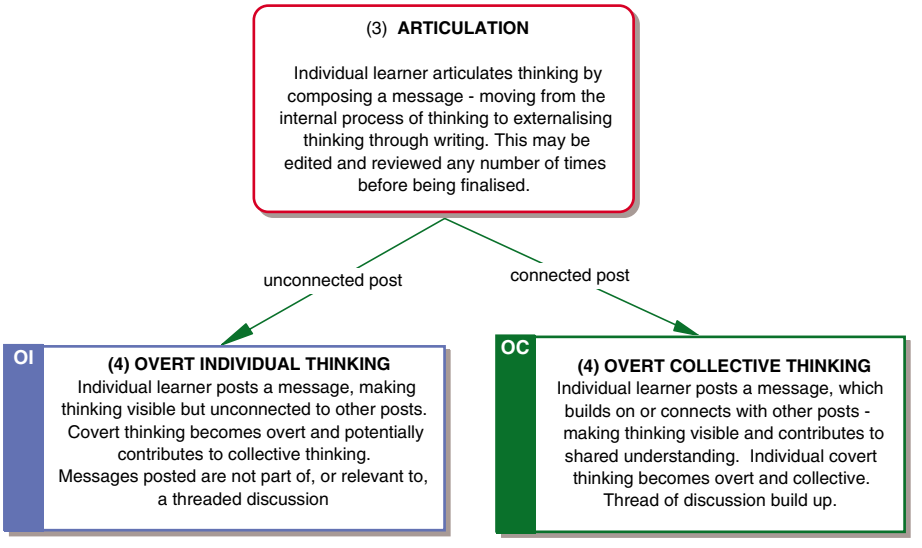

Figure 5. Overt articulation.

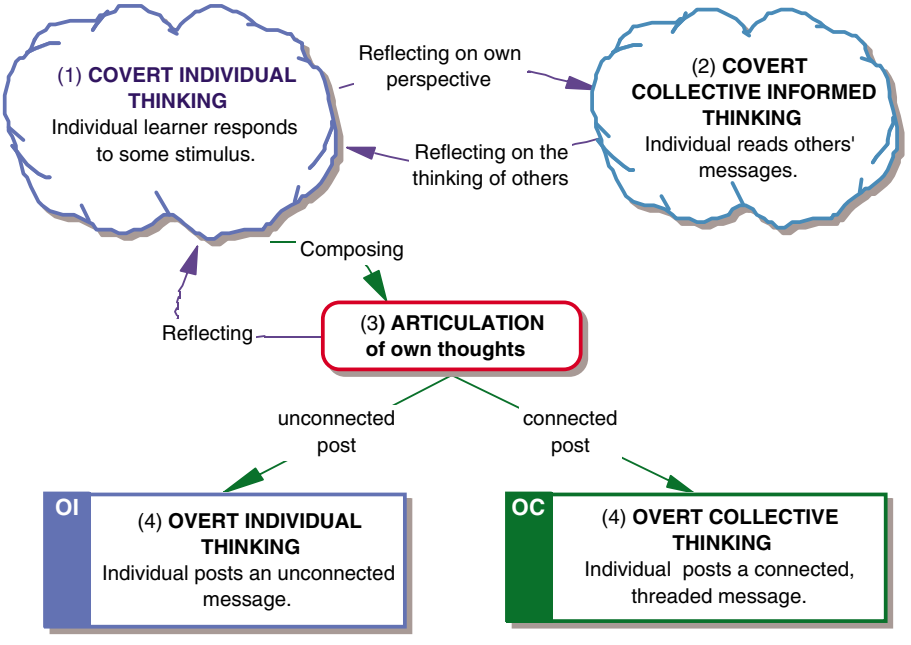

Figure 6. Individual learning opportunities created through online discussion.

This study is limited in that none of the case studies focused on a male participant and none of the case studies focused on a non-contributor to online discussion. Further, it may be that the learners' interactions have been influenced by the non-participating presence of the researcher, although there was no evidence to suggest that this was so. The lack of inclusion of learners who chose not to contribute to the online discussion does not invalidate the analysis of the case studies, but rather highlights that this is an aspect that would be worth following up in further studies. It may be particularly helpful to explore the relevance of the framework for learning through discussion for non-contributors and to gain insight into their reasons for not contributing to online discussion.

Conclusion

The case studies provide an insight into learners' approaches to online discussion, the strategies that they use, their reactions to engaging with others and their perceptions of learning through discussion that is not readily available in other research studies.

The framework for learning through online discussion which emerged from the reconsideration of the processes, as identified by the learners and related to in the literature, highlights the importance of articulation as part of the learning process and the importance of building on the contributions of others. In the two discipline settings within this study, the tutor had designed activities specifically intended to engage learners in online discussion, but in both settings there were limitations to how learners chose to engage in this. Tutors need to be explicit about the rationale for including online discussion as part of the learning experiences, not just in terms of noting expectations of frequency of posting or desired response times, but in terms of

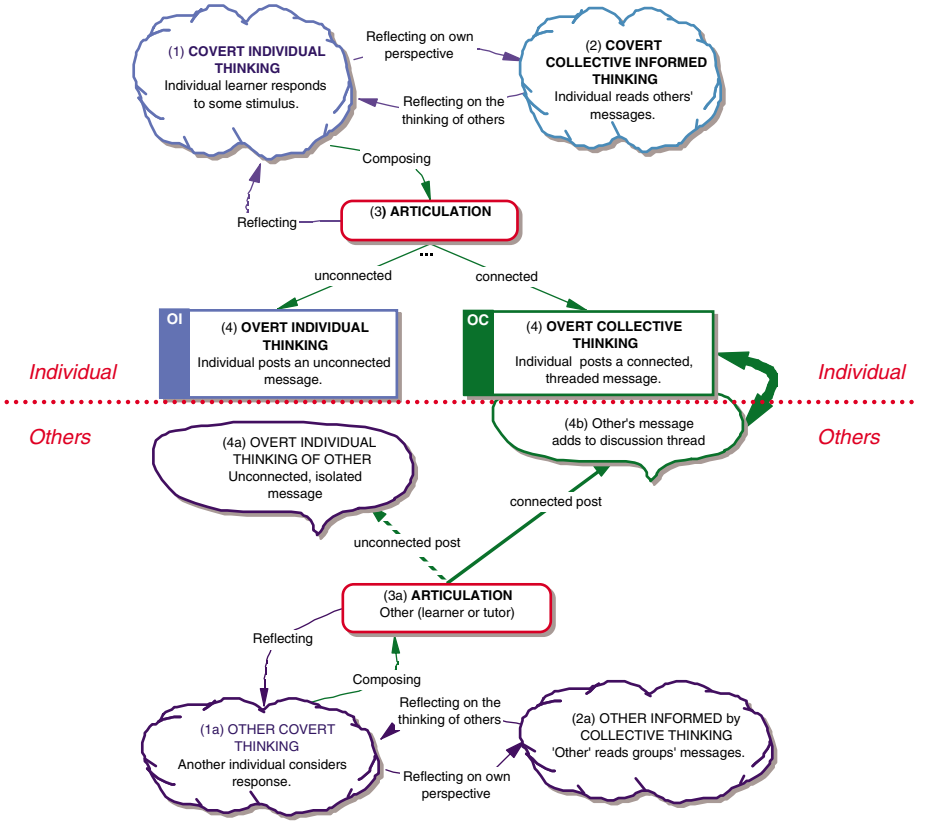

Figure 7. A framework for learning through online discussion.

what is meant by discussion and how discussion is expected to develop as the learning activity progresses. Tutors should explain to learners why online discussion in the form of written contributions may be helpful in terms of developing thinking and moving from an individual perspective to a collective informed perspective or shared perspective.

The proposed framework for learning through online discussion provides an alternative perspective to the Conversational Framework of Laurillard (2002), by focusing on the learner engagement rather than the tutoring role, and by raising the essential role of articulation in learning through online discussion, without which thinking cannot be shared and feedback (which is a key aspect of Laurillard's framework) cannot be provided.

Further development of the framework might provide a means of using the framework for learners' self-analysis or tutor-analysis of engagement with the learning opportunities. It is possible for the framework to be used as the basis of evaluative questions which encourage learner and/or tutor reflection on the covert processes of engaging with discussion, the overt processes of engaging in discussion, and the manner of articulation. It may be possible for further research to share the

framework with the learners and tutors, and to then use that as a basis for examining the learning experiences.

Whether having an understanding of learning through online discussion expressed in this way is helpful for tutors and/or learners in terms of supporting and developing their use of online discussion remains for further research.

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The Making Assessment Count (MAC) consortium – maximising assessment and feedback design by working together

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(Received 12 June 2011; final version received 30 June 2011)

The Making Assessment Count (MAC) project started at the University of Westminster in 2008. It sought to align staff and student expectations of feedback and support greater use of feed-forward approaches. A baseline analysis of staff views in the School of Life Sciences suggested that students did not make strategic use of the feedback they received. A similar analysis of the student position revealed that as a group they felt that the feedback provided to them was often insufficiently helpful. To address this dichotomy, a MAC process was developed in the School of Life Sciences and trialled with a cohort of about 350 first year undergraduate students. The process was based on a student-centred, three-stage model of feedback: Subject specific, Operational, and Strategic (SOS model). The student uses the subject tutor's feedback on an assignment to complete an online self-review questionnaire delivered by a simple tool. The student answers are processed by a web application called e-Reflect to generate a further feedback report. Contained within this report are personalised graphical representations of performance, time management, satisfaction and other operational feedback designed to help the student reflect on their approach to preparation and completion of future work. The student then writes in an online learning journal, which is shared with their personal tutor to support the personal tutorial process and the student's own development plan (PDP). Since the initial development and implementation of the MAC process within Life Sciences at Westminster, a consortium of universities has worked together to maximise the benefits of the project outcomes and collaboratively explore how the SOS model and e-Reflect can be exploited in different institutional and subject contexts. This paper presents and discusses an evaluation of the use of the MAC process within Life Sciences at Westminster from both staff and student perspective. In addition, the paper will show how the consortium is working to develop a number of scenarios for utilisation of the process as a whole as well as the key individual process components, the SOS model and e-Reflect.

Keywords: assessment; consortium; coursework; efficiency; e-Reflect; exam; feedback; feedforward; JISC; MAC; online; PDP; peer; reflection; SOS model; strategy; tutor; VLE

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ISBN 978-91-977071-4-5 (print), 978-91-977071-5-2 (online)

DOI: 10.3402/rlt.v19s1/7782

Introduction

In recent years, the university sector has focussed attention and resource on feedback, not directly because of its centrality in the learning process, but because it has been consistently flagged as a problem area by the national student survey (NSS). Students complain about ineffective feedback via the NSS but staff also have reason to be disgruntled. Many spend considerable time marking work and providing valuable feedback only to see piles of uncollected assignments suggesting disinterest and disillusionment amongst the students (Winter and Dye 2005). Many staff strongly believe that students only pay attention to the mark they receive and make little attempt to engage with their feedback (Wotjas 1998; Mutch 2003). Some research has suggested that withholding the mark can lead to greater engagement by students with their feedback (Carless 2006) and an increase in the value added by the feedback (Nichol 2007).

Assessment feedback has the potential to enhance achievement but only if the right balance can be struck between measuring performance and shaping and developing the individual (Gibbs and Simpson 2004). It is accepted that the balance between assessment of learning *and for* learning has leaned too much towards the former, driven by the need to measure student performance. Such emphasis, driven to some extent by greater numbers of students and modularisation, leads to bunching of assessments (Price and O'Donovan 2008) and less opportunity for students to derive benefit from 'practice' application of knowledge and ideas with feedback often coming too late for it to make much difference to their performance (Higgins, Hartley, and Skelton 2002).

Given the problems with formative assessments, it is imperative that feedback provided on marked work is sufficiently well crafted to help the student move forward. The feedback, irrespective of delivery, also needs to be linked to the processes that provide an opportunity for the student to analyse and make use of the feedback in what is now termed a 'feed-forward approach' (Hounsell, Xu, and Tai 2007). One missed avenue for feed-forward on assessed coursework is the personal tutor as they are often out of the loop on their tutee's performance until it is too late for them to make a difference in terms of ensuring that feedback is acted upon and leads to a definitive plan for improvement. This apparent decline in effectiveness can be linked to higher numbers of students and modularisation.

Many universities have responded to the need to fundamentally revisit the feedback process; from delivery through to action, by making more use of technology; for example, online marking and coursework return to increase speed. This should enhance the likelihood that a student utilise the feedback received in their next similar assignment (Denton et al. 2008). In addition, technology allows for feedback to be returned in different ways, and there is emerging evidence that suggests alternatives to written feedback can lead to better formative feedback experiences (Macgregor, Spiers, and Taylor 2011). At Sheffield Hallam University a system integral to the institutional virtual learning environment links the electronic release of marks to action on the part of the student. Here students do not see their grade until they have looked at the electronic feedback that has been provided and have had the opportunity to write a reflective entry into the system (Hepplestone 2010). However, there is the potential, given the NSS driver, that the use of technology

could fuel superficial tick box approaches that may satisfy the customer but do little better to guarantee genuine personal development and improvement.

Technology may make a quality difference to feedback where it is part of a process that has at its heart the facilitation of meaningful interaction between students and their tutors, either online, face to face or both. In this paper, a process [the Making Assessment Count (MAC) process] designed to facilitate a dialogue that connects the feedback the student receives on their work, through their reflection, to the support and guidance of their tutor will be described and evaluated. The consequences of the process on students and staff will be discussed. In addition the paper will show how it is becoming possible for other universities and different subject areas to adapt the process to suit their own needs and priorities by working together as part of a strategic consortium.

Methods

Data from our baseline activities demonstrated that the feedback staff provided was deemed useful, yet students wanted more as they felt that would enhance their learning (Kerrigan et al. 2009). Conversely, there was a significant misalignment between student actions and their perceptions by staff in relation to how students use feedback and the value they place on the written comments. To address these core issues, a process, termed MAC, was developed to enhance the amount of feedback students receive, demonstrate action on feedback to staff and enhance communication between students and their tutors. The summation of these ideas developed into a new model of student feedback into what can be defined as the SOS model of a tripartite feedback; Subject, Operational and Strategic (Figure 1).

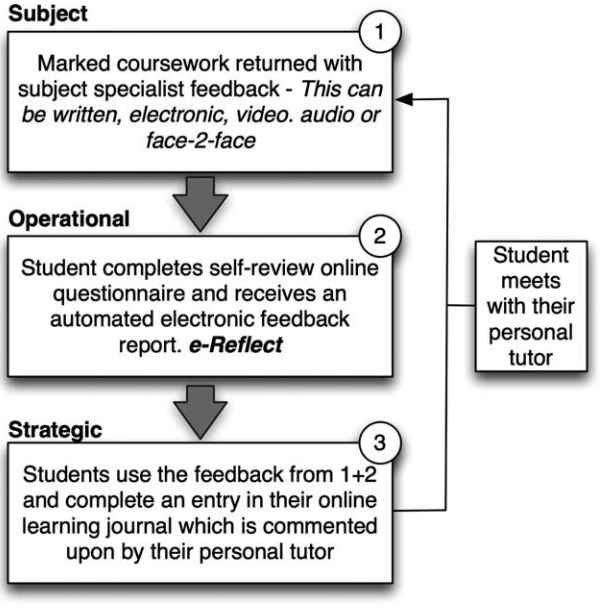

Figure 1. The SOS Model of student feedback.

Subject

The feedback on the students' returned work mostly focusses on material aligned to academic performance and the development of subject matter and skills, indicating a level of performance, suggesting improvements and highlighting good achievement.

Operational

After collecting their assignment and reading their subject feedback, students complete an online self-review questionnaire. This requires close engagement with the feedback they have been given and focusses on both the process and outcomes of learning – for example, students have to indicate how long they spent on the assignment, whether the guidance they had been given was appropriate and how well they understood the feedback they had received. Their responses are then processed, server side, and personalised reports sent to students instantaneously via email. Importantly, the report also contains a graphical representation of the student's performance on all assignment completed. The online system used to complete the online questionnaires and produce the reports is known as e-Reflect.

Strategic

In the final step of the SOS model, students use the Operational report and their Subject feedback as a prompt to write short reflective entries, focussing on actions they believe they need to take to improve, in an online learning journal that is shared with their personal tutor. Personal tutors can comment on and extend the reflections in the learning journals and suggest further strategic action. Once this stage is completed, both tutors and students can take better advantage of their face-to-face contact time: students enter the tutorial better able to articulate their difficulties, while tutors, who can refer to their tutees' learning journals both before and during the tutorial, are better prepared to give appropriate support and guidance.

The e-Reflect tool

The e-Reflect tool is an integral component of the MAC process (step 2), helping to encourage the student to think about their feedback and approaches to study, as well as providing additional operational feedback. Importantly, e-Reflect also serves as a 'bridge' between the student's assignment feedback and their personal tutor. During the initial pilot phase, e-Reflect 1.0 was built using Excel Macros and then for the larger-scale rollout, e-Reflect 2.0 was developed with central computing services that linked to the student records system (via RSS), enabling more effective processing and report generation. As more institutions become interested in adopting e-Reflect, version Reflect 3.0 was developed as a free-standing open source tool (Figure 2). In e-Reflect 3.2 (current version), questionnaire authoring by staff, questionnaire completion by students, report generation and storage and updating/sharing of the learning journal is all completed within a single system. There is also a system of alerts via email,

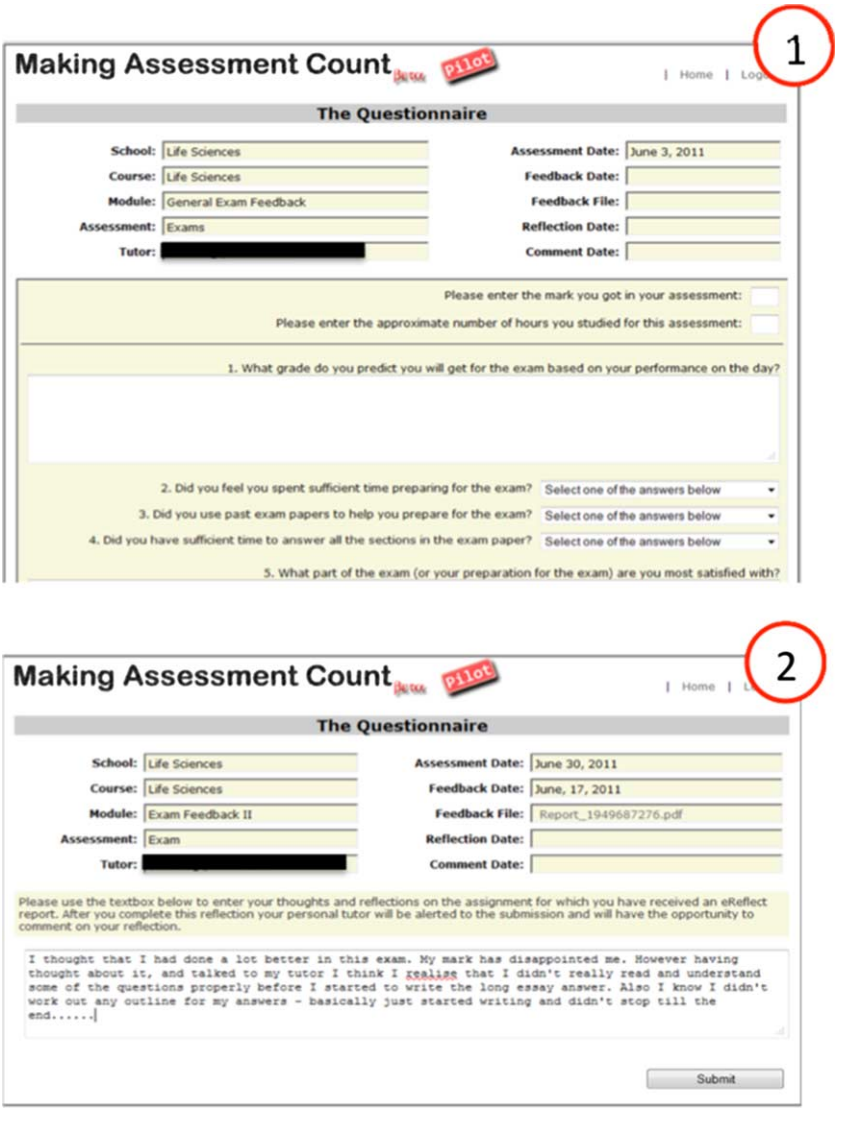

Figure 2. Screenshots of the MAC tool. (1) The customisable online questionnaire students are asked to complete and (2) the area where they enter their reflective log.

which communicate to staff when a tutee has completed a reflection and to students when their tutor has commented on their journal.

Evaluation

The MAC process was trialled on a large scale involving 380 undergraduates and 35 staff in the School of Life Sciences and subsequently evaluated by questionnaire and face-to-face interviews. This school was chosen as two members of the project team were active lecturers in it and had access to large numbers of students. It is important to note that the MAC process is not discipline specific and is easily

transferable to any subject. Both staff and students experiences were explored and analysed.

The student view

Prior to the face-to-face interviews, a questionnaire was offered to the entire cohort and completed by 65 students. This disappointing response was attributed to the timing of the questionnaire: it coincided with the end of term. To increase our understanding of the student experience a second evaluation is planned at the beginning of the new academic year aimed at the same initial cohort. Analysis largely reveals a picture of positive student views of the MAC process. A majority of respondents indicated that they had used e-Reflect either because it gave them extra feedback, helping to realise mistakes and prepare for other assignments, or because they thought that it was a way to improve and keep track of their progress. About 30% of respondents thought that using e-Reflect had helped them to build a better relationship/communicate more with their tutor. Conversely, about 10% said the process was time consuming and like an extra assignment. This response was surprising: the online questionnaire only took a few minutes to complete and the online learning journal only required a paragraph of text. A review of the student responses indicated that in some cases they were writing large reflections and thus spending too long on the process. To address this, students were supported on how to complete the learning journal. Furthermore, in one instance the completion of e-Reflect was linked to a grade and so viewed by some as an assignment – following a review it was decided that this was not the best embedding of the process and a more student-centred, participatory approach was adopted instead. A majority of the respondents answered yes to the question 'Did using e-Reflect help you to do any more of the things you feel you should do when you get a piece of marked coursework returned with feedback'?

It should be noted that only a small proportion of students who did not engage with MAC at all completed the questionnaire. It has to date proved impossible to gather together significant such students to elicit more on the basis of their lack of engagement. There is anecdotal evidence from academic staff that it was not just the high achieving students that engaged, although equally many staff felt that it was likely that the majority of the 'non-engagers' would be those students needing help and support most. This is borne out by the fact that of the set of students in the undergraduate cohort who did not progress, hardly any of them had engaged at all with e-Reflect.

Whilst the questionnaire data provided a good empirical base, the data from the face-to-face interviews highlighted a variety of straightforward benefits. Excerpts are shown in Table 1. The students who took part in the face-to-face interviews were drawn from those who completed the initial questionnaire.

Not everything that students have said was positive. However, consistent amongst students was the view that the MAC process was only going to be 'really good' or 'make a difference in the long run' if the feedback received on work was understandable and if personal tutors regularly commented on students' learning journals and spoke to students about their feedback. This notion that students are now able to give feedback to their tutor about the quality and 'fitness-for-purpose' of their feedback has raised some interesting questions and prompted useful actions.

Table 1. Student comments on the MAC process.

"It has helped me especially on a couple of assignments where I've actually taken up the opportunity to see a module leader. One of my marks was quite low and this is not normally to my standard. The e-Reflect feedback suggested that I speak to the module leader and so I took this advice and made an appointment. I wouldn't normally have thought to do this and it helped. He gave me ways I could improve and suggested a different way of approaching some of the subject matter. It has helped I think because since then my marks have shot up".
"First of all when I fill in the questionnaire and I put a new entry in my learning journal I identify my problem which I was thinking of. And I see it more clearly when I put it as a blog. And basically when I get feedback that I can understand I can share my thoughts with my personal tutor in my blog and sometimes he will come back with something I didn't think of".
"For me personally it's the way that I can see every piece of coursework that I've done. With the graphs it gives I can see where I'm falling down, where my strengths are and my weaknesses are. And also it was very helpful to get advice on how much time I should have spent on an assessment".
"Well for me e-Reflect has helped me to workout exactly where I am going. I come from a previous degree which already set me high standards and with e-Reflect, the three that I've done so far have allowed me to see that actually I was slowly dropping but I can actually identify where I'm dropping in".
"It's made me think more about the assignments. Before if I got a good mark I just thought yeah that's a good mark and left it at that. But now I'm actually going back and thinking about what I could have done better".

Comments around these two themes of the quality of feedback and tutor engagement with the MAC process are shown in Table 2.

All of the students who were interviewed and recorded had volunteered so to do in response to an email request. It is therefore possible that our sample of interviews is biassed towards students who are perhaps the 'high achievers', the more 'aspirational' or the more proactive and engaging. Whilst this cannot be ruled out, it was the case that none of the students interviewed were shy about providing negative feedback about the process. Across the 11 interviewed, 8 achieved $\geq 60\%$ marks on average and 3 achieved $\geq 40\%$ marks to $< 60\%$. When comparing the overall view of e-Reflect and its real/potential value there was no difference between the groups thus suggested that academic performance was not the sole determinant in their perception.

The staff view

Generally academic staff were not as positive about the MAC process. A minority (1 out of 11 interviewed) thought that MAC was of no use whatsoever whilst three

Table 2. Student comments on the MAC process in relation to quality and feedback.

"I think e-Reflect it's really great but its going to work only if we get proper feedback. Written, with good handwriting and with good points".
"I just need some hints about where I went wrong. Some kind of directions not something like so and a question mark and that's it".
"...Sometimes the feedback on your essay might just be, 'A good job'. Now that doesn't really give me enough information to work with".
"After submitting 3 or 4 e-Reflect questionnaires you remember what feedback is likely to come back. It's nice but alone it can't work, some tutors need to be continuously attached to it".
"e-Reflect without tutor comments is useless. If I want to reflect alone I can use Word. The whole point of e-Reflect is to get tutor and tutee to engage more around the work I have done".

others agreed that 'it clearly affected some students in a positive way'. The rest of the staff interviewed held a view somewhere in between, feeling that any initiative to highlight to students the need to pay attention to their feedback was good. Although almost all staff could see the potential of the MAC process and thought that it was something worth developing further, a number of significant issues and problems were raised. These ranged from not having the time to engage fully, through to significant doubts that the process would help the 'weaker' student.

A questionnaire sent to staff also highlighted the degree to which staff see potential for the MAC process with 10 out of 12 respondents agreeing that it is 'very good in principle'. However 33% highlighted a lack of student engagement as a problem whilst 25% of respondents highlighted the value of the MAC process for monitoring student progress. Encouragingly, over half of the staff respondents thought that the MAC process had improved active dialogue between students and staff over student's work and development and around 40% thought that the MAC process had impacted on the way in which they tutored and/or provided feedback to students (Table 3). Of note, two staff also stated that implementation of the MAC process had impacted on the way that they approached provision of feedback. Another member of staff changed the way he instructed his teaching team to deliver coursework feedback influencing 12 members of academic staff, some of whom were not directly engaged with MAC. Collectively this course team agreed to focus more on providing students with 'action points' that they should consider in order to improve.

Combined view on feedback sources

As part of the larger evaluation and support for future design, staff were asked how they deliver support on feedback and students were asked who they talk to about their coursework. This resulted in some interesting data linked to the use of the MAC process and highlighting a potential miss-alignment in activity. Students appear to be willing to discuss their feedback with their personal tutor as well as the person who marked their work and indeed with a 'third party' member of staff who they like (Figure 3). This suggests that the model of a tutor supporting action on feedback is valid and highlights that a professional relationship is important in this process. Interestingly, students seek more than one source of support; this may not always include the marker or their personal tutor. Whilst it is well known that peer feedback is important, the ability for students to comment and suggest actions on their peers' feedback is an interesting extension. Indeed, one could build this into the MAC process and permit students to select with whom their feedback is shared. Furthermore, these data show that feedback on a script is often shared with more than one audience: this should be considered when feedback is constructed.

Table 3. Staff comments on the MAC process.

"I have tried to give clear, concise and justifiable feedback on all work and embed corrections and tips for future work".
"e-Reflect has enabled me to observe potential problems earlier and to give generic advice on how to help the students improve".
"e-Reflect has enabled me to get to know my students better. It has made me think about the way I give feedback to ensure that it is clear to the students exactly what it is they need to improve by providing additional action points at the end of the work".

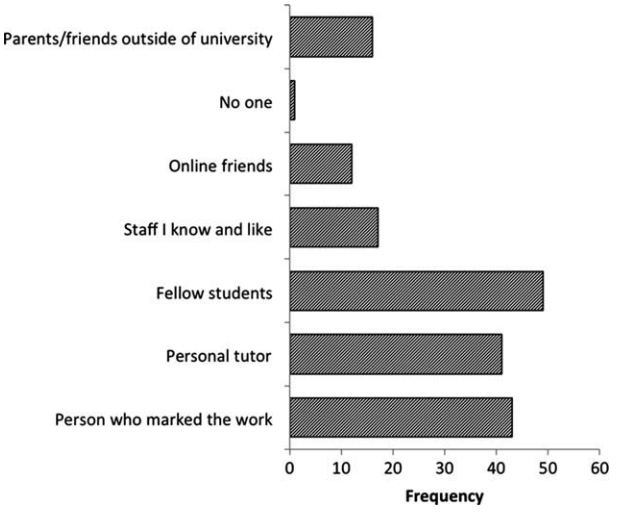

Figure 3. The students' sharing of feedback.

As these data suggest that students are engaging with staff about their feedback, we then asked staff how they are being contacted (Figure 4). Those who responded with either agree or strongly agree were grouped as *positive*, neither agree nor disagree as *neutral* and disagree or strongly disagree as *negative*. Interestingly, there did not appear to be a dominant method by which the students contacted staff for

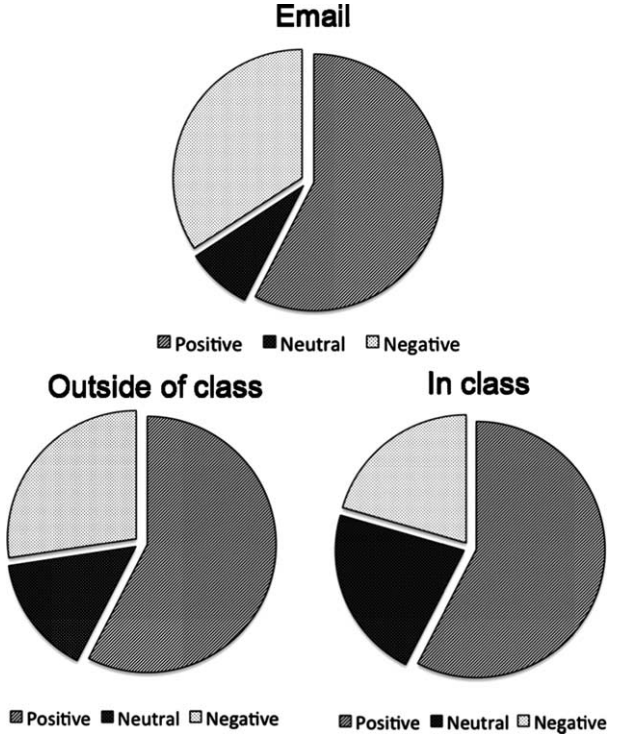

Figure 4. How staff are contacted by student to provide feedback support.

support with their feedback. There was a slight preference towards support in class, which would align with Figure 3 but the number of staff who gave a neutral response prevent this from being conclusive. These data do suggest that students are willing to accept additional feedback support by email and that some staff provide this.

Finally, we then asked staff how many students contacted them about the last piece of marked work they had returned (Figure 5). Whilst there were a few instances wherein all students contacted the member of staff, in the main most staff indicated that 10% or under of students had contacted them. Whilst initially this could appear to be of concern, the data from Figure 3 suggest that 43% of the feedback support students engage with is from peers and 56% from academics of which 10% may not be related to the piece of work. It could be argued therefore that under 1% of respondents took no action on their feedback.

The MAC consortium

Following the successes of the original MAC project, a number of other universities [specifically Bedfordshire, City University London, Greenwich, Reading and University of Wales Institute Cardiff (UWIC)] have been exploring how best to make use of the project outputs. This has included consideration of the MAC process as a whole, the SOS model and how best to utilise the e-Reflect tool. The notion of working with 'competitors' is complex as each institution within the consortium draws from the same student pools but importantly, we have realised that the learning and support form working together is significant. With each institution developing a different '*flavour*' of MAC, building on their own interests/expertise, and running a pilot with associated evaluation, everyone will benefit from the future findings (Figure 6).

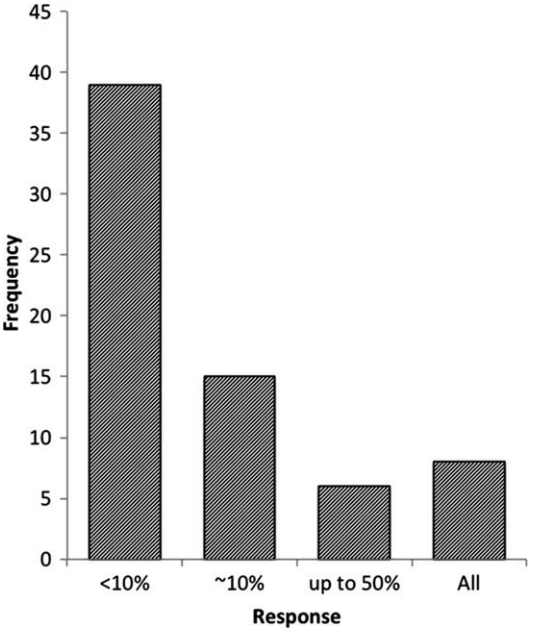

Figure 5. Analysis of students who contacted staff for support.

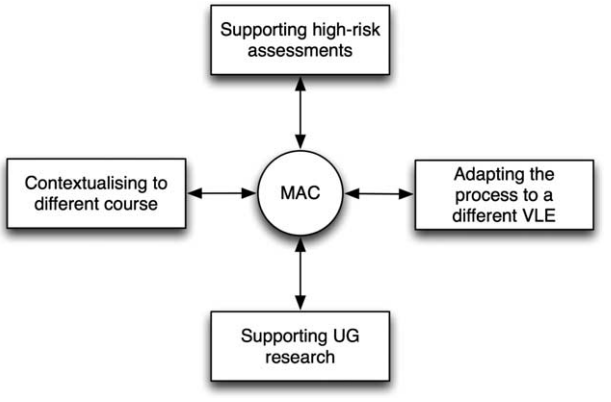

Figure 6. Enhancement of the MAC process by working as a consortium.

At UWIC the MAC process was piloted on an essay assignment with 50 first year undergraduate students on the BSc Sports Science programme. Contextual differences in the self-review questionnaire including whether students had made a plan for their essay before starting, whether they thought the mark received was as high as they could have achieved and what they plan to do next with the assignment gave a novel approach for MAC. A focus group of students at UWIC were generally extremely positive about the experience. They all said that they had benefited from the experience of using the MAC model, including the e-Reflect questionnaire and journal. When asked how they had benefited, most responded that it had made them think deeply about their own strengths and weaknesses, the ways in which they approached their assessment task, areas for future development and the usefulness of tutor feedback.

At City University London there is strong emphasis on engaging students with the feedback that they receive from their tutors as evidenced in the International Politics department that has a well-developed face-to-face personal tutorial scheme for students. As a consequence, the International Politics department plans to use an adapted form of the MAC process (academic year 2011–2012) to help link the students' work with the face-to-face tutorial meetings. As in the original MAC model, students will complete an online self-review questionnaire, however, staff will not be commenting online on students' reflections but instead students will book a face-to face-tutorial using an online Moodle scheduler. To achieve this, the Educational Support Team has built the MAC process into Moodle (Table 4). The student's reflection on their work will inform the tutorial.

At the University of Reading, the e-Reflect tool will be used at various stages of a year-long research project to assist undergraduate students. This novel approach of using MAC to track and support a substantive piece of coursework is an exciting development. Students will be asked to reflect on the preparation of the literature review for their research project immediately after the submission deadline and again after the return of the assessed review with appropriate feedback generated soon after their reflection. Also, students will reflect on their performance at the end of the laboratory work or data collection period and again feedback will be generated.

At the University of Westminster, the School of Life Sciences has adapted the original MAC process so that it can be used to facilitate feedback on written

Table 4. Delivery of a MAC process using Moodle.

Moodle Tool	Process
Moodle Gradebook	Online submission, dissemination of grades, *subject specific and operational feedback* and reflections to tutors and students.
Moodle Quiz tool	Delivery and collection of *operational feedback* questionnaire through multiple-choice questions and collection of student reflections using the essay question.
Moodle Scheduler	Booking and management of tutorials.
Moodle HTML block	Aggregation and display of the activities and guidance to ensure correct path through the MAC model.

examinations; this is a two-stage process. This use of the MAC process addresses the continuous concern that students do not receive feedback on exams. The first stage requires students to complete a questionnaire on an exam they have just taken that prompts the student to predict the grade they expect for the exam. It asks several questions about the way the student prepared for and answered the exam paper. The automated report derived from questionnaire completion provides tips on how to improve their future exam performance based on the responses they gave. Students then go on to write a reflection in their learning journal. The second stage of the process is initiated one month later (once all exam papers have been marked and approved by the exam board) at which point students are provided with an opportunity to see one of their exam papers annotated with written feedback. Students then complete a second e-Reflect questionnaire about their performance comparing the grade they predicted with their actual grade. They are sent a second automated report with suggestions of areas for further reflection after which they complete a second entry in their learning journal. This is shared with their personal tutor who is able to comment.

Finally, at the University of Greenwich the MAC process is currently being adapted to support staff development by integrating it with a postgraduate teaching and learning course. By substituting the coursework element with objectives and skills this will permit a reflective approach whilst promoting a student-centric strategy for enhancement around teaching and learning. At the University of Bedfordshire there are plans to use the e-Reflect tool to help international students to adapt to studying in the UK. Reflective questionnaires will be used iteratively in an attempt to support students more in the critical early stages of their taught programme.

Conclusions

There is strong evidence that the MAC Process can help some students engage with, and make more of their feedback. It seems that a straightforward technology (e-Reflect) can be used to encourage students to think more about their feedback. Importantly, the introduction of the technology can potentially change the nature of a face-to-face tutorial system to focus the tutee/tutor relationship more on academic performance as well as influence how academic staff approach delivering feedback. These three connected transformations are of clear significance and, provided that groups of staff are convinced of the payback, and that MAC or some '*flavour*' can be

readily integrated readily into support mechanisms, there is every possibility that students will benefit. The consortium strategy has enhanced the development and realisation of the MAC process by a trial in a second Virtual Learning Environment (VLE) as well as developing Moodle blocks, links to UG research and exam feedback – all significant enhancements that would not have been achievable by a single institution. However, variations in delivery of the approach are emerging, as are uses of a MAC process linked explicitly to personal development planning and employability.

The MAC process has strong potential to support students in their understanding and acting on feedback, as well as being a catalyst for enhancing student–tutor academic relationships. Furthermore, with increasing pressures on staff and student time, a tool that can enhance the effectiveness of face-to-face tutorials as well as support learning through reflection, could be a welcome addition to an institution's technology enhanced learning strategy. By working as part of an effective consortium, the development of the MAC process has been significantly enhanced, maximising the benefits of a project for those institutions involved thereby increasing sustainability and dissemination within the sector.

Information on the MAC project can be found at: http://www.makingassessmentcount.ac.uk

Acknowledgements

The MAC project and the subsequent benefits realisation project were funded by Joint Information Systems Committee (JISC) as part of the Curriculum Delivery programme. http://www.jisc.ac.uk/whatwedo/programmes/elearning/curriculumdelivery.aspx

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Studying the learning of programming using grounded theory to support activity theory

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(Received 17 May 2011; accepted 20 June 2011)

Teaching programming to first year undergraduates in large numbers is challenging. Currently, online supported learning is becoming more dominant, even on face-to-face courses, and this trend will increase in the future. This paper uses activity theory (AT) to analyse the use of tools to support learning. Data collection took place during 2008–2010 at Kingston University and involves over one hundred responses. This has been analysed into activity systems offering a detailed analysis of the use of a number of tools being used (in AT these include physical tools, such as technologies including books, and non-physical tools, such as conversation). When teaching programming to large numbers of students it is difficult to offer one-to-one attention and the reliance on such tools becomes more important. For example, in student responses a good integrated development environment (IDE) is shown to make learning easier and more enjoyable, whereas a bad IDE makes the learning experience poor.

Teaching materials, and access to these, were often mentioned positively. These included online communication, discussion boards and video lectures. Using AT offers sufficiently rich detail to identify key interventions and aids the redesign of the learning process. For example, the choice of an IDE for a specific language can have a larger impact than is initially apparent. This paper will report on the data collected to show where simple improvements to the use of tools may have a large impact on students' abilities to learn programming.

Keywords: learning programming; activity theory; grounded theory

Scope

The communities that have been involved in this research are students, staff and the researchers. "Staff" is broadly defined as whoever teaches and helps students to learn. This includes technicians who support students with any difficulty they might have using software and associated development environments. However, this paper presents only the analysis of data from two groups of students. Staff experiences will be reported subsequently.

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ISBN 978-91-977071-4-5 (print), 978-91-977071-5-2 (online)

DOI: 10.3402/rlt.v19s1/7801

Methodology

As Alsop and Tompsett (2002) suggest, the methods that researchers use to collect data seem unimportant to students and to stakeholders such as lecturers. However, to achieve accurate and reliable data, the choice of methodology is critical.

Activity theory (AT) was selected because of the nature of the subject being examined. There are multiple communities involved in looking for the same outcome. The outcome could for instance be that of passing a specific assessment. AT allows for a holistic consideration of the multiple perspectives involved. Its ontology requires different research methods depending on the aspect being considered. In particular the choice of methodological approach to study the subject's activity is key. However, AT does not specify any particular research methodology to be used. We have chosen to combine it with grounded theory (GT).

The case studies undertaken here have particular characteristics that need considering. These include:

- The nature of the subject being examined (learning Programming);
- The number of students involved [in our case the numbers being relatively small and so qualitative research methods were chosen to 'provide a rich description of the students' behaviours' (Alsop and Tompsett 2002) during the research];
- The changes in sample during the research life-cycle; and
- The multiple communities involved in looking for the same outcome (in our case passing an assessment).

We now present short introductions to AT and GT to clarify why they were chosen and how they can work together.

Activity theory

Activity theory is a psychological framework used to understand human activities. AT was introduced by Vygotsky (1896, 1934) and developed by Leont'ev (1981). Thereafter, many researchers have used AT in various subject areas. For example, Kuutti (1995) and Nardi (1996) used AT as a potential framework for human computer interactions and for transforming work in Information Systems. Scanlon and Issroff (2002, 2005) specifically utilised AT on the use of technology in Higher Education (HE). Engeström (1999, 2000, 2008) employed AT to examine individual and social transformation. They also developed the concept of an activity system (AS) to illustrate AT. Figure 1 illustrates the generic AS.

Nardi (1996) explains that an activity is the unit of analysis in AT and that the subject is the person or the group involved in the activity. The object stimulates the activity and provides goals and directions to the actions. Tools are the artefacts that can be used in the process of an activity. Other important factors in an AT framework are rules, communities and the division of labour. The whole result of an activity is the outcome or objective of the activity.

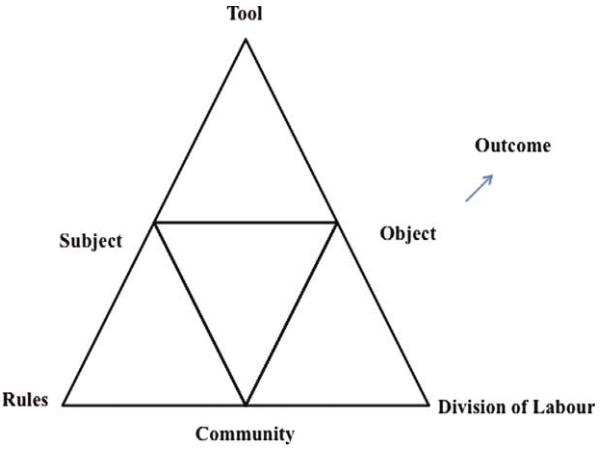

Figure 1. Generic activity system.

Combining GT and AT

The choice of AT was justified by reviewing the characteristics of the case being studied, learning programming using specific tools on undergraduate taught modules involving multiple communities. We required a rich collection of information to ensure that AT ontology is described well. Choosing a method to collect the key data about how and what is used by students in learning and using it to show whether they have "learnt programming" is a challenge. The decision to focus on a qualitative approach was driven by several factors: sample size, accommodating researcher bias, and a changing sample during the research cycle.

Grounded theory

Grounded theory (GT) was first introduced by Glaser and Strauss in social science almost 50 years ago. GT is an inductive qualitative research method that uses a systematic approach to constantly compare collected data and analysis. Here inductive means that there are no initial hypotheses. Accordingly, the researcher has to be as open minded as possible and design the research questions carefully.

Grounded theory interacts closely with data. Any possible hypothesis or theory is driven from the data, as Glaser and Strauss suggest:

> . . .clearly, a Grounded Theory that is faithful to the everyday realities of the substantive area is one that has been carefully induced from the data. (1967, p.239)

While Glaser and Strauss (1967) believe that new concepts and reality can be discovered from the collected data, Corbin (2008) argues that there is no reality out there waiting to be discovered, rather there are concepts and ideas that can be invented. She continues that humans do not discover reality. For example, Schwandt (1998) states that:

> . . .constructivist means that human beings do not find or discover knowledge so much as construct or make it. We invent concepts, models and schemes to make sense of

> experience and, further, we continually test and modify these constructions in light of new experiences.

Charmaz (2006) also believes that theory is constructed from the data:

> Grounded theory involves taking comparisons from data and reaching up to construct abstractions and then down to tie these abstractions to data. It means learning about the specific and the general – and seeing what is new in them – then exploring their links to larger issues or creating larger unrecognized issues in entirety... Grounded Theory methods can provide a route to see beyond the obvious and a path to reach imaginative interpretations. (Charmaz, 2006)

> GTM is categorized as an inductive method. Induction can be defined as a type of reasoning that begins with study of a range of individuals' cases and extrapolates from them to form a conceptual category. (Charmaz, 2006)

Other methods and approaches were considered. These included action research and phenomenography. The choice of GT above other methods and approaches appears to have been sound in the light of the initial outcomes. A further paper on the methodological issues is in preparation.

Activity theory helped to break down complicated situations and made them easier to analyse. GT allowed us to have a flexible and open approach to data collection. It also allowed us to decrease the number of presumptions and hypotheses which would have limited the possibilities of findings. However, the decision to use AT implied the need to conform to ontology. This led to data collection using some of the terms required by AT.

Data collection

Two open-ended questions (adapted from Alsop and Tompsett 2002) were used in this research. Students were asked to write about their best and worst educational experiences of learning programming and to specify the tools they used. They were also asked to summarise their stories in their own words. This was to ensure that the data received were framed in the language of the 'students' rather than the 'researchers'.

Data analysis

In using GT, the collected data were examined closely. In considering each response, questions were asked such as what has happened and why has it happened? An AS was built for each response as well as associated notes that included the researcher's analysis of the case. The early stages of GT analysis were then used. This included open coding (whilst keeping in mind AT's ontology which includes subject, object, tools, rules, communities and division of labour). In the first instance, the focus taken was on which tools the students have used and which communities have been involved in that event. Thereafter, axial coding was undertaken in two sets; one for the worst experiences and one for the best experiences. For the former this represents, put in the language of AT, 'contradictions' that in an AS need to be overcome for the activity to be successful (the resulting redesign, again specifically in the language of AT, is known as a 'shift' in an AS.)

Building activity systems

A first year student (Subject), who attends the "Programming Essential Module" (Object) in the first semester, is taken as a starting point. She/he goes to the lecture and listens to the lecturer who aims to explain the basic concepts of programming in Java. She/he picks up a handout and annotates it (this represents a Tool in AT terms). After the lecture, the student has the opportunity to go to the workshop to put the theory into practice. Here, she/he practices Java in a real environment using several other Tools (TextPad, the WWW, accessing the internet, notes and books.) She/he can also receive help from lab assistants (another Community). She/he is interacting with a machine, reading her/his notes and books and interacting with students, lecturer and assistants in order to achieve her/his goal (Outcome) of "learning programming".

As Engeström (1999) suggests in order to achieve a specific outcome there needs to be a subject, object, rules, tools, division of labour/effort and finally communities. Figure 2 has been annotated from Engeström to illustrate the example.

In the process of learning programming there are very likely to be problems, clashes, breaks and difficulties. Engeström (1999), Nardi (1996) and Roussou, Oliver, and Slater (2007) call these disturbances "contradictions". Analysis of data in this research aims to identify and clarify these contradictions and help identify how they can be solved to make the process of learning programming better, more smooth and enjoyable for students. For example, if the student above begins by writing a simple program called "hello world" in Java, compiles code and then faces syntax errors, she/he could either solve the errors with no help or call on help. This reflects the ability to self-correct or need an intervention from someone else in order to solve the difficulty.

To move away from a general example to something more specific, we give a response citing a student's worst experience:

> "While creating a game in C^{++}, using provided engine, I couldn't get it to do what I needed. The program compiled fine, so it was down to my logic. The lecturer suggested using break points to find my mistake – but I could not understand what they were telling me or if I was using them correctly. This was the most frustrating experience of a

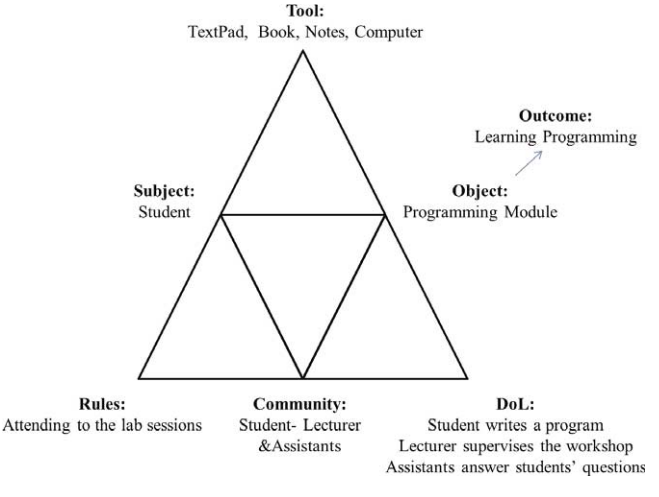

Figure 2. An illustration of the methodology.

few while using the visual studio suite – I didn't like using such a complex program without understanding how to use it properly, or having a thorough knowledge of the language beforehand.'' – ''Not knowing how to use the program''.

We build up an AS. The coding is shown in Table 1.

Figure 3 shows the AS of the above event.

In this example shifts (improvements) are needed in both the tool and communication process. The tool seems to be too complex for the student to use. Why is this the case? It could be because the environment is new or perhaps because Visual Studio is not a good development tool for programming?

We do not know the answer to the latter question. However, we can investigate the former question. The problem of a new environment can be solved by a ''short lived goal directed'' action (Engeström 1999). A shift in the object of the activity of learning programming in C^{++} to ''learn the IDE'', in this case Visual Studio, together with a short-term shift in the division of labour by having workshops to learn the integrated development environment (IDE) instead of writing code/ programming could help. In Figure 4, these shifts have been illustrated.

In contrast to a failed AS, an analysis of a good experience follows. This response was chosen from one of the set of best educational experiences from the same group as the previous student. This response, however, was not selected randomly. It was chosen because this student (Subject) shares the same Object with the randomly selected one above. However, the description is of a best rather than a worst educational experience. This shows that the same Object can be the reason for both good and bad experiences.

''The best educational experience when using a programming tool would be the time when I had to program a game using C++. Normally i would find this challenging so I decided to do more independent work using the program such as reading books and practicing on simple programs. By the time I'd finished I had created what I thought exceeded my expectations and for which I received a good mark. This was very satisfying and now I spend longer on independent work.'' – ''Spending time on a program is beneficial and is helpful for work''.

This leads to the following coding (Table 2) and AS (Figure 5) developed in the same way as the previous example.

Figure 5 shows the AS of the above event.

Table 1. An activity system coding.

Subject	Student
Object	Game design
Tool	Visual Studio (VS – an IDE from Microsoft to develop programs in C^{++})
Community	Student and the lecturer
Division of labour (DoL)	Student writes the codes and lecturer helps to find errors
Outcome	Confusion, frustration, student did not understand and not happy to use a complex program

Note: Researcher's interpretation: It seems that the student is not comfortable with the tool (VS), and finds it a to be a complex program. Despite seeking help she/he still does not understand the problem. Is it because the problem has not been fully explained or is it too hard for the student to digest? This student would prefer to understand the concepts before using it in the provided IDE. She/he summarises the story: ''Not knowing how to use the program''

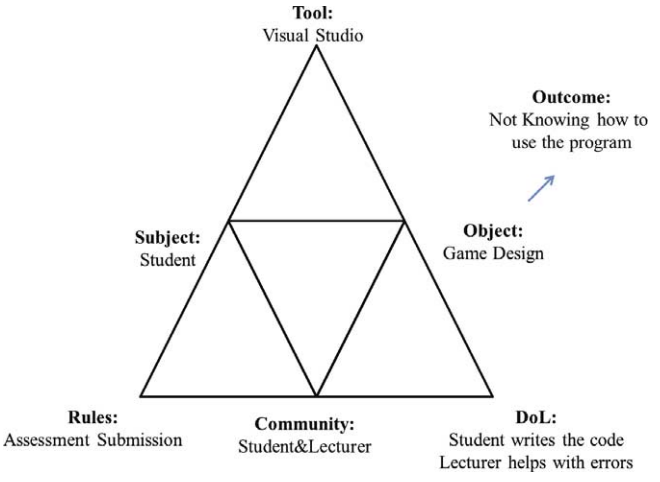

Figure 3. A specific activity system.

Subsequently, ASs were built for each response and these were then categorised. In GT, Corbin (2008) call this process "identify concepts from data". In other words, labelling data with specific words and terms, adding commentary about data analysis, stating comparisons and investigating ideas that appear in data. The result of this process for the failed ASs is shown in Figure 6.

Since the students were asked to summarise their stories, those summaries guided the researcher to label each response and then classify these into groups. Knowledge, structure, tools and programming languages are the four main categories that were driven from the data.

Knowledge contradictions are mostly related to syntax and materials. Some of the students found the syntax, taught for the specific programming language, hard to learn or too much for the duration of the semester. Some other students pointed out that the materials available for the modules did not cover the harder assignments.

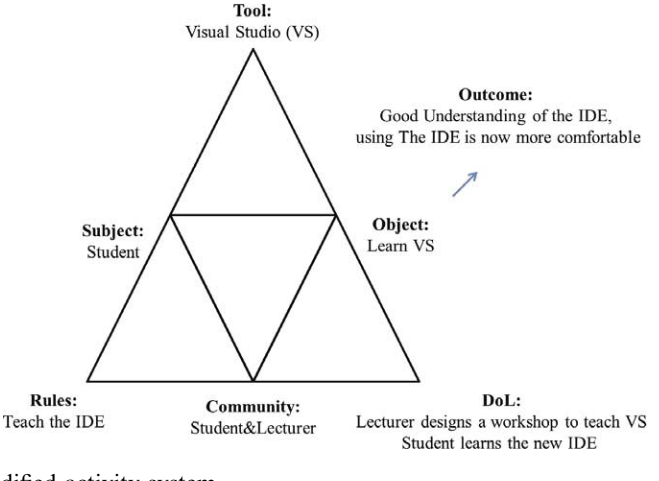

Figure 4. Modified activity system.

Table 2. A further activity system coding.

Subject	Student
Object	Game design
Tool	Books
Community	Student
Division of labour (DoL)	More independent work and reading books
Outcome	Good grade, satisfaction and encouragement

Note: Researcher's interpretation: From previous experience the student knew that she/he might have problems with designing the program, that is why she/he decided to do more independent work, study more, read related books to improve his/her ability to design the game. The student summary is clear: "Spending time on a program is beneficial and is helpful for work".

Tools are another contradiction in the process of learning programming for these students. IDEs specifically seem to be limited for the work they do. Students also highlighted that some of the IDEs in use are not helpful in terms of solving errors.

The same analysis is applied to the positive experiences in Figure 7, which illustrates the best educational experiences.

Conclusions

There are two main conclusions. Firstly, using AT with GT has led to the identification of contradictions that require shifts to lead to successful ASs that ensure that students are better able to learn programming. These are that:

1. The choice of IDE is important. Simple IDEs do not provide the required feedback to ensure adequate problem solving.
2. It seems that the tools are not as important as the behaviour/motivation of the student toward learning. Utilising all available tools (such as books, IDEs, online videos, search engines, Blackboard, Study Space, etc.) can

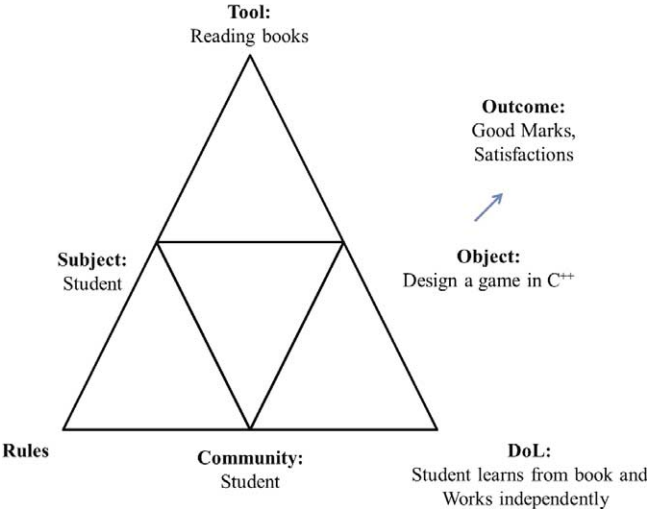

Figure 5. Associated activity system.

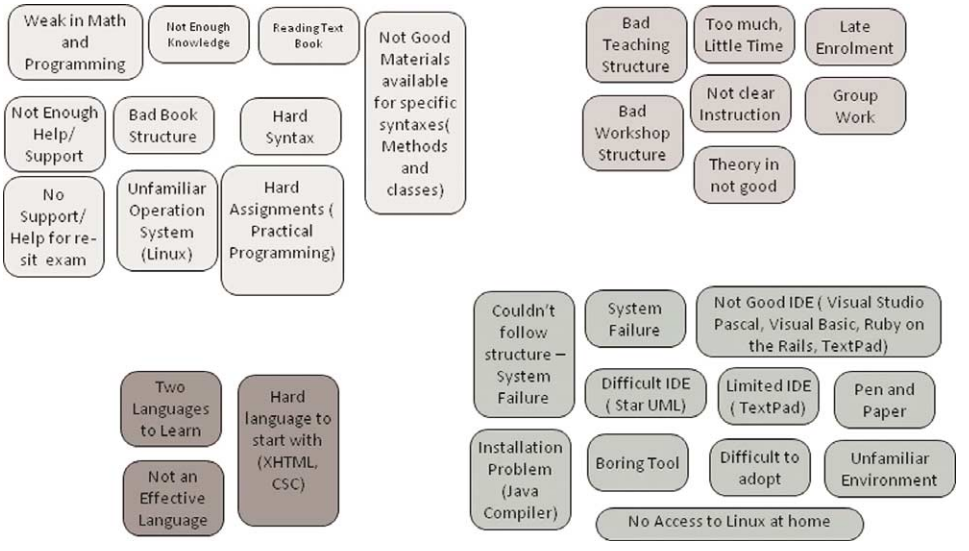

Figure 6. Analysis of failed activity systems.

increase the motivation to learn. These tools make it easier to learn independently of location and time.

3. The communities involved in the activity of learning programming are another high priority in the responses. The better the level of communication, the more rewarding the activity. The interactions between communities

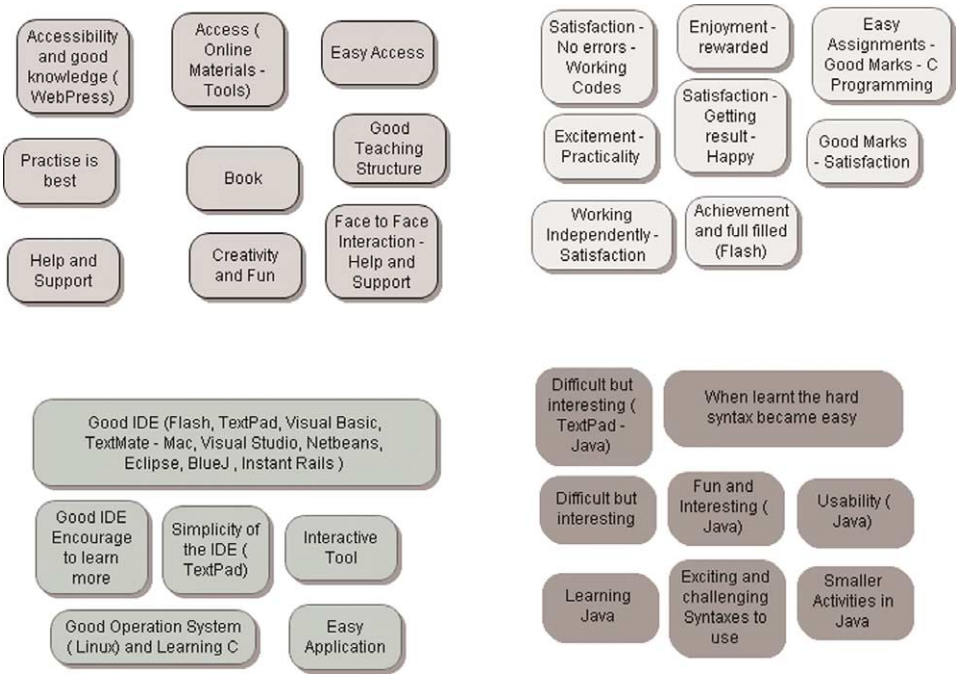

Figure 7. Analysis of positive activity systems.

include: student–student, student–lecturer, student–helpers and student–technicians. The involvement of technicians is critical because most of the technical problems occur the first few times that students begin to use a new environment.

4. A large mixed group does not help to support learning. Designing a suitable lecture/workshop for even the majority of a large diverse set of students is very difficult. Examining all students' programming knowledge before the first programming module is one possible solution to enable streaming or, at least, offering more targeted support/advice.

Secondly, in choosing AT as the framework, there was an implied need to find an appropriate approach to collect and aid the analysis of data, which needed also to be compatible with AT. GT was chosen to complement AT. Using GT offered sufficiently rich detail to identify key interventions and ways to redesign the learning process. AT helps to clarify any contradictions in an AS and provides a means to design changes/shifts to solve these contradictions. Using AT with a series of developing ASs can show the history of contradictions, changes and shifts during the process of learning. This aids the development, knowledge, structure and design of a better learning environment for the future. As Engeström (2000) argues, there is never a finished product in the learning process since there is always a moving target.

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The development of a rich multimedia training environment for crisis management: using emotional affect to enhance learning

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(Received 2 March 2011; final version received 19 July 2011)

PANDORA is an EU FP7-funded project developing a novel training and learning environment for Gold Commanders, individuals who carry executive responsibility for the services and facilities identified as strategically critical e.g. Police, Fire, in crisis management strategic planning situations. A key part of the work for this project is considering the emotional and behavioural state of the trainees, and the creation of more realistic, and thereby stressful, representations of multimedia information to impact on the decision-making of those trainees. Existing training models are predominantly paper-based, table-top exercises, which require an exercise of imagination on the part of the trainees to consider not only the various aspects of a crisis situation but also the impacts of interventions, and remediating actions in the event of the failure of an intervention. However, existing computing models and tools are focused on supporting tactical and operational activities in crisis management, not strategic. Therefore, the PANDORA system will provide a rich multimedia information environment, to provide trainees with the detailed information they require to develop strategic plans to deal with a crisis scenario, and will then provide information on the impacts of the implementation of those plans and provide the opportunity for the trainees to revise and remediate those plans. Since this activity is invariably multi-agency, the training environment must support group-based strategic planning activities and trainees will occupy specific roles within the crisis scenario. The system will also provide a range of non-playing characters (NPC) representing domain experts, high-level controllers (e.g. politicians, ministers), low-level controllers (tactical and operational commanders), and missing trainee roles, to ensure a fully populated scenario can be realised in each instantiation. Within the environment, the emotional and behavioural state of the trainees will be monitored, and interventions, in the form of environmental information controls and mechanisms impacting on the stress levels and decision-making capabilities of the trainees, will be used to personalise the training environment. This approach enables a richer and more realistic representation of the crisis scenario to be enacted, leading to better strategic plans and providing trainees with structured feedback on their performance under stress.

Keywords: affective computing; augmented reality simulations; affective impact in eLearning; timeline-based crisis scenarios; emotional markup

1. Introduction

It is often argued that learning under stress, for example in studying for exams or meeting deadlines for submission of coursework, focuses the mind and results in

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ISBN 978-91-977071-4-5 (print), 978-91-977071-5-2 (online)

DOI: 10.3402/rlt.v19s1/7780

faster processing, storage and recall of information. While there is often debate about the retention of that information and the knowledge thereby gained, there can be no doubt that this model is frequently self-imposed by students. Additionally, decision-making in stressful situations can be impacted by the affect of elements of the situation on the emotional and behavioural makeup of the decision-maker. This paper discusses the work of the EU FP7 Project, PANDORA, and describes a system currently being developed which is designed to use emotional affect in order to impact decision-making and enhance learning. The application under development is designed to enhance and expand training exercises for Gold Commanders in crisis management. Gold Commanders are specifically engaged in the development of strategic plans to deal with a wide range of potential crisis situations that can arise in civil society. These crisis situations could be:

- Natural events, such as extreme weather, earthquake, landslides, etc.
- Transport events, such as plane, train or vehicle crashes.
- Service failures, such as electrical power plant failure, water supply failure, etc.
- Health crises, such as pandemics, epidemics, containment conditions.
- Technology failures, breakdown of automated control systems, central services.
- Policing and terrorism events.
- Some combination of some or all of the above.

In order to develop strategic plans to deal with such situations, individuals who carry executive responsibility for the services and facilities identified as strategically critical within these situations e.g. Police, Fire, Ambulance Service, Local Authorities, Health Service, are expected to work together. These individuals are identified as Gold Commanders, and their role is explicitly strategic. They are in overall control of the emergency. However, they will not generally be at the site of the emergency, but typically co-located in a control room. They will set the direction and propose solutions for the tactical (Silver) commanders to implement. Silver commanders will also typically not be physically present at the site of the emergency but give direction to operational commanders (Bronze) who are responsible for organising resources on the ground. In practice some Gold commanders may also have tactical or operational responsibility. Their objectives are to: save and protect life; relieve suffering; contain the emergency; provide the public with information; protect the health and safety of staff; safeguard the environment; protect property; maintain/restore critical services; maintain normal services appropriately; promote and facilitate self-help; facilitate the investigation/inquiry; facilitate community recovery and to evaluate and identify lessons learned.

The training of Gold commanders to prepare them to manage a crisis is very important and is currently typically undertaken in two ways:

(1) Through the use of table-top exercises: These are low cost, paper-based exercises, with some limited audio-visual input, undertaken by groups of Gold commanders representing different emergency services etc. led by an expert trainer. These events take place in a dedicated training environment or in a standard meeting room at a Gold Commander venue, as required. The expert trainer provides guidance to the Gold commanders on the case study

being used, tries to provide an intensive time constrained activity to simulate the pressure of a real crisis and provides feedback to the Gold commanders after the event. This type of training exercise can be easily organised and is cheap to run but it lacks the authentic feel of a real crisis which would place the Gold commanders under extreme pressure to make rapid and effective decisions.

(2) Real-world simulations: These train Gold commanders in the field through the use of simulation exercises. These are very effective; however they are also extremely expensive, time consuming to set up and require specialist equipment etc.

The purpose of these types of training events is to:

- Develop the collaborative skills of the trainees in formulating strategic responses across a number of organisations and events.
- Develop the strategic thinking of the trainees in considering the implications of their decisions and the effects on other services.
- Develop the responsive skills of trainees in formulating alternative strategies and remediating actions in the event of the failure of a strategic response.
- Determine the strategic planning ability, decision-making capability, flexibility and capability under pressure of the trainees.
- Develop skills to deal with the media, which are inevitably required in the event of a crisis.

However, as outlined above, the typical table-top training model that is used has severe limitations in achieving these goals and is almost entirely dependent on the ability of the trainer to engage and motivate the trainees, and to assess their performance subjectively in the training event.

When a crisis occurs, human behaviour and preparedness is critical to the delivery of an effective solution and therefore training needs to be as realistic as possible. It is important to be able to simulate the information overload and related stress, together with the pressure in making decisions. PANDORA therefore aims to bridge the gap between the low cost, table-top exercises and the expensive real-world simulations by providing an on-line e-learning environment in which the group and the trainer can participate in a realistic, dynamically changing, time sensitive, immersive crisis simulation exercise, that allows trainees to practice their decision making and negotiation skills within a realistic, stress-controlled environment (see Figure 1).

2. Background on affective and emotional computing

One of the key features of the training system developed for PANDORA is that it should provide an environment that engages the trainees on an emotional level. Ideally the trainees should experience emotions of a similar nature and intensity to those that they might experience when dealing with a real emergency. To this end their emotional state will be monitored and manipulated during the training in a variety of ways. This aspect of PANDORA is based on research into models of emotion, decision-making and learning.

Figure 1. The virtual training environment.

Research in neuroscience and psychology shows a strong connection between cognition and emotion. Cognition plays an important role in creating emotions. Emotions, in turn, cause a wide range of effects on attention, perception and cognitive processes involved in decision making, problem-solving and learning. Often the word affect is used instead of emotion and indicates that a wider range of factors than those classically considered as emotions are involved.

A special issue on "Affective modelling and adaptation" of the User Modelling and User-Adapted Interaction Journal focuses on some issues that are relevant to PANDORA. In the introduction, affective computing is described as having four areas of interest. The first area is the analysis of affective states and the relationship between affection and cognition, such as learning. Second is the automatic recognition of affective states e.g. through facial expression or physiological measurements. The third area is the adaptation of a system in response to the affective state of the person. The fourth aspect of affective computing concerns the design of avatars able to exhibit affective states. The second of these areas is considered the most difficult i.e. the ability to precisely and accurately recognise the affective state of a person. Most of the work reported relates to tutoring systems and modelling affective states of learners (Carberry and de Rosis 2008). Forbes-Riley et al. (2008) demonstrate how frustration and uncertainty influence learning and show that adding affective state to learning models increases the level of accuracy of the model. D'Mello et al. (2008) study the relationship between affect and features of interaction (such as the number of words in a student's response, response time etc.) and show that affect can be recognised by these. They consider a wider range of states than Forbes-Riley et al. (2008). McQuiggan, Mott, and Lester (2008) try to identify the level of student self-efficacy and confidence. The initial results of this study show that physiological response may be a predictor of self-efficacy. The work of Porayska-Pomsta, Mavrikis, and Pain (2008) derives a set of rules to adapt interactions with learners to their affective state. Yannakakis, Hallam, and Lund (2008) consider ways to estimate the level of engagement in games in order to adjust the virtual environment to the preferences of children.

An important aspect of affective computing concerns the design of avatars able to exhibit affective states. The design and implementation of computational emotion

models is needed in order to support this. Marsella and Gratch (2009) have carried out research aimed at building a stable computational model of emotions based on appraisal theory. Figure 2 illustrates the relationship they see as existing between appraisal, emotion, coping and cognitive processes and illustrates the key sources of emotional dynamics.

The EMA model has been empirically assessed for three particular types of coping strategies: Wishful Thinking, Resignation and Distancing (Marsella and Gratch 2009). Marsella, Gratch and Petta (2010) propose an analysis of the role and utility of computational models of emotions. Psychological theories of emotions are typically formalised with a high level of abstraction through not very formalised natural language. This implies a high level of abstraction and a lack of detail and rigour. In contrast, computational models require a greater degree of precision since the theory must be implemented through a computational model. In this light computational models lead to the identification of underlying assumptions and complexity that are usually hidden and that need to be managed. Computational models can then be seen as a way to substantiate theories as well as a framework for their construction.

3. Description of PANDORA work to-date

3.1. Modes of delivery

The PANDORA crisis training room, which is where training is conducted, is designed to work in three different modes. These are:

(1) Single site training – this is where the training takes place in a physical room where the trainees and the trainer are co-located. The trainees sit around the table in the same way as they would have done for the paper-based table-top

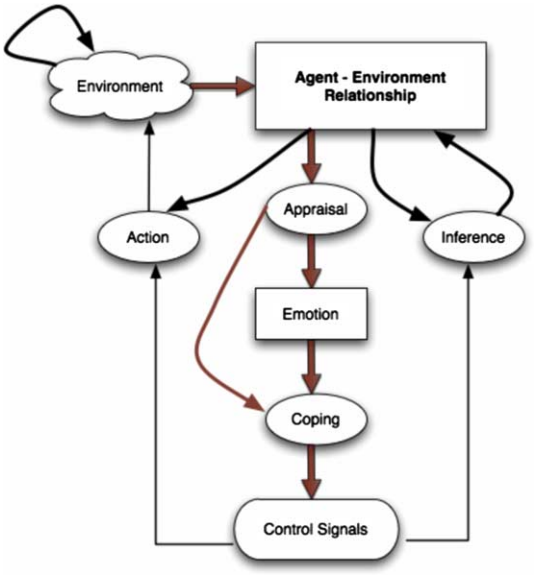

Figure 2. Theoretical assumptions of the relationship between appraisal, emotion, coping and cognition, and the sources of dynamics (Marsella and Gratch 2009).

exercise; however, with PANDORA, a range of consoles are used to provide multimedia information using sound, pictures, maps, animations, videos etc. for example, to simulate receiving information about the crisis such as a news broadcast. Biometric sensors are also used to gather physiological information about the trainees to assist in an analysis of their stress levels etc. The trainer is able to configure the scenario to e.g. set up NPC to role play an emergency service not represented within the group of trainees; subject matter experts; represent higher control (HICON) such as Government ministers – these individuals would be above the level of Gold Commanders and have the authority to demand actions or constrain resources, and can impose their decisions on the crisis team and the scenario; lower control (LOCON) – these individuals represent the lower levels of command within the crisis team and can provide valuable feedback on the tactical level realisation of the strategy being developed by the Gold Commanders.

(2) Deployed training – this is essentially the same as for the single site training; however it is not delivered in a dedicated room, but elsewhere, for example at the site of one of the Gold commanders taking part in the training. The PANDORA system, equipment and setup must therefore be portable to enable this delivery mode to be realised.

(3) Distributed training – in this mode, as shown in Figure 3, the physical room is replaced by a virtual room and trainees participate through a web-based interface. The 3D virtual room contains NPC. As with the other two modes these fulfil any key emergency service roles that are missing from the trainees. Each trainee is represented by their own avatar. It provides the same multimedia channels as the physical room to provide the trainees with information on the unfolding crisis with which they have to deal.

3.2. PANDORA architecture

The underpinning architecture of the system is the same for all three deployment modes and is made up of several key components which are described below:

- The Crisis Module Framework – This provides an event network to model a crisis scenario against a timeline, supporting the management of the training

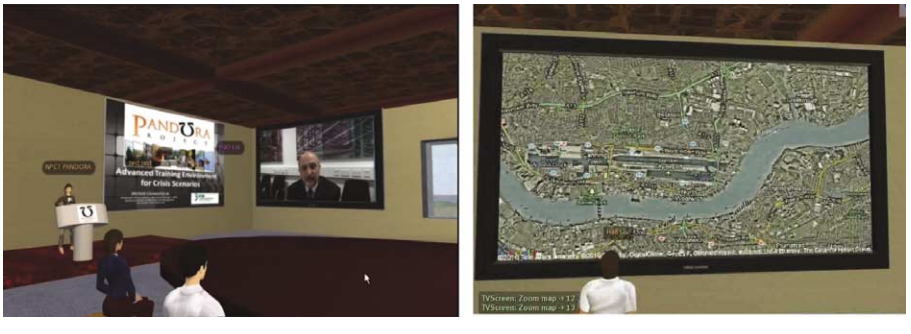

Figure 3. In-world slide show, streaming video and map application.

process including the introduction of decision points for trainees incorporated into events within the crisis scenario. Event network planning and mapping to timelines is managed through a knowledge-based approach, utilising rules stored in the Crisis Knowledge Base.

- The Behavioural Framework – This considers the behaviour of trainees, based on a pre-determined user model, and feedback from a variety of biometric sensors and the trainer during the training session. This component shows how a complete loop crisis-stimuli/trainee-reaction/PANDORA-behaviour-analysis can be implemented and shown to work in a training environment.
- The Trainer Support Framework – This allows the trainer to carry out three key functions:

  (1) The setup of a scenario for use with a particular group of trainees e.g. configuring an avatar to represent a missing trainee from one of the emergency services.
  (2) Customise a training session and dynamically update a scenario whilst it is being executed e.g. by compressing the timeline in which events occur and/or to interject additional events, in order to increase the stress levels of one of more of the trainees.
  (3) Record each run of the scenario so the trainer can review the training session after it has been completed with one or more trainees to reflect on the rationale for the decisions made and the alternative choices that could have been chosen during the simulation.

- The Emotion Engine – This is a middleware component within the PANDORA system, providing facilities for the development, configuration and introduction of NPC into the crisis scenario to interact with the trainees, and multimedia information assets, tagged for emotional affect. The NPC framework also permits the trainer to take control of an NPC to provide direct inputs, in specific events, to the trainees. The Affective Framework, which is a sub-component of the emotion engine, manages a repository of affectively tagged multimedia assets and uses inputs from the behavioural framework and local mashup rules to produce combinations of those assets to provide emotionally and behaviourally affective information to the trainees. The output of the Emotion Engine, generated through the Environment Framework Builder, is a rendering specification describing the environmental conditions, multimedia information assets and NPC to be generated in the training environment.
- The Emulated Crisis Room – in essence this is the trainee environment, since the rendering of the information generated from the other components is realised within this component.
- Integration of the above components is managed through a middleware model that has been developed for the project, and various test beds and test harnesses are also being constructed specifically to meet the needs of the PANDORA system.

3.3. Design for emotional affect

This section describes in more detail how the emotional affect is created by the PANDORA e-learning environment through both behavioural simulation and modelling, and the Emotion Engine.

The focus of the behavioural simulation and modelling functionality is to:

- Select, model and monitor the relevant human factors or psychological variables that can influence decision making.
- Develop a model able to represent trainees' actual behaviour/profile.
- Propose (plan) high-level personalised training goals and user interactions for the crisis planner.

The trainee model takes into account both psycho–physiological parameters e.g. heartbeat rate, personality traits, self-efficacy and pedagogical parameters like training methods. User profiles are developed by asking the trainees to take neuropsychological and psychological tests in advance of the training in order to assess factors such as self-efficacy, self-estimate, affective style, anxiety etc. The PANDORA system will then determine a personalised training path for each trainee, customised with difficulty levels and challenges.

PANDORA must also have the ability to relate a user's emotional and psychological aspects within a computational user model that is able to recreate physical effects. The Emotion Engine has been designed with two components outlined as follows:

(1) An NPC Framework, which can provide representations ranging from simple text information through to full avatar representation (dependent on the mode of deployment of the system) and can represent emotion within those characters within the limitations of the media format used and the current state of the art in emotion representation.
(2) An Affective State Framework, which maintains a repository of multimedia assets related to the training scenario, tagged according to potential emotional affect and linked, where appropriate, to events in the scenario event network. This Framework can combine assets using mashup rules to create emotionally affective multimedia artefacts, subject to the requirements generated from the Behavioural Framework.

The emotional and behavioural condition of the trainees will be monitored in the Behavioural Framework, which will provide input to the Affective State Framework, primarily associated with determining the level of affective input to provide to the trainees, individually or as a group. This information can be pre-determined within the event network, dynamically created by the behavioural framework on an individual or group basis, or input directly by the trainer through that framework.

Within the Affective State Framework a local Multimedia Asset Store will provide a repository for a wide variety of multimedia assets developed to support the scenarios. Each of these assets will be meta-tagged with an XML emotion mark-up language specification, adapted specifically for PANDORA, which will provide standard information on the type and nature of the asset, the media channels for

which it is appropriate, the potential for combination with other multimedia assets, duration, etc. It will also indicate an affective level that the asset individually can be expected to engender in the trainees, based on an affective scale defined and categorised for the PANDORA project. These assets can also be specifically tagged for use in specified events in training scenarios, to support the rapid selection of assets.

The key concept to consider in the development of multimedia information representations for the trainees is the affective impact that combinations of these assets may have. It is standard practice in film and TV design and production to utilise combinations of environmental outputs to generate affective conditions, often referred to as *ambience*. While in the PANDORA environment there will be no background music to create mood, it will be possible to use audio effects to reinforce outputs generated from a crisis situation. The use of video images combined with TV style voice-overs will permit differential levels of anxiety in the voice-over to be associated with the same images, permitting reuse to change the affective impact related to the same information, and a number of similar techniques may be applied to video and audio information. By using an XML-based tagging for multimedia assets, it becomes possible to use rule-based mechanisms to combine multimedia assets and create mashups to achieve a desired level of emotional affect within the environment. Information management techniques, such as overloading the media channels with multiple inputs, noisy media channels, missing and incomplete information, and media channel failures, can all also be used to impact the stress level of the trainees. Given that the system can identify the current emotional and behavioural level of the trainees, and for the purposes of the training event a target emotional level can be identified, then the Affective State Framework can be used to manage the information presentation to the trainees to impact on their emotional state on a trajectory towards the target level. The efficacy of affective impact of particular approaches will be determined from changes to the emotional and behavioural level of the trainees, determined by the Behavioural Framework. This information will be used to enable the system to learn and adapt the rules and techniques to provide more effective affective controls.

3.4. Summary of key PANDORA features

The PANDORA system addresses the shortcomings of the existing training model, enhances the range and scope of the training events and offers the potential for future development by:

- Offering a fully featured multimedia environment to provide information to the trainees, including audio, video, maps, texts, email, graphics and text.
- Developing a structured, timeline-based, sequence of events, crisis scenario model running in a computer-based simulation environment controlled by the trainer.
- Providing real-time operational inputs demonstrating strategic decision outcomes to trainees, asking them to dynamically revise strategic plans and decisions.
- Capturing trainee behaviour and emotional state, through the use of pre-event information capture, direct sensor inputs, self-reporting by trainees, and

trainer inputs, and using affective media effects and information presentation techniques to induce changes to those behavioural and emotional states.
- Providing a graphical virtual representation of the training environment to support on-line distributed training events.
- Providing virtual characters, in any form from textual through to full animation, to engage in the event, including replacements for missing trainees, to ensure that the full scenario enactment is supported in all training events.
- Providing the trainer with a full control system for the training event, including the ability to change events, add new events, expand and compress timelines, provide direct interventions into the scenario and increase or decrease the emotional stress applied to individual trainees.
- Maintaining a detailed log of the training event, to permit rerun of some or all events, modelling of individual trainee performance and capture of relevant and useful events as exemplars for future training.
- Maintaining configurable scenario models, knowledge, multimedia asset and databases to enable the system to build a wide range of crisis scenarios, to use as training events for those involved in crisis management at all levels.

4. Contribution to the EmotionML standard

Emotion Markup Language (EmotionML) is an XML-based language designed to represent emotion in a machine-readable manner. It is going through the W3C standards process and is currently at the 'Working Draft' stage (W3C 2010a). EmotionML is intended to be used as a plug-in language i.e. to be used in conjunction with other XML languages such as SMIL.

The main areas in which EmotionML is expected to be applied are:

(1) Annotation of data and media.
(2) Recognition of emotion expressed by people.
(3) Simulation of emotion by technological artefacts.

All three of these areas are relevant to PANDORA, and so from the inception of the project, EmotionML was considered as a likely technology for use in its implementation.

Detailed consideration of how EmotionML could be used to implement aspects of PANDORA revealed several potential issues with the version 1.0 or the draft standard. Three of these are outlined below:

(1) EmotionML considers scales (e.g. for representing intensity of emotion) to be continuous, linear values. This may not be adequate to capture important information in PANDORA. In some cases scales may need to be logarithmic or take into account the notion of a 'tipping point'. In other cases it may be important to be able to represent discrete values.
(2) EmotionML allows for different vocabularies (e.g. for representing the category of emotion). The need for this is the lack of agreement amongst professionals, such as psychologists, about a single vocabulary. The problem of having a multiplicity of vocabularies, especially with none being specified as a default, is that of interoperability. As PANDORA moves beyond a pilot

project it is likely it will need to interact with external systems e.g. to use media originated and annotated externally and so interoperability will be important.

(3) EmotionML allows for emotions to be tagged with a timestamp. In PANDORA data received from monitoring the trainees' affective state will be received in a stream throughout training and it will be useful to be able to represent the identification of emotion as starting at a time offset within the session.

These issues and a description of planned use-cases for EmotionML in implementing PANDORA were discussed at a W3C EmotionML Workshop in October 2010 and will be taken into account when revising the draft standard (MacKinnon, Windall, and Bacon 2010; W3C 2010b).

5. Conclusion and future work

The PANDORA project will produce an advanced training system, targeted specifically at Gold commanders in crisis management scenarios. Since Gold commanders represent the strategic level of crisis planning, improving the training and thereby the efficacy of their strategic thinking and the design of their remediation plans will have a significant beneficial effect in the handling of a variety of different crisis. Better crisis management will have significant socio-economic impacts, in terms of reduced casualty rates, faster and more efficient remediation, reduced loss of working time, reduced loss of productivity and improved coordination of expensive resources. Additionally, since the project will provide different deployment models for the training scenarios, it becomes possible to train larger numbers both at strategic and tactical levels, utilising distributed virtualised representations of information, and thereby advance the training scenarios into fully immersive digital environments. Such an approach will enable the use of varied training scenarios that are too expensive for physical simulations to be realised in virtual form, thereby enabling training activities that are not currently practical. Again this will have significant socio-economic benefits, in the ability of crisis managers to develop more wide-ranging, complex and detailed strategies and remediating actions to deal with the ever-growing range of crises that they might be called on to manage. The use of the PANDORA system in different partner countries within Europe will also support the sharing of best practices in crisis management, scenario information and experiences, and will promote understanding of different response modes related to cultural, legal and social variations, which would be of particular importance when dealing with crises that cross national boundaries.

Whilst the PANDORA system is currently being developed for crisis management training, the e-learning architecture and component model is not specific to this particular situation and could be used for a variety of different training needs, since the key component is a scenario that can be modelled as a set of discrete events against a timeline. We can envisage a large number of different application areas ranging from business planning, through health and social care, to regional infrastructure planning, all of which could be modelled within the PANDORA system and then used for simulation and training purposes. In fact, if we consider that the PANDORA system offers a visualisation and simulation environment to

support event network-based scenarios, we can consider its use for almost any timeline-based process. The benefits of the training environment, which include the modelling of the behaviour of trainees, the potential for customisation of the immediate training session by the trainer and the introduction of affective elements to impact the emotions and behaviours of the trainees, provide a range of facilities that could be utilised in different ways. Using the PANDORA approach to provide training for a variety of different sectors and scenarios would give Europe a significant lead in the use of visualisation and simulation technologies to provide learning experiences that would otherwise be too expensive, too dangerous or simply impracticable for the general workforce. The socio-economic and social impacts of the widespread use of high-quality simulation and visualisation in distributed virtual environments to provide realistic learning experiences would be extremely significant.

Acknowledgements

This paper is a product of research and development by consortium members of the PANDORA project funded by an EU grant under FP7-ICT-SEC-2007-1, grant number 225387.

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School trip photomarathons: engaging primary school visitors using a topic focused photo competition

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(Received 2 March 2011; final version revised 17 May 2011)

The aim of this study was to explore the potential of photomarathons as a fun and engaging way to support students making connections between what they learn during a museum visit and what they learn in school or other contexts. Sixty primary school pupils aged between six and eleven took part in a photomarathon activity during their trip to the Roman Baths. The children were split into three groups. During their visit each group undertook three one-hour activities, namely: a photomarathon, a hands-on artefact exploration activity with a museum education officer, and a school-group handheld audio tour. For the photomarathon activity the children worked in subgroups of three and, for 15–20 minutes, took photos on three themes around the museum. At the end of the available time the children submitted a set of photos, one photo for each theme. Photo galleries for each theme were then generated and made available on a website for the pupils. The students voted for the best photo in each theme gallery, and a small prize was awarded to the members of each team that took the winning photo. A week after the visit the children were asked a number of questions concerning their visit. The photomarathon was spontaneously mentioned by 41% (23/56) of the children as the best activity in their visit to the Roman Baths, which was more than any other activity they engaged in during the visit. Overall, of the three activities the children liked the photomarathon the best. There were no age differences in how engaging the children found the photomarathon activity and all children regardless of age were able to take photographs.

Keywords: museum learning; school visits; photomarathons; empirical studies

Introduction

Photomarathons are a timed competition in which a group of photographers are given a set of themes to take photos on. At the end of the available time (typically around 12 hours) each entrant submits a set of photos, one photo for each theme in the given order. The judges then choose the best photos and award prizes.

As a school trip activity, a photomarathon can be completed within an hour (including the judging and prize giving). The visiting group of pupils are first introduced to the rules of the competition and the judging process; they are then given cameras and three or four curriculum-related topics to take photos on. After a

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ISBN 978-91-977071-4-5 (print), 978-91-977071-5-2 (online)

DOI: 10.3402/rlt.v19s1/7797

set time limit (typically 15–20 minutes) the pupils return to upload their photos and vote for their favourite within each topic category. By using topics provided prior to the visit by the teacher and/or the pupils, the photos taken during the visit form a personal collection of resources that can be used after the trip as a basis for further class discussion or student research activities.

We were interested to see if pupils enjoy the photomarathon activity and to what extent it can help motivate visitors to engage with museum exhibits. We argue that aligning the competition topics with the curriculum encourages pupils to think about those topics during their trip, and helps them to relate what they learn during the trip to the work they do afterwards in class. This paper introduces the research that motivated the development of the school trip photomarathon activity and the outcomes of a formative evaluation trial, including the design of the activity, the development of the technology used, the feedback received and the subsequent re-development of our photomarathon toolset.

Related work

Class visits to museums are a long established and popular activity for schools. For example, the Roman Baths in Bath had 50,140 visitors in self guided educational groups between April 2009 and March 2010, and a further 9889 visitors in educational groups that took part in a teaching session organised by the Roman Baths.

School museum visits such as these are important because they:

- expose students to subject matter that cannot be covered in the classroom,
- introduce them to resources in their community,
- provide a varied social experience,
- are memorable experiences for the students which can be drawn upon after the visit by the teachers in appropriate learning situations, and
- can offer cross curriculum learning opportunities.

Research on museums has reported mixed findings in terms of knowledge and cognitive gains after visits to museums (Donald 1991; Griffin 2004). However, knowledge gains are not the only outcome of museum visits. Students can also gain in terms of positive attitudes and motivation towards the museum and its subject matter (Falk et al. 2004; Jarvis and Pell 2005; Rennie and McClafferty 1996). These gains are in some ways more important because they not only inspire further study and visits to the museum, but also motivate and engage the students in further school work based on their visit. Considerable research has found that high levels of motivation and engagement in schools are related to higher academic achievement (for a recent review see Ryan and Deci 2009). Further research has shown that post-visit visit activities in the school are important because they help students assimilate new concepts and resolve possible misconceptions (Anderson, Lucas, and Ginns 2003; Anderson et al. 2000). Falk and Dieking (2000) argue that it is only after a visit that the experience becomes relevant and useful.

There has been considerable research on the use of mobile devices to support school visits (see for example Cabrera et al. 2005; Galani et al. 2003; Hsi and Fait 2005; Mulholland, Collins, and Zdrahal 2005; O'Hara et al. 2007; Papadimitriou et al. 2006). This work has moved beyond the audio guide found in most museums,

and developed systems that facilitate exploration, information searching, communication and documentation (Hsi, 2002).

There have, however, been few studies that have tried to bridge pre-visit, visit and post visit learning in the museum and the school. One notable exception is MyArtSpace, which was a service developed to run on mobile phones to support inquiry learning by (Vavoula et al. 2009). The process begins prior to the visit with goal-setting at the school. During the visit the students use MyArtSpace to gather information either through taking photographs or field notes during their school field trip. This information is automatically sent to a website where the students can view and present their work after the visit. The authors report that the service was effective in enabling students to gather information in a museum, and provided resources for effective construction and reflection in the classroom.

Another recent example that supports inquiry learning across contexts is the Zydeco system (Cahill et al. 2010; Kuhn et al. 2010). The system includes an online web component allowing students to define goals, questions and information for their science inquiries. This information is uploaded to a handheld device so that students can photograph, tag and annotate information in a museum. Students can then access their museum work back in the classroom to complete their investigations.

Both of these systems are designed to support inquiry learning, an approach intended to encourage students to explore topics of interest that relates resources and activities to a focused problem or topic under investigation. The aim of this paper is to build on this work by exploring the potential of photomarathons as a fun and engaging way to support students making connections between what they learn in their museum visit and what they learn in school or other contexts.

Formative evaluation trial

Participants

The sixty primary school visitors were divided into three more manageable groups. The first two groups were made up of pupils from two classes with an age range of nine to eleven year olds; the third group consisted of younger pupils, aged seven to eight. Table 1 presents the distribution of pupils, teachers and assistants between the three groups. During the day each group undertook three one-hour activities, namely: the photomarathon, a hands-on artefact exploration session with one of the museum education officers, and a school-group audio tour using individual handheld audio guides.

The session plan for the one-hour photomarathon was as follows:

- Introductions (10 minutes)
  - Introduce the researchers and explain the competition rules and regulations, give each subgroup a camera, and explain how to use the camera (reminding the pupils about their three topics, which are also printed along with the rules on a label attached to each camera).
- Pupils exploration and photo taking (20 minutes)
  - Pupils (supervised by their teacher and the assistants) go around the museum taking photos on each topic.
- Photo uploading (5 minutes)

Table 1. The distribution of pupils, teachers and parental assistants across the three groups undertaking the photo marathon activity during a one day school visit in October 2010.

Group	Start time (duration 1 hour)	Age range	Number of pupils per group	Number of pupils per subgroup	Number of teachers	Number of assistants
Group 1	10:30	9–11	24 pupils in seven subgroups	4 groups of three pupils and 3 groups of four pupils	1	2
Group 2	11:30	9–11	21 in six subgroups	3 groups of three pupils and 3 groups of four pupils	1	2
Group 3	14:00	7–8	15 in five subgroups	5 groups of three pupils	1	4

    - Upload the photos to a computer using three topic folders. Each subgroup selects a photo for each topic, which is placed in the corresponding topic folder.
- Reviewing and judging (15 minutes)
    - Show each topic folder as a photo gallery and ask the pupils which ones they prefer and why (keeping the discussion focused on the specified topic). Before moving on to the next topic, ask the pupils to vote for their favourite (having discussed them for a couple of minutes). The goal is to identify the photograph that best represents the topic (i.e. not the clearest or best composed photo).
- Prizes (5 minutes)
    - Award a small prize (age appropriate) for the best photo in each topic.
- Reset (5 minutes)
    - The group moves on to the next activity while the researchers reset the cameras and computer for the next session.

Resources

A large office was made available in the back rooms of the museum for the photomarathon sessions (see Figure 1). A data projector and screen were used to

Figure 1. The room setting and equipment used for the photomarathon activity.

show the photo galleries and some introductory PowerPoint slides. Canon PowerShot A460 (point-and-click) cameras were used by the pupils. As noted above, laminated labels reminding the pupils of their photomarathon themes and rules were attached to the pupils' cameras.

A printed copy of the PowerPoint slides containing information on the activity and details of the website were given to each teacher (prior to the pupils taking photos), along with a set of small paper leaflets with the web address and password details to enable each of the pupils to access their gallery online after the visit (these were given to each of the teachers at the end of the photomarathon session).

Three computers (two netbooks and a laptop) were used by the authors to upload the photos. The photos were then copied from the two netbooks onto the laptop, which was running a local web server XAMPP. This is an easy to install Apache distribution containing MySQL, PHP and Perl (http://www.apachefriends.org/en/xampp.html). It could generate image galleries for each topic folder. The resulting gallery folders were copied to a publicly available web server at the end of the day.

Formative evaluation

The children completed a pre-test one week before their trip to the Roman Baths, which was a general assessment of their knowledge of the Romans. A week after their visit to the Roman Baths, the children were given a post-test. It consisted of a general assessment of their knowledge of the Romans, which was the same as the pre-test, and an evaluation questionnaire of their experience at the Roman Baths.

The questionnaire consisted of an open ended question asking "what was the best thing about the visit to the Roman Baths?" The next four questions asked the children to rate their visit to the Roman Baths overall, the photomarathon, the audio tour, and the teaching session. The children used a five point 'smiley face' scale which ranged from 'awful' to 'brilliant'. The smiley face scale was developed and validated by Read and MacFarlane (2006) as a means of surveying children in the age group taking part in the study. The children were asked which activity they liked the most and which activity they liked the least. Finally, they were asked whether they found taking pictures easy and whether they had visited the photomarathon website.

Findings

The 18 subgroups took 154 photos in total. On average each group took 8.6 photos (with only one group taking less than three). In the evaluation questionnaire, the children were first asked what they thought was the best thing about the Roman Baths. We noted the number of children who mentioned either: the photomarathon, the audio tour, the teaching session, a general comment about the Roman Baths, a specific comment about the Roman Baths, or lunch.

Figure 2 shows that 41% (23/56) of the children commented that the photomarathon was the best thing about their trip to the Roman Baths, compared to 18% (10/56) who mentioned the teaching session, 11% (6/56) who mentioned the audio tour, 14% (8/56) who mentioned the Roman Baths in general; 12% (7/56) who mentioned something specific about the Roman Baths and 4% (2/56) who mentioned lunch. On this measure the photomarathon was the best aspect of their visit.

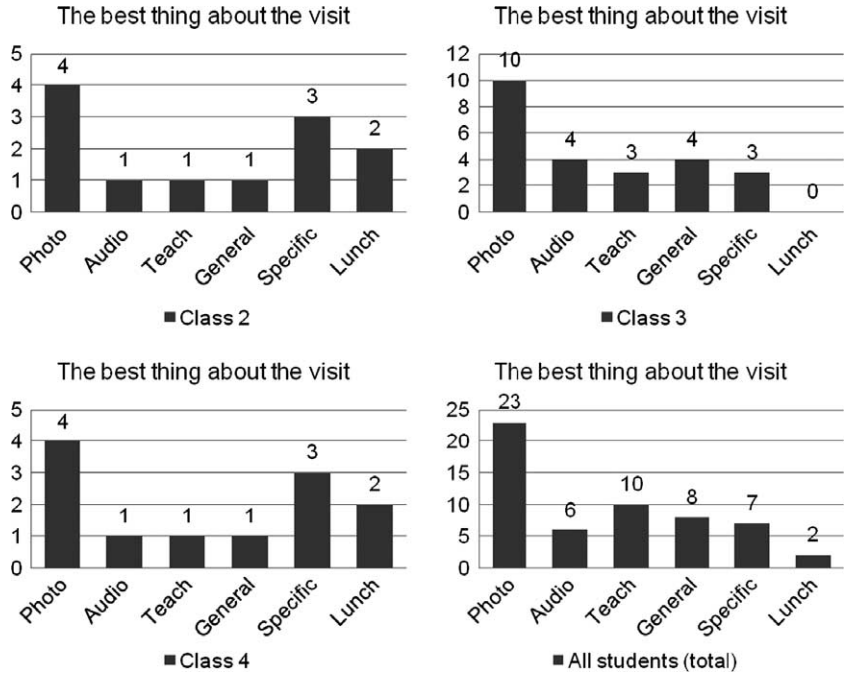

Figure 2. The students' reported best thing about the visit, for each class and total.

The next set of questions asked children to rate their visit to the Roman Baths using a five point smiley face scale.

Figure 3 shows that 64% (36/56) of students rated their trip to the Roman Baths as brilliant, 20% (11/56) rated it as really good and only one child rated it as not very good. There was an age difference, with 83% (10/12) of younger children (i.e. Class 2) rating it brilliant compared to 35% (7/20) of the older children ($\chi^2 = 16.8$, df $= 6$, $p < 0.05$).

Fifty percent of the children (28/56) rated the photomarathon as brilliant, 29% (16/56) rated it really good and only one child rated it not very good (see Figure 4). There was no age difference ($\chi^2 = 3.0$, df $= 6$, $p > 0.05$). Fifty seven percent of children (32/56) rated the audio tour as brilliant, 16% (9/56) as really good, 7% (4/56) rated it not very good and one child rated it as awful. There was no age difference ($\chi^2 = 11.6$, df $= 8$, $p > 0.05$). Fifty five percent of the children (30/55) rated the teaching session as brilliant, 16% (9/55) rated it as really good, one child rated it not very good and one child rated it awful. There was no age difference ($\chi^2 = 9.9$, df $= 8$, $p > 0.05$). Comparing the three activities, the most highly rated was the audio tour followed by the photomarathon and then the teaching session. The differences are very small and not significant.

The children next had to select which of the activities they liked the best (Figure 5 left). Overall, the most popular activities were the audio tour and the photomarathon, both selected by 40% of children (21/53). The teaching activity was selected by 20% of the students (11/53). They were next asked which activity they liked the least (see Figure 5 right). Forty nine percent of the students (24/49) said they least liked the teaching activity, followed by 31% (15/49) choosing the audio tour and 20% (10/49) least liking the photomarathon. A third of the children (19/57) said they had looked

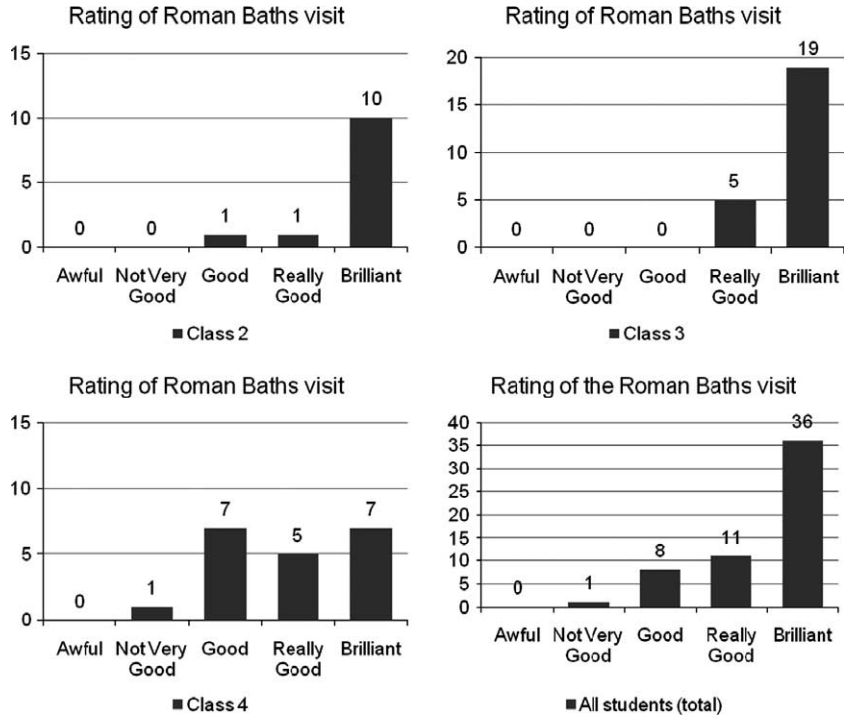

Figure 3. The students' ratings of their visit to the Roman Baths, for each class and total.

at the photomarathon website and 88% of the children (50/57) said they had found the cameras easy to use.

Comparing the children's knowledge of Roman Britain as assessed by the pre and post questionnaire, there were no significant differences in the children's knowledge after visiting the Roman Baths compared to before.

Discussion

The aim of this evaluation was to investigate the use of photomarathons as a way of supporting students making connections between what they learn during their museum visit and what they learn in school or other contexts. The photomarathon was spontaneously mentioned by 41% of the children as the best activity in their visit to the Roman Baths, which was more than any other activity they engaged in during the visit. Fifty percent of the children thought the photomarathon was brilliant, and only one child did not think the photomarathon was good. There were no age differences in how engaging the children found the photomarathon activity and all children regardless of age were able to take photographs. Thus, as an activity the students found it a fun and engaging experience. Unfortunately, we found no significant difference in learning outcome after the visit, which is not unusual (Griffin 2004) and possibly can be explained in terms of the short duration of the visit and the unfamiliar and unusual location (Donald 1991).

There were a number of difficulties that emerged with the photomarathon activity. The timings of each photomarathon session were challenging to manage. The pupils quickly grasped the goal of the competition, they understood the topics,

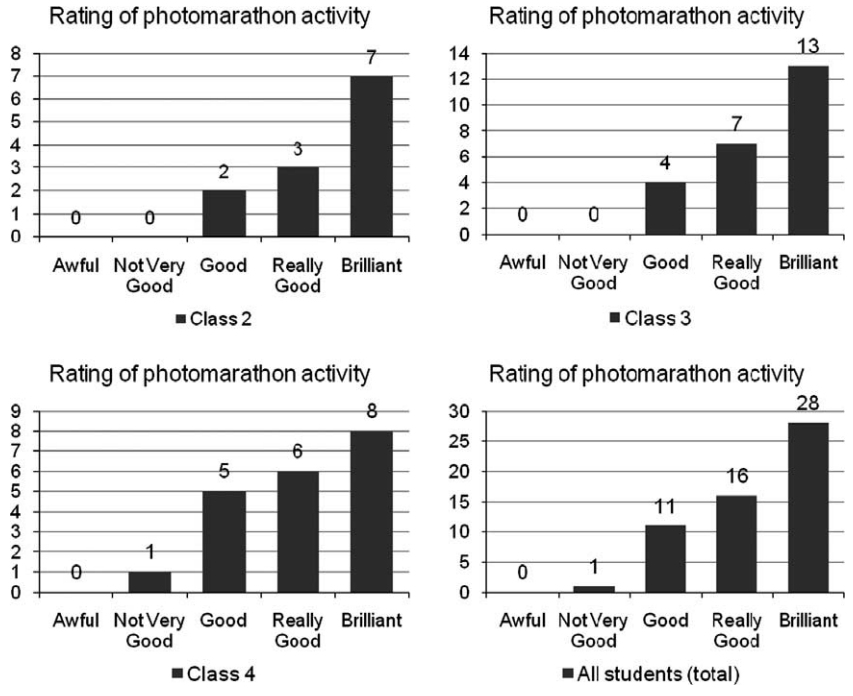

Figure 4. The students' ratings of the photomarathon activity, for each class and total.

and had no difficulty operating the cameras. The photo uploading process took longer than expected. This was partially due to the logistics of asking each group to identify their selected photo for each topic.

The peer judging of photos generally worked well. Each student could vote for one photo in each topic category, but could not vote for their own photos. In cases where the vote was split between entries one of the researchers took on the role of a (television talent show) judge to choose a winner. The teacher for the pupils in the youngest age group suggested after the session that it may also be appropriate to include a small prize for taking part in the competition.

Some problems also occurred regarding the attribution of photos to each group. As identical cameras were used, the automatically generated image filenames were similar for every group. For some of the topics multiple groups had photographed the same or

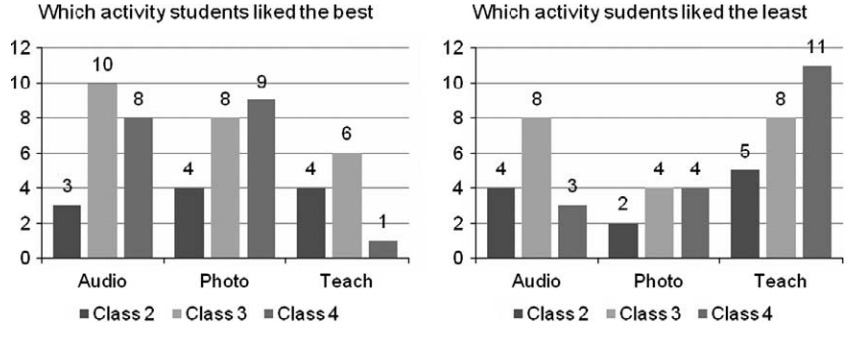

Figure 5. The students' most liked (left) and least liked (right) activity for each class.

very similar objects, resulting in a couple of cases were the attribution of the winning photo was difficult.

Activity revision and toolset re-development

In general, the photomarathon activity went well and the pupils enjoyed it. However, due to the timing and photo attribution challenges discussed above, an alternate means was sought for uploading and labelling photos. A solution has been developed that uses Android mobile phones; a web server, such as the temporary laptop server used above; and a wireless local area network. The photos taken with the camera on each phone can be automatically synchronised onto the local web server over the wireless network (see Figure 6). This approach uses commonly available relatively cheap technology, along with an existing set of free phone applications.

To automatically synchronise the images from each phone, a scaled down web server application (such as kWS) running on each phone will make the photos on each phone's SD card available as a website. A web synchronising program (such as Wget or rsync) running on the local laptop web server is then used to download the images from each phone to the relevant group folder on the web server. As the students return from taking their photos the phones automatically connect to the WiFi network (if only available locally) and the photos are uploaded to the website. Each group can then select their preferred image for each topic and submit it (i.e. drag it) to the corresponding topic gallery. The attribution of photos is handled automatically by appending a group name or identifier to each photo file as it is uploaded to the website.

Conclusions

Critical for the success of Photomarathons is the engagement of the teachers. The teachers in our study were very engaged, and were active in selecting the appropriate themes prior to the visit to the Roman Baths and the follow on activities using the photo galleries in the school. It was also important to discuss the themes with the educational staff at the Roman Baths to ensure they were suitable for the site.

Figure 6. An example photomarathon toolset for collecting photos from a set of Android mobile phones, comprising of a wireless router, a netbook computer and some phones.

The revised design of the proposed system means that the Photomarathons could be an activity ran by the museum or the school. It only requires Android mobile phones with a digital camera and WiFi connectivity, and a network enabled netbook (or laptop) computer. In our study a projector and screen were set up in a room at the Roman Baths, but it would be possible to run the presentation and judging process at the school after the children return from their visit. It is unclear whether it would be more beneficial educationally to run the judging process during the visit or after the visit. After the visit, it would be another way to connect the visit to the museum with the learning taking place at the school. The advantage of supporting the activity in the museum would be that it would have dedicated resources and staff for supporting and running Photomarathons, which would require minimal preparation on the part of the teachers to set up. The flexibility of the system also means that it could be run in non-institutional contexts (e.g. field trips) and visits to locations where it may be difficult to run the judging process in situ (e.g. visits to cities).

Another issue which may be worth exploring is whether Photomarathons are more beneficial as a group activity or an individual activity. Currently, they are a group based activity and research has consistently shown the benefits of group based activities over individual activities (Lou, Abrami, and d'Apollonia 2001). Informal observation of the groups provided evidence for and against this view. Some groups would discuss the themes and have discussion about which images would best illustrate those themes, however other groups would distribute the activity between themselves with each child taking one photograph with little or no discussion. In future research, we are planning to investigate the discussion children have concerning the photographs and whether this is related to their benefits of participating in Photomarathons.

This study has shown that Photomarathons are a fun and engaging activity. Further research is being undertaken to investigate the potential of Photomarathons, using the revised design as a means of successfully linking visits to museums with learning in schools.

Acknowledgements

We would like to acknowledge the support of the staff at the Roman Baths, without whose support and enthusiasm we would have been unable to conduct the study. We would also like to thank Eileen Scanlon and the Personal Inquiry Project for the loan of the cameras and Clifton School for allowing us to observe their visit to the Roman Baths, which gave us the initial idea for the project. Above all, we would like to thank Anne Hewitt, Jenny Crossthwaite, Darren Roberts, Ruth Roberts and the children of Farmborough School for participating in the activity during their visit, and for offering activity design suggestions and competition themes prior to visit, as well as their feedback and comments afterwards.

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Fostering academic competence or putting students under general suspicion? Voluntary plagiarism check of academic papers by means of a web-based plagiarism detection system

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(Received 17 May 2011; final version received 11 June 2011)

In view of the increasing number of cases of plagiarism and the ease of use of on-line published texts, universities are faced with a considerable challenge to prevent and take action against plagiarism in academic student papers. In reaction to plagiarism, web-based plagiarism detection systems (PDSs) are increasingly used to check submitted papers – this checking entails various problems, for example the percentage of plagiarism found is only an indication of the actual extent of plagiarism and not all types of plagiarism can be identified.

To cope with this problematic situation the voluntary plagiarism check (VPC), an alternative preventive university didactic concept, was developed at the University of Education, Freiburg (Germany). It focused on the development of individual skills. Students were able to submit their academic papers (e.g. an undergraduate paper, final thesis) anonymously. These were then tested with the PDS Ephorus. Following interpretation and summary of the findings by the project team – plagiarism as well as referencing mistakes – we advised the students on a suitable approach to academic writing based on their own typical mistakes. The VPC was conducted as a three-semester research project and was later evaluated. About 500 academic papers were tested. In 90% of the undergraduates' work incorrect and/or missing citations were found. This high percentage decreased among students in later semesters. Instances of plagiarism were detected in about 40% of the papers when the texts of advanced students ($\geq$6th semester) were tested. At the same time the length of the plagiarised texts decreased.

Around half of the students stated that it was acceptable to copy single sentences or short passages from other sources without citation; they did not consider plagiarising on a limited scale as cheating. A similar number of students admitted to having doubts about whether they could write a good paper without plagiarising. Almost all students said that they had experienced considerable uncertainty, stress and fear while writing academic papers. The project results offer new insights into Internet-focused working strategies, on student justification for plagiarism and attitudes to literary property and on frequent mistakes. In addition to showing that there is broad acceptance among students of the VPC, the results can be taken into consideration in curriculum development and in developing courses to meet the needs of students.

Keywords: voluntary plagiarism check; universitiy didactic concept; plagiarism check of academic papers

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ISBN 978-91-977071-4-5 (print), 978-91-977071-5-2 (online)

DOI: 10.3402/rlt.v19s1/7611

The setting: the prefix 'e' changes academic learning and work

Plagiarism is dishonest and as such is academic misconduct. The intellectual property of third persons is ignored in practising plagiarism. Academic writing requires the ability to use the correct academic style for the citation and acknowledging of sources. Students should be able to apply what they have learned in the teaching context to their own research and publication practice. The increase in incorrect documentation practice goes hand in hand with the increase in use of on-line material – in fact we are dealing with the problem of 'e'-plagiarism. Our daily experience shows that many students use the Internet to borrow texts and ideas without mentioning the sources. They claim this on-line material as their own work. Weber (2009) refers to this phenomenon as the "copy & paste culture". Studies show that 25–60% of students plagiarise (e.g., Greubel 2009; McCabe 2005; Scanlon and Neumann 2002; Szabo and Underwood 2004; Weber 2009). For a current literature review on the academic (dis)honesty of college students, see Payan, Reardon, and McCorkle (2010).

In the context of academic learning, the Internet serves as a source of information and a means of communication, participation, collaboration and social networking. The addition of the prefix 'e' necessitates changes in teaching practices. It is not just a question of applying existing learning skills to an electronic medium. With the establishment of e-learning contexts, universities expect students to become more active knowledge-designers in individualised, self-determined learning processes. This "shift from teaching to learning" (Welbers and Gaus 2005) raises the expectation that university didactic concepts will support such a change of the entire teaching and learning culture. In order to achieve a move towards learner-centred teaching and learning, on-line-based didactic concepts have to cover the whole qualification process, including the resulting academic papers. Given that when plagiarism occurs, it is mostly a case of copying & pasting Internet content (Weber 2009); this (mal)practice must be viewed and treated as common' e'-plagiarism. Therefore, the detection of such plagiarism is usually carried out by means of a text comparison with on-line sources. This means we are dealing with a challenge in the field of media-supported teaching and learning and their didactics. In order to find concepts for prevention, the focus must be on finding out which specific features of on-line-culture encourage plagiarism.

Attention should be paid to the variety of reasons for plagiarism, ranging from deliberate to unintentional acts (Evans 2006; Kohl 2010). In Figure 1, an overview of the possible causes is given (summarised from Bowman 2004; Greubel 2009; McCabe, Klebe Treviño, and Butterfield 2005; Weber 2009). The findings show that in many papers lack of knowledge, poor academic sensitisation and false perceptions of the purpose and readership of the paper of the writing cause the errors and omissions. In view of our particular university didactic perspective we focused on a concept of prevention: the aspects in Figure 1 with a white background.

There are some didactic approaches which can help prevent unintended plagiarism such as giving students the opportunity to self-check their academic papers by using a plagiarism detection system (PDS). Students themselves can use the technical systems to check their papers. Such procedures receive positive feedback from the students themselves (e.g. Dahl 2007). However, it is questionable whether students can acquire honest academic working strategies and learn correct citation by

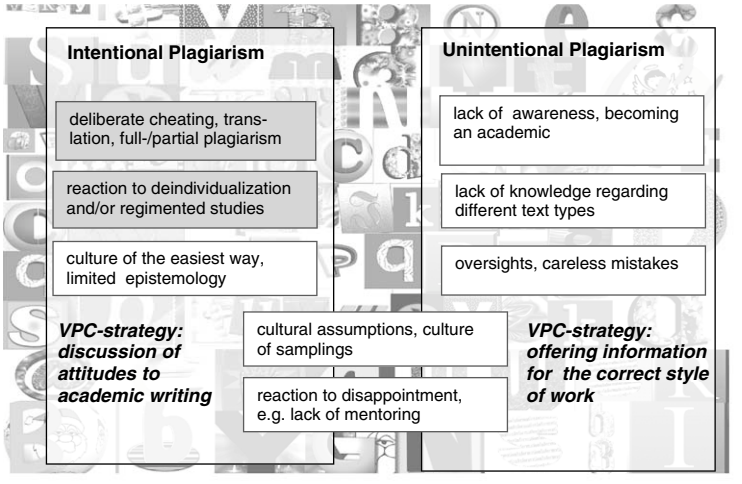


Figure 1. Possible reasons for plagiarism.

merely receiving a technical detection report. In the report, errors are not self-explanatory and there is no opportunity to explain or to discuss inappropriate attitudes. However, feedback and advice from academic staff seems to result in changes in the writing process and the acquisition of ethical norms (Engler and Landau 2011).

> [...] if a campus decides to address academic dishonesty by creating a social norms campaign, then the campaign must use the most credible source of information. [...] our results indicate that students are attentive to the source of these messages and may use this information, in part, to determine their behavioral response to the normative message they receive. Efforts to identify and use credible sources (perhaps professors) to share messages about the true levels of academic dishonesty will contribute to more successful social norms campaign outcomes. (Engler and Landau 2011, 48)

Bringing the subject of plagiarism up for discussion and evaluating different types of plagiarism consistently is a difficult undertaking for colleges. There is disagreement among academic staff regarding what constitutes academic honesty with regard to using and acknowledging sources – in the evaluation of student performance as well as in their own writing behaviour (Bennett, Behrendt, and Boothby 2011). This hinders the development of a common teaching concept across different faculties.

The university didactic research project voluntary plagiarism check

> Plagiarisms are mostly produced out of ignorance and only rarely intentionally. Measures to avoid plagiarisms should rather be aimed at explaining and instructing the correct action than at repression. (Dannenberg 2009, 133, translated by author)

With this project we achieved a change of perspective: from general suspicion to an opportunity to develop skills. Our central aim was to raise awareness and allow students to gain additional qualifications, so that they take responsibility and carry out future academic work fairly.

Our main questions while carrying out and evaluating the research project (using descriptive statistics as well as formative and summative evaluation methods) were:

(1) Is a facility such as the VPC system suitable to support the transfer from the teaching context to personal academic practice? Is there a demand for this among students?
(2) Which types of plagiarism and/or mistakes in referencing and the acknowledgement of sources exist at our college, and to what extent? How do students explain their academic writing process? Which factors do students list as affecting their behaviour?

A general atmosphere of trust on the part of university lecturers in the honest working methods of their students as well as responsibility on the part of students cannot be achieved in an atmosphere of general suspicion or by means of a routine test of all academic papers by using a PDS. The concept of the project voluntary plagiarism check (VPC) should be viewed as one possible alternative or a complement to other didactic concepts with the aim of prevention.

In the three semesters up to February 2011, a VPC of students' academic papers (term paper, undergraduate or final thesis) was implemented and evaluated at the University of Education in Freiburg, Germany (www.ph-freiburg.de). The university offers programmes of study in education. Eighty per cent of the students are undertaking initial teacher training. BA/MA degree courses in health education and promotion, economics education, media education, early years education and adult education are also available. Undergraduate degrees typically take three to four years to complete. Graduates of all courses will most likely work in the field of education. This means that they may act as role models when it comes to handling intellectual property. The project was based at the Centre for Media Literacy (medien|kompetenz|zentrum, www.ph-freiburg.de/mkz), and run by the author.

Using the Internet-based PDS Ephorus (www.ephorus.com), students were able to have their work checked anonymously. They could either send the project team their paper by email or bring a file (*.doc, *.rtf, *.pdf) stored on a USB memory stick during office hours. After plagiarism detection and interpretation of the PDS-report they receive personal feedback and, if necessary, useful concrete advice for the practical application in academic communication and writing as well as background information concerning ethical and epistemic background issues. Examples drawn from students' texts in the PDS report were used to generate feedback.

The students were able to choose between a personal consultation and summarised feedback by mail. The students did not receive the full PDS report. This was to prevent the PDS reports from being used to check whether intentional plagiarism would be detected when the paper was submitted to faculty. At the same time, we wanted to encourage students to revise the paper on their own with the help of the examples provided. It became clear that certain mistakes appeared repeatedly. It therefore proved useful to give advice based on well-chosen examples. In our study, about 500 academic papers were checked for plagiarism and mistakes in citing and this was followed by a consultation. Directly after the consultation, the VPC service was evaluated by the students. An on-line questionnaire with standardised and open questions was used (https://www.soscisurvey.de/plagiatskontrolle).

With the aim of statistical capture, the text characteristics of every submitted paper were recorded by the project team (e.g. type of paper submitted, mistakes found, types of plagiarism, subject area). Descriptive results could be derived from this data, for example, frequency of plagiarism, type of quoting mistakes (see research question (1)).

From analysis of this questionnaire we obtained information about:

a. students' motives for cheating, for using the VPC, for their writing process,
b. self-assessment of writing skills, habits in the use of on-line material and their underlying epistemologies,
c. course of study, year of study (see research question (2)) and
d. assessment of the didactic concept and the actual performance of VPC, their suggestions for improvement (see research question (1)).

We established that students from all courses and all departments used VPC. This is shown in Figure 2. Depending on the size of individual departments, the number of papers submitted varied. It was interesting to establish that plagiarism and/or citing mistakes did in fact take place in subject areas where academic staff had denied this would happen due to subject-specific circumstances. We were able to show that the incorrect use of sources is present in all departments and that students from all departments have a need for advice.

Regarding the kind of academic papers that were submitted (Figure 3) one can see that mainly final theses were tested with VPC (60%). Term papers were 37% and 3% were dissertations as well as other types of texts we could not identify.

Web-based plagiarism control – detection is not proof

It is difficult to identify and prove plagiarism without technical support. Comparison is often time-consuming and, therefore, cost-intensive. Noticeable changes in writing style, unusual choice of words or 'brilliant ideas' sometimes indicate plagiarism – but the original sources are often not identifiable or traceable, as in the case of translated texts, for example. A PDS allows for quick and easy detection – by comparison with on-line material and with a bank of previously checked files – with no extra effort. The PDS compares a paper with millions of others on the Internet. The document is

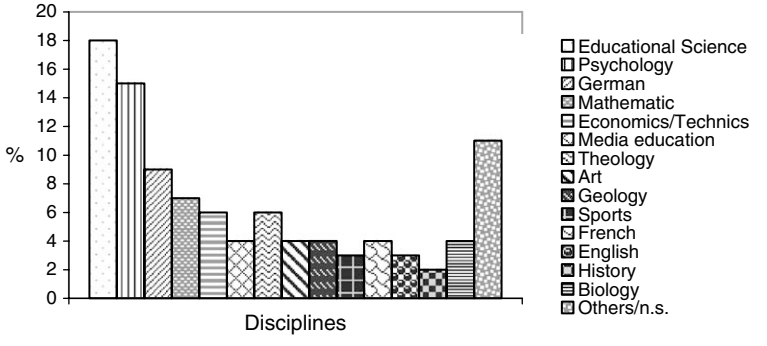


Figure 2. Disciplines using the VPC.

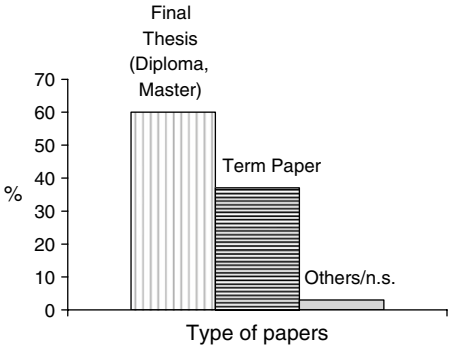


Figure 3. Type of papers submitted.

simultaneously checked for matches with any papers submitted to that system in the past. The results are displayed in a summarised report. The ease of use of this technical search solution makes it of particular interest to universities. The software can be integrated in existing learning management systems.

We have to consider what level of reliability can be achieved by a PDS. The result of plagiarism checking contains information about correspondences with other text sources. The percentage of agreement between the detected source and the original source is shown along with the associated URL (Figure 4 and 5). Every match has to

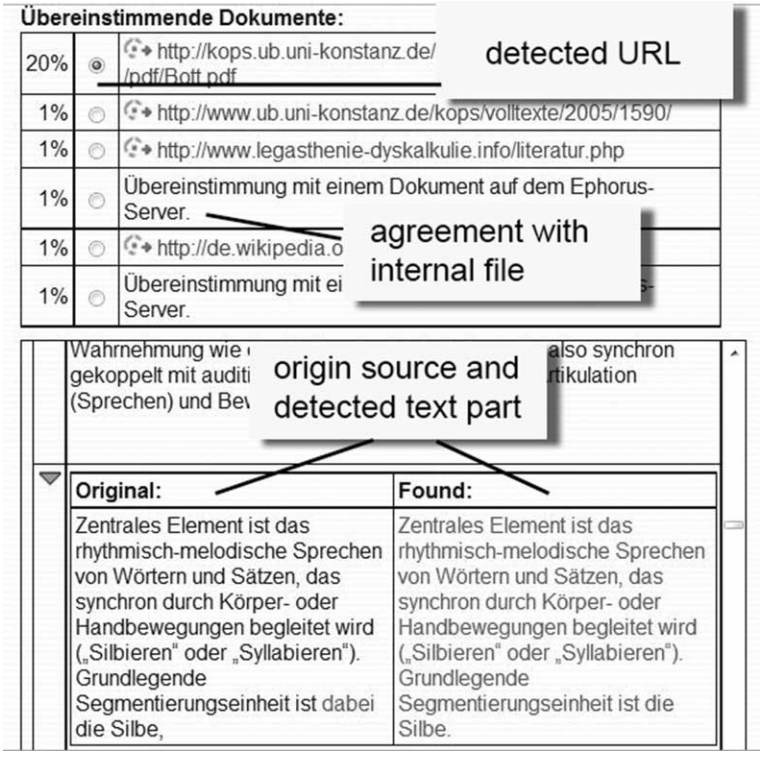
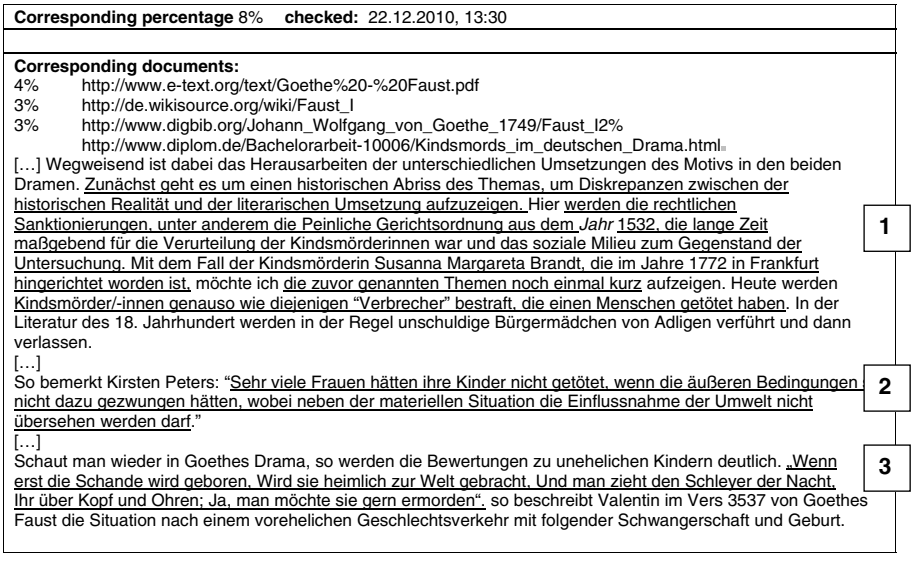


Figure 4. Screenshot, detailed results.



Corresponding percentage 8% **checked:** 22.12.2010, 13:30

Corresponding documents:
4% http://www.e-text.org/text/Goethe%20-%20Faust.pdf
3% http://de.wikisource.org/wiki/Faust_I
3% http://www.digbib.org/Johann_Wolfgang_von_Goethe_1749/Faust_I2%
http://www.diplom.de/Bachelorarbeit-10006/Kindsmords_im_deutschen_Drama.html

[…] Wegweisend ist dabei das Herausarbeiten der unterschiedlichen Umsetzungen des Motivs in den beiden Dramen. Zunächst geht es um einen historischen Abriss des Themas, um Diskrepanzen zwischen der historischen Realität und der literarischen Umsetzung aufzuzeigen. Hier werden die rechtlichen Sanktionierungen, unter anderem die Peinliche Gerichtsordnung aus dem *Jahr* 1532, die lange Zeit maßgebend für die Verurteilung der Kindsmörderinnen war und das soziale Milieu zum Gegenstand der Untersuchung. Mit dem Fall der Kindsmörderin Susanna Margareta Brandt, die im Jahre 1772 in Frankfurt hingerichtet worden ist, möchte ich die zuvor genannten Themen noch einmal kurz aufzeigen. Heute werden Kindsmörder/-innen genauso wie diejenigen "Verbrecher" bestraft, die einen Menschen getötet haben. In der Literatur des 18. Jahrhundert werden in der Regel unschuldige Bürgermädchen von Adligen verführt und dann verlassen. **1**

[…]

So bemerkt Kirsten Peters: "Sehr viele Frauen hätten ihre Kinder nicht getötet, wenn die äußeren Bedingungen nicht dazu gezwungen hätten, wobei neben der materiellen Situation die Einflussnahme der Umwelt nicht übersehen werden darf." **2**

[…]

Schaut man wieder in Goethes Drama, so werden die Bewertungen zu unehelichen Kindern deutlich. „Wenn erst die Schande wird geboren, Wird sie heimlich zur Welt gebracht, Und man zieht den Schleyer der Nacht, Ihr über Kopf und Ohren; Ja, man möchte sie gern ermorden", so beschreibt Valentin im Vers 3537 von Goethes Faust die Situation nach einem vorehelichen Geschlechtsverkehr mit folgender Schwangerschaft und Geburt. **3**

Figure 5. Printable result of plagiarism detection via PDS Ephorus.

be evaluated – not every match is a plagiarism. In fact, in many cases corresponding parts were in fact not plagiarism, e.g. matches due to careless mistakes in quoting sources, definitions or legitimate quotes from classical literature, as shown in Figure 5. The PDS indicates plagiarism, but cannot prove it. The detected text parts become plagiarism only by the interpretation of the lecturer. When both plagiarism and mistakes are present, as in the example, it is not easy to decide.

Only a small number of plagiarism types can be identified by a PDS – it is limited to verbatim plagiarism of more than 10 consecutive words. These detected sentences mostly originate from on-line material, available free, the extracts rarely come from printed or fee-based publications. It is not possible to detect plagiarism based on translations, mosaic plagiarism, adopting the pattern or structure of arguments and ideas, alterations, paraphrasing and restructured parts of a text. Self-plagiarism or submitting someone else's work cannot be identified either.

In our experience, mostly mixed forms of plagiarism appeared in the papers checked. In the event of detection of 'e'-plagiarism it is very likely that other types of plagiarism may occur too and/or that text extracts from printed publications have been borrowed as well.

To sum up, a PDS is not a miracle solution to detect plagiarism, but it is extremely helpful as long as teachers and lecturers know how to interpret the findings. They also have to be aware that if no plagiarism was found by the PDS, this does not automatically mean that there was no plagiarism at all in the paper submitted. Precisely, because it is not a miracle solution, but it was available for use in the context of the preventive didactic methods shown in this article.

The work in Figure 5 was an original part of a checked undergraduate thesis. Underlined passages correspond to sections in source documents, URLs are given at the top. *Sub-section 1*: real plagiarism with some words substituted; parts were borrowed from a BA thesis. *Sub-section 2*: citation ('Kirsten Peters said "Sehr viele . . .'") without date or page reference. Perhaps this was a mistake because the

source is listed in the reference list. Or it might be borrowed from the BA thesis too, because the citation itself appears in the thesis as well. In this case, the student would not have actually read the article written by author Kirsten Peters. *Sub-section 3*: a correct textual component, a verse from Johann Wolfgang von Goethe's Faust.

Results: thoughtlessness, carelessness, ignorance but rarely cheating

> Personally, I used the VPC to make sure that I made no mistakes, even though I really feel relatively secure in citation. The theme of correct academic writing is rarely discussed in courses. So, the VPC is a good way to make up to for this. At the end of the long writing-process I was so confused. I really didn't know if I had overlooked errors in some kind of inaccurate work and I didn't remember the sources of some passages either. This was not deliberate plagiarism and the VPC gives me the chance to eliminate these errors before submitting my paper. With the feedback I got I feel more confident now. I spent a lot of time on literature review and research. After a certain point, it is difficult to distinguish between your own thoughts and the intellectual property of others. So the VPC is very helpful! (Student, mail feedback 2009; translated by author)

At this point it should be emphasised that the following results may not be generalised to the general occurrence of plagiarisms at our university or to the overall attitudes, writing habits and knowledge of all students. It is assumed that a sub-group of students with a background of particular interests and knowledge used VPC. We reached about 10% of the students at our university with our service. For this sub-population of students we can determine that the VPC was suitable for their aims and useful as a complementary qualification. It was rated as very helpful and graded very highly. The most commonly cited reasons for using VPC were (1) fear of negative consequences in the case of mistakes, (2) awareness of gaps in one's own knowledge, (3) insecurity in the face of inconsistent information for correct academic writing (e.g. citing styles), (4) high level of conscientiousness because of planned academic career and (5) compensation for the lack of input on correct academic writing in the academic disciplines.

Summary of results

(1) Occurrence of plagiarism and quoting mistakes: plagiarism, intentional as well as accidental, exists in all text forms and appears in every discipline. In the academic papers of students in their first three semesters of study, we found a large number of plagiarism and quoting mistakes (90% of examined papers). Mostly, longer excerpts were copied from sources, which were not cited at all or cited in an incomplete/ erroneous way.

This high instance of plagiarism decreased as students progressed through their studies. From the 6th semester to degree-level, quoting mistakes and plagiarism 'only' occurred in about 40% of the papers. Also, the length of the excerpts used clearly decreased. This might be seen as progress in learning. Or it may be that with the increasing differentiation in studies and specialisation in research questions, the probability of discovering text conformities may decrease: it was not possible to integrate as much Internet content as in the academic papers written by students in early semesters.

(2) Self-assessment of academic writing: there is great uncertainty about correct academic writing and considerable pressure when composing one's own texts. Ninety-one per cent of students said that they had had problems, ranging from fear and stress (not being good enough at the subject, writing something wrong, difficulties in expressing their own ideas, time pressure/cognitive overload, unforeseen mistakes in form and content type) to loss of motivation (lack of interest in the topic, lack of mentoring by lecturers, lack of explanations about honest academic practices). About 30% of the students assumed the submitted papers were not read thoroughly by lecturers.

About 50% stated 'it is acceptable to borrow single sentences or shorter passages from texts without citing', about 25% admitted to plagiarising in this way and to doing this regularly.

Two-thirds of students learned the correct use of sources on their own, some learnt correct academic writing from peers, only 20% said that they received explicit instruction about honest academic practices in lectures or seminars at university. One-third stated that they acquired knowledge about citing incidentally.

(3) Evaluation of the VPC: 95% of students who had used VPC indicated having used it to reduce insecurity and in particular the fear of poor marks (50%). Twenty-one per cent wanted to compensate deficits in their studies by utilising the consultation – this type of motive can be labelled as 'self-determined prevention'. These students were motivated to learn the correct method of citing. In addition, we interpreted intended plagiarism in the occurrence of several large matching text passages ($>15\%$ of the content) in single papers. Sometimes students presented plagiarism with text correlations $>85\%$, mainly borrowed from on-line-buyable sources for academic theses. Three per cent of the students presenting such papers tried to use VPC to check whether the deliberately plagiarised paper would be identified when submitted to faculty. (In fact, they were disappointed that we could not give them this assurance. Perhaps this is the reason why in the last semester of the project not a single paper of this kind was presented to the team.)

We found there was broad acceptance of the VPC. It was evaluated very positively with the grade 1, *sehr gut* (equivalent of a grade A). All students were keen that VPC should be set up as a regular service in the future. In particular, the personal feedback given with examples from their own text was considered extremely helpful. In addition, it was suggested by students that feedback and advice should be available more quickly – it sometimes took two or three days until the results were available due to technical issues.

Summary and perspective

The frequent cases of plagiarism at universities were a convincing reason for implementing the university didactic concept of the Voluntary Plagiarism Control. We viewed 'e'-plagiarism as an opportunity to discuss attitudes, to gain knowledge as well as to establish a basis for curricular development in teaching academic integrity and, in particular, correct citing and honest use of sources. With the VPC authentic and significant learning becomes possible. This kind of situated learning ties in with the concept of autonomous learning and thus reflects the idea of on-line based teaching at universities in general. The findings of other authors cited above on the various causes of plagiarism (Figure 1) – of which a large number do not lead to deliberate

plagiarism – were confirmed for the sub-group of students using VPC. We assume that students in general often have difficulties in academic writing and many of them plagiarise intentionally or unintentionally. To address this issue the VPC has been available as a permanent service at the Centre for Media Literacy since March 2011.

Currently, a detailed artefact analysis of the submitted papers is in preparation. We would like to explore aspects of the ontogeny of academic writing competences (Pohl 2007) concerning the prevalence of plagiarism, also in correlation with research competences and epistemic relief (Pohl and Steinhoff 2010).

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Development of a simulated Internet for education

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(Received 27 February 2011; final version received 22 June 2011)

This paper describes the early stages of research and development of an educational environment designed to enable learners to participate in remote, group based large-scale activities based on local area network and wide area network technologies working on a range of systems and within different learning situations, such as in class group work, remote group work or independent learning. The environment covers specifically routing, switching and wireless principles in the domain of computer networking. This is accomplished using the 'multiuser functionality' feature found within the Cisco Academy programme, Packet Tracer application. The initial research explores how a 'virtual Internet' can be implemented to enable learners to engage with the scale and complexity of the Internet without interacting with active routing infrastructures thereby interfering with others. Different communities of interest from Cisco Systems as well as their Academy Programme academic affiliates have contributed to the development of the resource as well as to research into how individuals participate in learning as a result of using this software. This paper tells the story of the iterative action research process with two initial learning situations of 'remote many' participation and 'in class many' participation in a large scale networking exercise. As research is still in the development process, this paper explores the experiences and observations gathered from engaging with the two learning scenarios, describing how each interaction exercise was perceived by participants and their educators. Initial findings from both activities indicate that the concept of an 'Internet on the Internet' to deliver simulated practical learning has considerable potential and brings an alternative dimension to the practical learning experience. Research is ongoing, with the work in this paper informing the continual iterative process.

Keywords: constructivism; situated-learning; simulation; Packet-Tracer; collaborative-learning

Introduction

The Open University in the UK commenced offering the Cisco Academy Programme, the Cisco Certified Networking Associate (CCNA) in 2005 as a blended distance-learning course as part of the Foundation Degree in Information and Communications Technology (ICT). Since inception this course has reached in excess of 4000 students across the UK and some internationally, all taking the course in a blended distance-learning mode.

A challenge is managing access to course specific router and switch technology, giving students an essential opportunity to engage in interactive practical activities.

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ISBN 978-91-977071 (print), 978-91-977071-5-2 (online)

DOI: 10.3402/rlt.v19s1/7777

This enables each student to acquire a view of the complexity involved in network environments, such as a corporate wide area network infrastructure or the Internet itself.

The course team responsible for the management of delivery explored a range of tools, including Netlab+ distributed by Netdev Group (http://www.netdevgroup.com) and Packet Tracer from Cisco Systems Inc. (Academy site at http://www.cisco.com/web/learning/netacad/index.html) This included setting a range of assessment tasks using these tools and experimenting in group based delivery as researched by Smith and Moss (2008) and Prieto-Blázquez (2008), The research focused on the setting of course assessment items and the management of synchronous and asynchronous learning using both resources.

With the introduction of multiuser functionality in Packet Tracer version 5.0 and the publication of the Packet Tracer Multiuser Protocol (PTMP) (Wang 2008), the Packet Tracer application enables students in disparate locations to interact on a common simulated practical activity.

An overview of Packet Tracer

As a network simulation environment, Packet Tracer provides simulated router, switch, server, workstation and networking protocol resources for students and educators to create diverse and complex networking scenarios, extending the pedagogical and practical experience during participation in the Cisco Academy Programme.

The Cisco Certified Networking Associate (CCNA) version 4.x exploration and discovery curriculum contains embedded laboratory exercises for the students to complete. These are in-class on live networking technology, remotely via the Netlab+ system or by launching the Packet Tracer application from within the curriculum content. Packet Tracer activities are goal based, giving students attainable milestones and feedback by indicating the completion percentage based on the given activity scenario.

As a simulation tool, the 'operating system' deployed on simulated workstations and routers forms a critical subset of the actual technology, presenting similar behaviour, performance and idiosyncrasies within a contained experience.

The inbuilt multiuser functionality allows students and academic centres to create environments that can interact, irrespective of locale, type of academic institution and supporting network infrastructure. This results in the ability for two students, in any location, being able to create a connection and complete a practical activity of their choice. Figure 1 illustrates two independent instances of packet tracer using a peered network connection, with two simulated workstations exchanging simulated network traffic.

A multiuser connection can be established on any Transmission Control Protocol (TCP) port, with ports 38,000–38,999 selected by default. An academic centre may elect to use an alternative port according to local networking security policies.

Packet Tracer is therefore able to handle multiple multiuser connections between many of users. It can support one:one, one:many and many:many options, with either remote or local collaboration scenarios available to students and academic centres alike.

Designed to be 'easy to use' anyone using the Packet Tracer application can quickly create a multiuser connection by using the default port and an Internet Protocol (IP) Address or established domain name as illustrated in Figure 2.

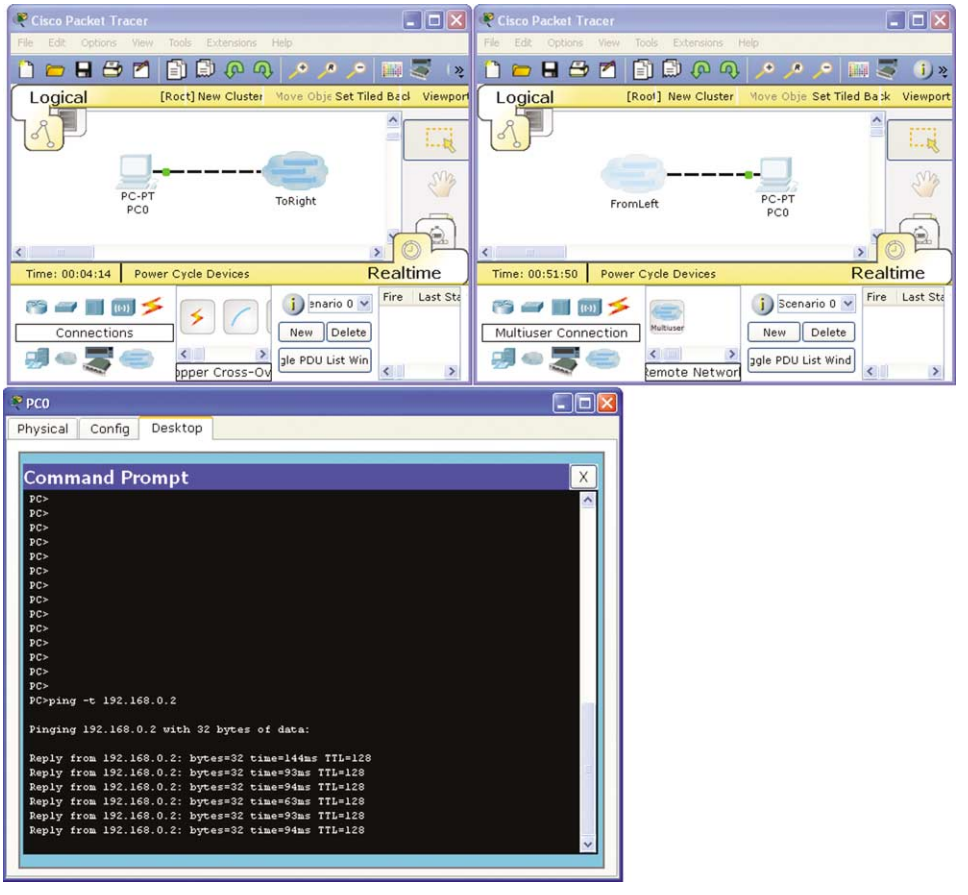

Figure 1. A peered example of Packet Tracer Multiuser communication.

With the many:many multiuser interconnection available, multiple academic centres may create a mesh of connections, with students interconnecting to a collaborative environment internally or externally to complete a range of practice-based learning activities.

Creating a relay

There is a clear pedagogical benefit in allowing students and academic centres to connect across a Local Area Network (LAN), a Wide Area Network (WAN) or the Internet via Packet Tracer for their work. However, the application presents a serious networking trust issue in the explicit exchange of an IP address or domain information by any participant.

Any one:one connection between peers would carry an implied personal trust, assuming that both parties are aware of the other's need to connect. With each party present at the workstation hosting the packet tracer application, they are able to permit or deny any initiated connection. Packet Tracer at this level does not allow anonymous connects unless the user specifically configures the application to do otherwise; this is not a default state.

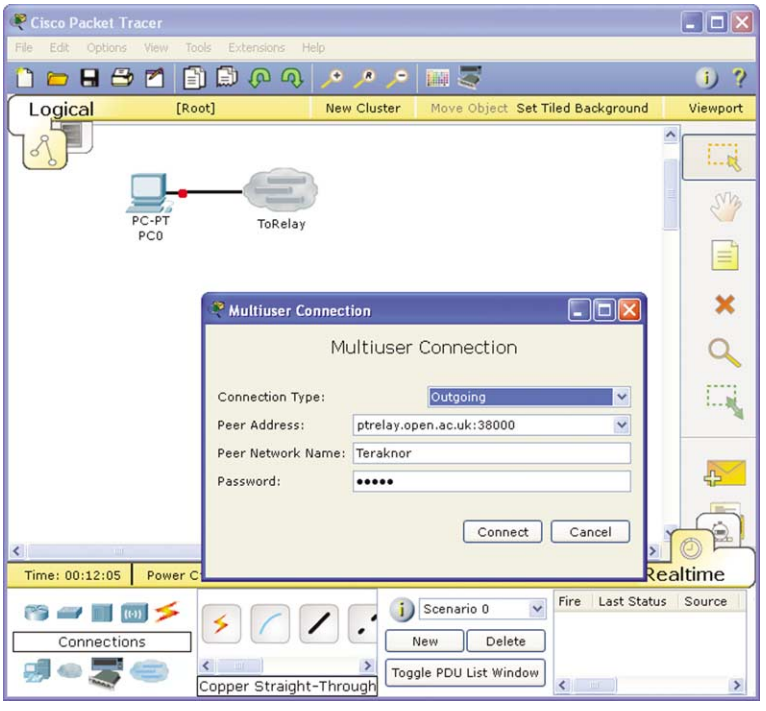

Figure 2. Creating a multiuser connection from Packet Tracer.

With a one:many, in an internal scenario, the same trust principle as the one:one connection relationship is implied. The academic leading the practice-based session will be present to invoke the activity and therefore trust any incoming connections.

At the stage where centre-to-centre communication takes place and communication has to interact with an academic organisation's network security policies and firewalls, a question is raised regarding the authenticity of the remote connection and the trust surrounding from whom the connection may be coming. The complexity of the question increases with each new connection and potential participant.

Furthermore, when a remote learning scenario occurs, normally with students who study via blended distance-learning, the likelihood is that students have never met and therefore have not formed an albeit basic trust relationship. There is a need for social exchange to engender trust (Xueming 2002), and this raises an immediate issue, insomuch as students are now expected to exchange their IP address, port or domain information to enable direct communication with someone with whom they have no personal contact or no potential conscience when it comes to unethical behaviour. With the lack of formal hierarchy, Gurzick et al. (2011) identify that there need to be leaders and designated participants in an online collaborative environment.

Therefore in the establishment and creation of any one:one connection between distance based students (in respect of Figure 2) who may have never met and therefore have a lower trust exchange there is the potential for abuse, via hacking, exploit, denial of service or cyber stalking. This would present many academic centres with the risk of multiple liabilities and thus encourage any reasonable

academic or network manager to refuse to allow the multiuser feature to run on their system.

Resolution of this security threat is essential in maintaining trust between distance based students and remote centres. In exploring potential solutions, research focused on the many:many property of Packet Tracer, with the question: "What if a trusted intermediary was available?"

With a many:many scenario, trusted secure devices could be created for academic centres as well as students to interconnect. Now the trust is with the intermediary, as the domain and the port of the intermediary is known to everyone. No individual or academic entity would exchange any sensitive information regarding IP address, domain or TCP port. Therefore creating a relay server, hosting a trusted instance of Packet Tracer, overcomes many of the immediate security and trust issues.

With this in mind, all of the relays could be interconnected in a mesh (Internet like) structure. Having each relay connected to other relays would create a secure physical structure that would support a scalable community of practice, as new relays can easily be added as the community grows. Overarching technical benefits would be:

(1) Secure communication using the PTMP (Wang 2008).
(2) The opportunity to implement a range of technical platforms for each relay implementation, assuring system agnosticism (no single preferred manufacturer or software vendor).
(3) Ensuring that the simulated network infrastructure is adaptable and diverse, presenting no restriction in the learning scenarios being developed by participants.
(4) Resilience, with multiple relays (some possibly acting as intermediaries), overcoming the indiscretions of technology.

Each has differing benefits, in learning delivery and technical deployment, and can be adapted to reflect of local academic and technical need. Scenarios can be designed to encourage practice-based development and situated learning as described by Lave and Wenger (1991).

Students and academic centres have the freedom to create their own local networks on Packet Tracer and interact with the intermediary servers as they wish. In an experimental context, a default file has been provided to ensure everyone has a common entry point into the multiuser environment, giving a constructivist scaffold for a common level of entry, (Rüschoff and Ritter 2001).

In addition, support has been given to the research by the Cisco Systems Packet Tracer development team in developing an add-in; the multiuser connection manager (MUCM) tool manages redundant connections that have remained unused for a predetermined time period so that the system does not become overloaded with them.

The pedagogy of creating an Internet on the Internet

Relying on one intermediary relay server limits the potential value in scale and reach of the collaborative opportunity available. The sole purpose of Packet Tracer is to engender understanding of complex network topologies and the interaction of protocols and devices in this environment. The multiuser feature, supported by the

formation of a collaborative interlinked mesh of intermediary relay servers, means that the system gains resilience and localisation, with the potential for a worldwide 'ring' of systems all interconnecting each accommodating geographic locale specific preferences and academic requirement.

The practical outcome of such a mesh is the immediate advantage is to offer academic centres and individual learners a system able to provide them with the learning experience of building a complex internet work without the political and security complexities of using the 'real' Internet.

Packet Tracer provides access to otherwise inaccessible IPv4 and IPv6 address ranges, as well as an extensive range of networking technologies including: DHCP, NAT, STP, VPN, QoS, BGP, OSPF, EIGRP, RIP, dot1q, VTP, in an environment allowing students to make mistakes and learn from their experiences without impacting others.

In a collaborative distance based framework, the creation of an intermediary relay supported a mesh of relay servers. Laurillard (2002) identified how academic centres as well as students can engage in distance based synchronous and asynchronous learning. The use of Packet Tracer in this context exemplifies these findings and allows local technological needs and conceptual needs of the students to be respected at the time of interaction. In addition, the flexible nature of Packet Tracer means that, with suitable core topology design, one group of learners can interact with the system at the same time independent of other learning collaborations. Thus the distance based asynchronous and synchronous, collaboration can co-exist between classes of students in a specific geographic locale as well as internationally.

Assessment based learning may take place using the local Packet Tracer client in the activity mode, with students interacting in a 'staged' learning and problem solving scenario thereby providing discovery based exploratory learning.

Having a constructivist ethos, the concept of an environment open to personal interpretation of the student as well as the guiding academic is synonymous with many of the principles proposed by Piaget (1978). The distributed learning methodology supported by Packet Tracer with the multiple sources of information, each giving form in a constructivist paradigm, gives credence to the emergent concept of connectivisim from Landauer and Dumais (1997).

The first stage of research

The research programme commenced in September 2009 with distance-learning students participating from the UK Open University's T216 (Cisco Networking/ CCNA) and T824 (Advanced Networking/CCNP-BSCI) courses.

The test scenario was for each participant to connect to the relay server via two clients (both on the same local host), create an Extended Interior Gateway Routing Protocol EIGRP peering by:

- adding a new local network into the autonomous system routing process for each client instance,
- adding at least one workstation for each local network,
- pinging the default gateway from each workstation and
- pinging each other.

Testing was confined to a one-hour window from 19:00 to 20:00 GMT. During this time over 40 participants joined with a peak of 15–20 different peers in the 19:20 to 19:40 window. To ensure a baseline network behaviour, one host ran a continuous simulated client-to-client ping and a continuous simulated ping to the intermediary server.

The MUCM, managed to rollback connections, ensuring deletion when disconnection notice expired after five minutes.

At 19:40 (estimated) the Packet Tracer application crashed during a period of apparent peak activity. The research team subsequently revisited the test case by examining four scenarios in a controlled test environment:

- Emulating the same event, increasing load, to observe the factors leading to failure.
- Testing the system on Linux without MUCM interactivity.
- Testing the system with MUCM in Windows.
- Testing the system without MUCM in Windows.

In addition, with all of the scenarios, upon failure the test was repeated without EIGRP present. Early findings have concluded that the 15 second hello timer for EIGRP works within a LAN based multiuser setting but as soon as Internet communication is in play, the application, operating system and transmission latency all combine so that the next hello packet arrives too late for the simulator. This leads to a hold down state and increased application activity.

An additional unanticipated challenge was the need to mentor/coach some of the participants during the session (via skype and email). Anecdotally it would seem that for some, there was a difficulty in understanding the concept of how they were connecting to others in this remote environment.

Conclusions from the first stage of research

The first test case proved the potential for disparate individuals from diverse locations to connect and engage in a semi-synchronous, primarily asynchronous practical activity. Following the simple practical scenario, each participant completed the tasks set. Therefore the development of group based participatory activities in the sphere of situated learning of Lave and Wenger (1991) in an online environment.

A key finding, was the recognition that some of the participants needed to understand how to engage with the distance learning scenario. The challenge for the host was enabling the participating group to construct the mind-set to understand how they were each able to participate in this en masse exercise. To understand this, the researchers need to work with groups of students face-to-face to understand where the misunderstanding lay, through either experience or perception of the conceptual network structures. This is a constructivist model (Piaget 1978) as students have to become active participants in the learning process, needing an initial environmental anchor to base their constructed ideas upon.

The second stage of research

A challenge in any activity requiring volunteers is the recruitment of those volunteers. Since the initial research there have been three successful interactive

scenarios. The timing of these has been principally driven by availability. It was recognised that all participating students need to have a minimum of the Cisco Academy exploration or discovery first course behind them to comprehend the networking terminology and technology.

To avoid other effects, the student age range was kept in a small window, with participating students being either second years on a high school equivalent technical vocational programme or first years on an undergraduate honours degree programme. This gave a range of 17–20 years of age with the majority in the 18/19 year-old age group.

Research sessions were in May, November and December 2010, reflecting academic calendars of each group and availability. The May and November sessions were with two groups of 18 and 11, 17–19 year olds at a college of Further Education. The December session was with a group of 30, 18-20 year-old year one undergraduate students at a London University. Group selection was based on the class/group available at the time suited to the demands of timetable, and availability of the willing volunteer teacher and the researcher.

Each of the sessions was scheduled for a three hour half day block. The first was a morning session 09:00 to 12:30 with break, the second session was 10:30 to 15:00 with intervening lunch break and the third session was a PM session from 14:00 to 17:00 with a short break.

Each session used the majority of the time, with an average of thirty minutes remaining to enable the students to complete an optional challenge activity. In each session the researcher acted as teacher/facilitator whilst the normal session teacher/instructor acted as class-room support and secondary observer.

Each session was facilitated as an in-class teaching session, where each of the student participants was aware that they were helping to test the multiuser functionality of Packet Tracer and get in return additional networking skills (via practice-based learning).

The use of a data projector connected to the teacher's computer running the relay instance of Packet Tracer, provided the students with an essential conceptual cue for students supporting the work discussed by Janitor and Kniewald (2010). It enabled them to see how their own simulated LAN and WAN was behaving in relation to the greater relay based WAN infrastructure.

Typical of many academic classrooms, each computer running during each session had the same hardware specification and operating system installation, including local policy constraints and user rights. This ensured that each student participating had the same technological advantages/disadvantages as all others during the lifecycle of each activity. The activity was managed in a systematic follow-the-leader step-by-step format, keeping all students at same position in the process.

The group-based activity is presented to students in two parts. The outcomes of the previous research showed that some did not understand the conceptual network and needed a scaffold to base their conceptual viewpoint upon. The student group would commence the activity with a formative warm-up exercise (the scaffold). In this, students were paired and given the task of creating a simple network of two hosts and being able to send a 'virtual' ping from one Packet Tracer instance to the other across the academic network as illustrated in Figure 3.

This short exercise sets the scene and ensures all participants are working from the same stand-point in their ability to use the software. All participants are already

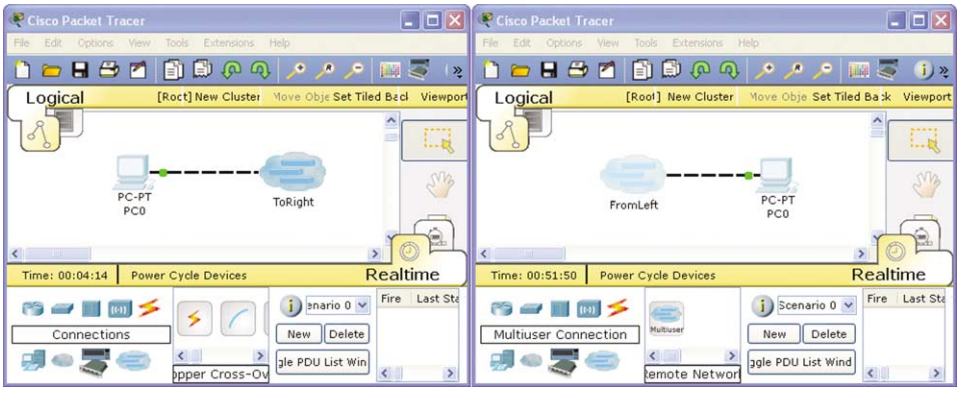

Figure 3. Peered example of Packet Tracer Multiuser communication.

low-level users of Packet Tracer, by virtue of their membership as students of the Cisco Academy programme. By introducing the participants to the 'multiuser' tool, their understanding of the additional tools available in Packet Tracer is increased.

Following the formative scaffold activity, the students participate in the large-scale activity to build a simulated WAN, with multiple individual simulated LAN's.

The structure of the activity is a replication of the experimentation explored in the first stage of the research, with the relay no longer a remote server, but the teacher's computer. This assists the learning process experienced by the students and observing instructor, discussed by Laurillard (2002). In each session, the teacher's computer is attached to a classroom data projector. Each student is able to see their own multiuser connection locally as well as their remote connection on the teachers Packet Tracer instance thus reinforcing the assurance that they are correctly participating in the practical task and successfully building a remote (otherwise unseen) connection.

The relay instance of Packet Tracer contains a simulated router with a series of simulated switches all connected to a core switch (Figure 4). The simulated protocol selected is again EIGRP and each student is presented with unique IP addresses to use during the exercise.

Routing protocols, as with many network technologies, can be configured in many different ways to achieve the same goal. To remove any confounding variance, all students are presented with an instruction sheet containing the commands they must use. The students own instance of packet tracer is a self-constructed system when assembled, and resembles the illustration in Figure 5. The system is kept simple to reduce potential variance, by ensuring the students have specific devices and cable types to implement.

Conclusions from the second stage of research

Qualitative feedback was collected from each cohort, the intention was to understand their personal viewpoint of their experience in participating in the sessions as well as in the activities.

At the end of each session, before departure, the students were asked to complete a short anonymous questionnaire, with questions listed in Table 1.

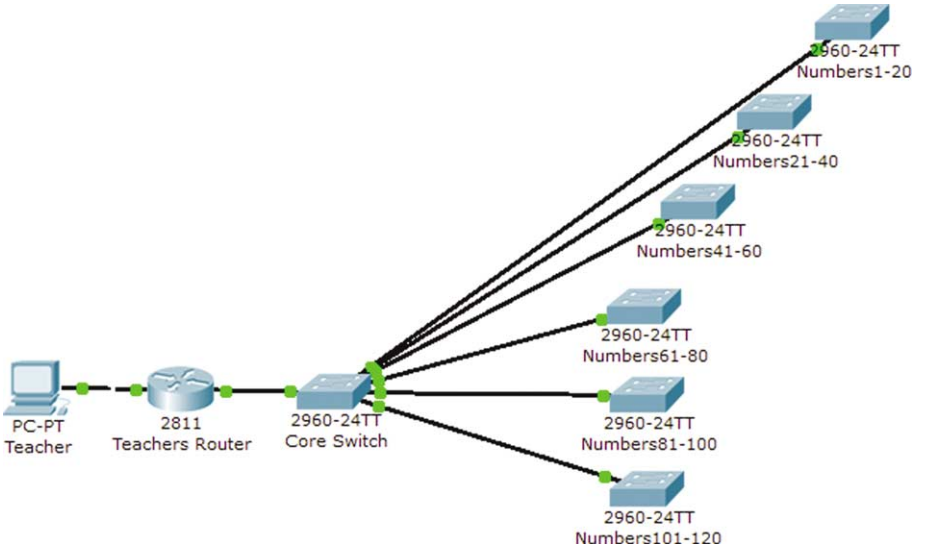

Figure 4. Teacher relay-server structure.

The questionnaire results are summarised in Table 2. As the groups are small, and the questionnaire short, there are no missing responses; no additional personal information was requested.

From the results in Table 2, the dominant feedback implies that the students believed that using the simulated practical was a personal benefit, where the responses to questions one and three indicate a high percentage (Table 3) of positive responses to the enquiry about their learning.

It is notable that for the November cohort, the groups of students were in the early stages of their learning for the academic year, whereas the May and December cohorts were either at the end of their respective academic year or semester.

Questions two and four explored the student's experience of Packet Tracer. Apart from two outliers (reason unknown), question two indicated that the majority had not used the multiuser tool beforehand. With Question four, the response indicates an interest held by the students to continue using the multiuser tool in packet tracer. This may have been stimulated by their feelings regarding the preceding session.

In engaging with the practical activities, the students could be seen to personally link constructivist personal concepts as described by Piaget (1978) and readily connect their own private concepts to a visual, simulated physical network environment. This is supported by parallel research described by Lo (2010), who states that "appropriately used collaborative learning activities do promote student learning and student satisfaction". This is also supported by Hare and Graber (2007)

Figure 5. Student Packet Tracer instance.

Table 1. Questionnaire.

Question number	Question
1	Has this exercise enhanced your practical understanding of IP addressing? (Y/N)
2	Have you used the Packet Tracer Multiuser tool before this session? (Y/N)
3	In your own view, has this given you some understanding of routing protocols? (Y/N)
4	Would you consider continuing to use Packet Tracer in the way demonstrated today? (Y/N)

in their research into how students engage in a constructivist-learning paradigm adopting and dismissing misconceptions when playing 'invasion games'.

The activities have demonstrated that once the student has been given an introduction to the multiuser tool, they are able to engage in a structured activity to build a complex simulated network environment, reflecting the model of situated learning discussed by Lave and Wenger (1991).

Formal questionnaire feedback as well as the in class anecdotal experience of the researcher, reflects an enthusiasm from the learners to continue studies using the Packet Tracer application in this mode.

Research discussed in this paper, allied with prior research suggests that the structured development of a system to create a simulated Internet provides an alternate learning methodology for in-class as well as remote distance-based learners.

Future development

The centres involved are willing to host future sessions, inviting the researcher back to continue the same exercise, as well as new different scenarios with their students. Other centres are interested in participating in the research and are willing to engage in the activities described in this paper, as well as working towards more complex scenarios. The challenge for these centres, as for the original participants, is finding the right group at the right time in their year as well as in the study week.

Once the students and teacher/instructors become familiar with the technology and the constructivist learning experience, the plan is to move the activity to a remote 'central' relay server model, with more than one centre participating during the research and working on a collective multi-site learning activity.

Table 2. Questionnaire result data.

	Feedback					
	May (18)		November (11)		December (30)	
Question number	Y	N	Y	N	Y	N
1	14	4	11[a]	0	21	9
2	0	18	0	11	2	28
3	15	3	11	0	24	6
4	16	2	11	0	26	4

[a]This is earlier in the academic year for this cohort, where IP addressing was a new subject.

Table 3. Questionnaire result percentage.

	Feedback as a percentage					
	May (18)		November (11)		December (30)	
Question number	Y	N	Y	N	Y	N
1	77.7	22.3	100	0	70	30
2	0	100	0	100	6.7	93.3
3	83.3	16.7	100	0	80	20
4	88.8	11.2	100	0	86.6	13.4

Acknowledgements

The author would like to thank Dennis Frezzo of Cisco Systems and his team for inspiration, insight and support as well as the enthusiastic support from Cisco Instructors. Special thanks is due to Paul Wallin of Kingston University (UK) and Ken Lamb, Milton Keynes College (UK) as well as the enthusiastic academy students alas too numerous to mention.

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Using hypermedia annotations to teach vocabulary on the Web

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(Received 11 December 2010; final version received 26 July 2011)

This project measured the effect of using hypermedia annotations on short and long-term vocabulary retention in teaching vocabulary through Web-based language learning activities. A total of 62 university students were randomly assigned into two homogeneous groups; and then both groups were given a pre-test. Both groups covered 12 expository passages selected by the researchers from the BBC website. The subjects had to sit for an immediate quiz to measure the short-term effect of the treatment and finally, at the end of the course and a two-week interval, subjects sat for their post-test. Findings revealed that there was a significant effect of the hypermedia annotations on the retention of vocabulary in the short term ($p < 0.05$). However, the post-test results indicated that the effect of the treatment in the long term faded away, and the significance of the means was not sufficiently high to reject the null hypothesis.

Keywords: hypermedia annotations; plain text; vocabulary retention; WBLL

Introduction

Teaching vocabulary through Web-based language learning (WBLL) activities has been popularly used in English as a foreign/second language learning (EFL/ESL) context (Son 2008). Hypermedia as a multidimensional computer tool has been practiced by language teachers to facilitate learning and teaching processes (Cummins 2008a). It provides an integrative network tool utilised in classrooms around the world. Knowledge of vocabulary is the backbone of learners' competency which facilitates learning of any language tasks. Decarrico (2001, as cited in Celce-Murcia 2001) claims that "vocabulary learning is central to first and second language acquisition and specialists now emphasise the need for a systematic and principled approach to vocabulary by both teachers and learners" (285). Therefore, learning vocabulary is often perceived to be "of critical importance to the typical language learner" (Zimmerman 2001, 5).

Teachers and learners can utilise website resources for various pedagogical purposes to scaffold teacher–student interaction in and outside the classroom (Cummins 2008b). The present study evaluated the effect of using hypermedia annotations, as opposed to plain or printed texts, on learners' vocabulary retention. Hypermedia is defined as an audio and external presentation of the passage in addition to the picture presentation of the passage provided by the authors of the passages. Slatin (1991) defined hypermedia (or hyper-document) as an assemblage of texts, images and sounds-nodes-connected by electronic links so as to form a system

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ISBN 978-91-977071-4-5 (print), 978-91-977071-5-2 (online)

DOI: 10.3402/rlt.v19s1/7799

whose existence is contingent upon the computer. The passage may accompany extra-textual annotations or computer software (i.e. encyclopedias or online dictionaries). In contrast, plain or printed texts are paper print of the material to provide the learners with vocabulary learning tasks. For instance, monolingual or bilingual dictionaries (e.g. monolingual Longman Dictionary of Contemporary English) which are used by learners to pick up the right definition at the time they recognise a need.

Statement of the problem

Baker and Westrup (2003) refer to the stages of vocabulary teaching as: "First the teacher conveys the pronunciation and meaning of the new vocabulary item (Presentation). Second, the teacher checks that the student has understood properly (Practice). Third, the teacher consolidates and tries to get the students to relate the word to their personal experience, and use it in context (Production)" (37). This is the teachers' point of view: at the same time that the teachers are trying to teach vocabularies based on Presentation, Practice, Production (PPP) approach, most learners feel embarrassed, trying to look each and every word up in their dictionaries, making them easily give up. When it comes to vocabulary learning in foreign languages, Nguyen and Khuat (2003) assert that "vocabulary learning is considered as boring as they [foreign language learners] have to memorise unfamiliar words and spelling". In both cases (teaching and learning vocabulary), eventually we see that most of the class time is spent on activities other than the intended one (Hulstijn, in press).

Therefore, vocabulary teaching and learning is a time-consuming effort in traditional approaches. First, learners will always show a need for more and teachers will always see and attempt to satisfy it. Second, because of the time and energy involved in teaching and learning vocabulary, the prime focus is on the meaning of the intended vocabulary: other features of the vocabulary (multidimensionality of vocabulary knowledge) would be overshadowed for the sake of meaning. According to Hulstijn and Laufer (2001), "if learners pay careful attention to the words' pronunciation, orthography, grammatical category, meaning and semantic relations to other words, they are more likely to retain the word than if they pay attention to only one or two of the above word properties" (541).

Nation (2005) claims that successful comprehension requires automatic recognition and decoding of 95–99% of the words in a text. It has also been claimed that reading is one of the main ways language learners acquire new vocabulary knowledge (Bogaards 2001). For these reasons, in this study a reading approach will be used to examine vocabulary retention. On the other hand, the researchers attempted to eliminate parameters which hindered the acquisition of vocabulary and introduced the medium through WBLL activities which language learners may focus more on their learning, rather than being distracted by the process of finding a vocabulary meaning in their dictionaries. Using Computer-Assisted Language Learning (CALL) approaches to teaching vocabulary, teachers are also freed from the long and boring process of teaching vocabulary and are allowed to focus more on other needs of language learners (Gorjian 2008).

In this study it is believed that using hypermedia may enhance the quality of the input which ultimately encourages meaningful language learning; provision of such detailed information, often called "Rich instruction" or "Rich scripting" (McWilliam 1998) which aims to provide a deeper understanding of a word, and

make it an "accessible vocabulary item" (Nation 2001, 95). Accordingly, the main research questions to be pursued in this study are: (1) could enriched texts (hypermedia) help Iranian EFL learners acquire and retain new vocabularies? and (2) regarding multidimensionality of vocabulary knowledge, could hypermedia be used as a solution to teach a comprehensive knowledge of the intended vocabularies? The study seeks to address the following null hypothesis: enriched texts (hypermedia annotations) have no effect on Iranian EFL learners in learning and retaining new vocabulary.

Background

The ideas mentioned above are all well dealt with the advent of hypermedia. The use of computer technology in teaching languages has been dramatically increasing worldwide over the past decade (e.g. O'Dowd 2003; Chen, Belkada, and Okamoto 2004; Hayati 2005; Hubbard and Levy 2006; Son 2008). Using this technology not only facilitates learning processes (Gorjian 2008), but also holds other great potentials for language learning. One of these potentialities is the ability to present information in different formats using graphics, sound, text and video with links to other chunks of information through using WBLL activities (Robb 2006; Son 2007; Cummins 2008a, 2008b).

Hypermedia annotations have several advantages; researches carried out by Boers, Eyckmans, and Stengers (2004) and Abraham (2008) have provided evidence of an overall beneficial role for computer-mediated text glosses providing lexical support on comprehending authentic readings and learning vocabulary. Researchers were inspired by the premise that a variety of glosses for words in various modalities, such as printed text, graphics, dynamic video and sound, might have differing capacities to facilitate vocabulary acquisition and retention (De Ridder 2002; Boers and Lindstromberg 2005).

Presenting information in this way enables readers to access information in the order most appropriate to their purposes. Using appropriate presentation methods enables learners to obtain a deeper impression of and richer information about the target words to make them enter the long-term memory more easily (Zhang 2008). In addition, in traditional approaches any unexpected subject matter (vocabulary, in our case) cannot be dealt with in advance, no matter how necessary. In our case, if a word out of the blue poses a problem, in traditional approaches teachers could not think of ways of dealing with that word without shifting the focus in class and diverting time (McDonald 2008). For these reasons, comprehensive vocabulary knowledge seems indispensable but almost impractical to achieve in traditional classes.

The idea of hypermedia learning/teaching is also suggested by cognitive psychology. Cognitive psychologists and language acquisition scholars working within the framework of cognitive psychology believe that retention of information is determined by the way in which this information is processed (Hulstijn and Laufer 2001). They suggest the Involvement Load Hypothesis that "the retention of unfamiliar words is, generally, conditional upon the degree of involvement in processing these words" (545).

Son (2008) proposed that "hyperlinked multimedia documents and computer mediated communication (CMC) tools; the Web can support language teachers to integrate Web resources into the language classroom" (34). Smith and Stacy (2003) emphasised that CMC "has changed the nature of distance from an individual

experience that is largely remote and isolated from other students, to one in which the technology can enable more ongoing interaction with fellow students'' (165). The potential for manipulating online technology within a collaborative learning environment is one of the greatest strengths of CMC.

Hubbard and Levy (2006) argue that the influence of technology on language teaching and learning has developed along with the parallel growth in the development of course work to prepare language teachers with appropriate methods of using the technology in the classrooms. They focused on classroom teachers who should use CALL ''to promote, manage, or assess their students' learning. Note that 'classroom' is used in its broadest sense to subsume language teaching in a traditional physical space, a computer lab, a mix of physical classroom or lab and online, or entirely online'' (13). Robb (2006) believes in maximising the opportunities for the EFL/ESL teachers to experience ''with technology, both new and old, to interact with their colleagues and to access other sources of information on technology'' (346). He also emphasises the effect of fostering positive attitudes towards computer technology in the classroom and educational settings ''by providing multiple examples of good practice, as well as the printed, digital and human resources that are required to attain this goal'' (346).

Methodology

Subjects

This study was conducted with sample of 62 Iranian EFL students based on non-random convenient sampling. They had entered university for their undergraduate studies. Subjects were selected based on a given TOEFL test, Barron's 2003 edition, and the results of the test indicated that in terms of educational background, level of English mastery and vocabulary knowledge, the subjects were homogeneous and could be considered as intermediate in their proficiency stamina. Then they were divided into two groups based on systematic random sampling. The subjects were 62 (15 males and 47 females) students with the age ranging from 21 to 39. They were measured under two conditions: plain text group (i.e. control group who dealt with the plain texts) and hypermedia group (i.e. experimental group who dealt with hypermedia annotations).

Instrumentation

This study used the following instruments:

1. Pilot test: To investigate the suitability of the level of the text and to examine how much time it would take the subjects to complete the task, a pilot test of hypermedia version of the text was conducted with five students who did not take part in the actual research. The reliability of each and every test used in this research was calculated by Kuder-Richardson formula (KR-21). The reliability coefficients for the pre-test and the post-test were 0.75 and 0.74 respectively.

2. Pre-test: A pre-test containing the actual test items was administered to the subjects before treatment in order to determine how well the subjects knew the contents before treatment. The subjects were asked to answer 40 multiple-choice

vocabulary questions, selected from the course passages, in 30 minutes. To ensure that students did not give more attention than they should to the words appearing in the pre-test, no mention was made of the subsequent learning lessons and the immediate quizzes or post-test.

3. Immediate quizzes: After each session where students had covered the two passages given to them to be read for the sake of comprehension, there was a 2–3 minutes rest and right after that there was a short multiple question quiz asking the meaning of the new vocabularies learnt in that session.

4. *Post-test:* Two weeks later after the end of the course, the instructor administered the post-test without notice. The sudden presence of the instructor in the class was to test the retention of words in a longer period to see the real effect of the treatment. The only difference of this test to the pre-test was that the order of questions was changed to wipe out the probable recall of pre-test answers.

5. *Multidimensionality (MI) test*: It was claimed earlier that hypermedia can boost multidimensionality knowledge of vocabulary in language learners. Therefore a pronunciation test was designed at two levels, in one level, which was comprised of a written part of the test, components of vocabulary were put into questions. This part consisted of 10 items and each item was testing phonetic transcription, part of speech, past form of the verb, superlative form of adjective and plural form of noun for a chosen vocabulary from the passages covered.

Procedure

Since this comparative study consists of two distinct approaches to vocabulary learning, the materials used were the same for both groups except for the medium of presentation, for this reason two kinds of presentation were used, namely, hypermedia presentation and the plain text presentation.

Expository passages from the BBC website (www.bbclearningenglish.com) were selected for this study. Subjects viewed 12 passages over six sessions where each session lasted for about one hour. Subjects in both groups were not informed in advance that they would be tested because it was assumed that if they knew, they would consciously try to learn the new words. It was hoped that attempting to prevent the subjects from making such a conscious effort would create a more natural environment.

The subjects in the hypermedia group ($n = 31$) were introduced to a hypermedia-learning programme, designed by the researchers for the vocabulary retention. The programme provides users reading an expository English text with a variety of glosses or annotations for words in the form of text, graphics, video and sound, all of which are intended to aid in the understanding and learning of unknown words. The plain text group ($n = 31$) were put into the control group with the same material except for the medium of presentation (i.e. paper).

A pre-test containing the actual test items was administered to the subjects before treatment in order to determine how well the subjects knew the contents before treatment. Both groups completed an identical pre-test; subjects were asked to answer 40 multiple-choice vocabulary questions in 30 minutes. These 40 questions were selected from words picked out from the course passages.

Based on the interactive theory of reading, two types of annotations were identified as facilitators of top-down and bottom-up processes: textual annotations provide information about the text, such as definitions of words (text annotations), their pronunciation (audio annotations) and illustration (graphics annotations). Extra textual annotations provide extra background information about the topic in the form of text, audio, illustration and video.

Textual annotations were linked directly to the text which gave students the same amount of information about each word, while extra textual annotations, on the other hand, were not directly linked to the text and were presented in the form of encyclopedia in this study. This information was different for each student and students selected different annotations based on their preferences in the form of media the information was available (i.e. text, graphics, sound or video). To make sure everyone had at least studied the passages once and in order to expedite the process, the instructor used a CD player available in the laboratory to play the audio track for the passages, so that students heard the words pronounced by a native speaker. After playing the audio track for each passage the students were asked a few comprehension questions.

Subjects on the plain text group were taught according to the convention of teaching in normal class in Iranian University context. That is to say, a printed form of the material designed for this study was prepared and distributed to the students. Students were told to bring their dictionaries (mono and bilingual dictionaries) into the class to compensate for textual annotation in the hypermedia group; the extra textual annotations used in the hypermedia group were not available for these students unless they asked the instructor (as is the case in traditional classrooms). Students were told to read the passage in groups (five groups of five, and one group of six students). The reason behind this division was to make the condition as close as possible to the hypermedia group. The criterion for the division of students in conventional group was the MI test (as was for the hypermedia group). The time allocated to complete the task was also the same one hour as was for the hypermedia group. Subjects in both groups read a text that contains words that the researchers have targeted for learning, but the subjects did not know this. They read the text in the normal way, that is, they read to comprehend its informational content.

Two weeks later after the end of the course and again without warning the post-test was conducted. Statistical analyses were performed using SPSS software version 15.

Results

Descriptive statistics of the pre-test were computed for both groups. The results showed that both groups were almost at the same level in terms of vocabulary knowledge of the mean scores (before the treatment) which also could be counted as another indication of homogeneity of both groups as it is presented in Table 1.

Table 1. Descriptive statistics for pre-test.

Groups	*N*	Mean	SD
Hypermedia	31	8.8065	2.01112
Plain text	31	8.5323	2.81643
Total	62		

Table 2. Descriptive statistics for immediate quizzes.

Immediate quizzes	Groups	Mean	SD	Min	Max
1	Hypermedia	12.9286	3.28778	2	18
	Plain text	9.2500	2.81687	4	18
2	Hypermedia	7.7857	4.66156	0	18
	Plain text	7.0833	4.60545	0	16
3	Hypermedia	13.3333	3.33563	8	20
	Plain text	9.7143	3.59894	2	16
4	Hypermedia	12.4667	3.43143	2	18
	Plain text	10.1429	4.10703	6	18
5	Hypermedia	12.2222	4.05096	4	20
	Plain text	12.0000	4.17029	4	20
6	Hypermedia	9.1111	3.05505	2	16
	Plain text	9.0833	3.86643	2	14
Total	Hypermedia	11.3529	4.17716		
	Plain text	9.5658	4.09113		

Immediate quizzes were administered to the subjects of both groups to check their short-term memory retention. First, mean and standard deviation of each immediate quiz was determined for both groups. Then the total mean and standard deviation of these six quizzes were calculated. As can be seen in Table 2, hypermedia group outperformed the subjects of the plain text group in each immediate quiz.

Since descriptive statistics could not offer the researchers valid information to reject or sustain the null hypothesis, a two-tailed independent *t*-test was run to see whether the observed difference between the groups was significant or not. Table 3 presents descriptive statistics of immediate quizzes.

Table 3. Immediate quizzes results.

Test	Groups	Mean	SD	t_{obs}
Immediate quizzes	Hypermedia	11.3529	4.17716	3.049*
	Plain text	9.5658	4.09113	

*Significant at $p < 0.05$.

The *t* observed value for immediate quizzes was 3.049, while the critical value is 2.042 at 0.05 level of significance. So the results of the immediate quizzes indicate that the difference between mean scores of both groups was significant enough to reject the null hypothesis.

For the post-tests, long-term memory of both groups was necessary. Table 4 shows the results of post-test.

Table 4. Results for post-test.

Test	Groups	Mean	SD	t_{obs}
Post-test	Hypermedia	10.7800	3.28215	−0.119
	Plain text	10.6731	2.98644	

The results showed that observed *t* (−0.119) was less than the critical *t* which indicated that the treatment did not work for the long-term retention. The results of immediate quizzes were in favour of hypermedia group but in the long run both plain

text group and hypermedia group had close results. Therefore, the plain text group had a growth in its mean (from 9.5658 to 10.6731); on the other hand, hypermedia group had a regression (from 11.3529 to 10.7800). The hypermedia groups' retention, although it has regressed, still is higher than that of the plain text group. Table 5 shows the results of immediate quizzes and post-test were put into calculation.

Table 5. Matched pairs: immediate quizzes and post-test.

Test	Groups	quizzes	Mean	SD	t_{obs}
Matched pair	Hypermedia	Immediate quiz	11.3529	4.17716	−0.475
		Post-test	10.7800	3.28215	
	Plain text	Immediate quiz	9.5658	4.09113	0.889
		Post-test	10.6731	2.98644	

In other words, hypermedia materials could benefit learners better in short-term effect. However, considering the data in Tables 4 and 5 in the long run, there would not be such a big difference between the two groups (plain text group's mean = 10.6731 and the hypermedia group's mean = 10.7800) and also there was not a significant difference between the groups (progress of the plain text group = 0.889 and regression of the hypermedia group = −0.475) that could be counted as superiority of one over the other. The results are depicted in Figure 1.

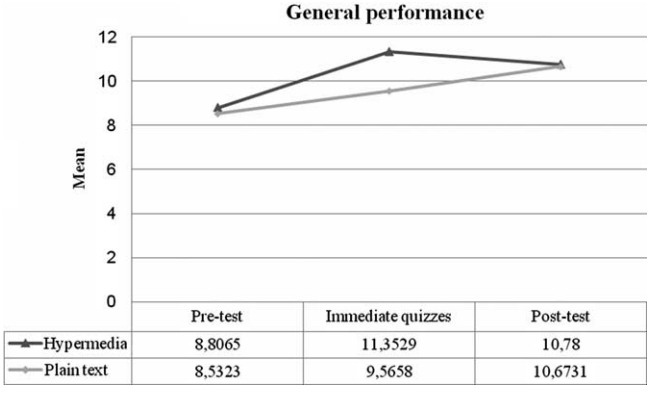

Figure 1. Learners' vocabulary retention in hypermedia and plain text groups.

After the post-test was administered, subjects were asked to take part in a conversation test. To have a fair judgement about their performance another teacher was asked to subjects in scoring their pronunciation.

In order to divert their attention from the main objective of this test, the subjects were told they were to be scored based on the degree to which they could remember the passages they were going to be asked to recite. Although the subjects were struggling to remember different parts of the passages the instructor was naming, they had no clue that it was their pronunciation that was being scored rather than the memory of the passage they were reciting.

After the data were gathered from their conversation test, the scores each subject had achieved from two scorers was averaged, then the obtained score was averaged

with the score each learner had gained in the written part of the test. Then the scores of both groups were given to statistical *t*-test analysis and the results are presented in Table 6.

Table 6. Results of multidimensionality vocabulary knowledge.

Groups	*N*	Mean	SD	t_{obs}
Hypermedia	31	15.2258	2.15576	0.424
Plain text	31	15.1333	2.23966	
Total	62			

Discussion

In light of the results obtained from Tables 1 to 6 and also as shown in Figure 1, the effect of the treatment on learning and retention of the vocabulary in the long run was not significant. Besides, the results of the immediate quizzes indicated that the retention of the vocabularies was better in hypermedia group, and the hypermedia group has outperformed their counterparts in short term in the mean scores of the plain text group ($3.049 > 2.042$). The results as indicated in previous sections showed a better retention of vocabularies in the hypermedia group at this stage (hypermedia group's mean was 11.3529, while the mean for plain text group was 9.5658 at the immediate quiz level).

The short-term results of this study were in compliance with the results obtained by Davis (1989) and Roby (1999). It could be implied from this study and other studies in the field of language learning that hypermedia could help language learners in achieving the desired results but care should be taken. As mentioned above, one of the benefits of hypermedia was providing fast, easy and accessible information. This advantage can turn into disadvantage if it becomes an end to itself rather than a means to an end.

Concerned with the first research question, the short-term retention of vocabulary was high enough in this study to reject the null hypothesis ($p < 0.05$); this was also supposed to be the result of the long-term retention of the study which was not obtained. It could be implied from this comparison that the plain text group not only kept the retention of vocabularies at the whole stage of the course, but also showed progress compared to previous tests (pre-test and immediate quizzes test) in comparison to post-test ($8.5323 < 9.5658 < 10.6731$). The hypermedia group showed progress in immediate quiz level but failed to progress in the post-test ($8.8065 < 11.3529 > 10.7800$).

Hypermedia was supposed to give an enhanced, comprehensive and in depth knowledge to the subjects to support the routes of the retention of the knowledge. However, the obtained results from this study have indicated that it falls short in proving the expected results of the treatment in the long run. The researchers believe the reason behind these results may lie in the advantage of the treatment over other media. That is to say, the fast, easy and accessible information available at the whole time demolishes the sense of need in subjects, which is in opposition with Involvement Load Hypothesis (Laufer and Hulstijn 2001). Subjects of this study felt no longer the need (thirst) to learn from what was supposed to be a learning experience, simply because they had already found the whole knowledge available

right in front of their eyes. It seems that providing all the information which a student needs will only work as long as the capacity of his/her short-term memory allows.

The subjects of hypermedia group, when given all they need and when they felt that there was no more pressure on them, started to establish what the researchers called "Go-ahead-I-Know character". In establishing this character, students no longer feel the necessity of the presence of their instructor because they know they can find the answers to their question without asking him/her. In addition, their sense of autonomy rose to a high level which kept them from appreciating the transient nature of hypermedia.

It seems that providing all that students need builds a mirage that learners know everything. Finding the answers to every question, learners may answer every related question to the passage by the help of textual and extra textual information, especially those which are related to vocabulary, seems to be enough to satisfy the immediate needs of the learners while not providing enough bonds for long-term retention. In other words, subjects, when finding the information available to them, forget their role as learners and just focus on a specific task. It seems that the results of this study support the Mental Effort Hypothesis (Rott, Williams, and Cameron 2002), that since the learners' effort reduced greatly in learning a vocabulary, the retention of vocabulary has been reduced greatly in the long-term memory.

Generally, it seems that the transient effect of hypermedia on learning could be to blame but the educational system in the Iranian context also contributed. The researchers believe that a factor is the long standing plain text-based nature of language learning and teaching in the Iranian educational system: learners were not accustomed to the roles and experiences this study was imposing on them. It seems that studies like this need more time before their real results will be judged. Until then serious thinking is needed to prepare the grounds to shift from the present situation to a more cutting edge one.

In respect to the second question proposed earlier, the results to this question have indicated that both groups performed equally. It should be added that considering the capacity of hypermedia it is obvious that it can support the multidimensional knowledge of vocabulary in different modalities. However, it became clear that the prime concern of the language learners in reading situations is to grasp the meaning of the unknown vocabulary. Other features of the vocabulary take second place for the language learner.

The results obtained from this study confirm Mayer (2003) who noted that the methods used in an instructional programme, not the delivery media by itself, impacts learning. Although every aspect of hypermedia was in favour of the hypermedia group, even a well-equipped study lends its success to practicality of the methods used in that study. In other words, no matter how equipped or multimodal a study could be, as long as the method used in that study does not generate the sense of need in learners it would not grant high-quality results.

But what could be said about the success of hypermedia group in the short-term retention of vocabulary could be due to the results of the immediacy of feedback and the effect of short-term memory on retaining the new vocabularies which fade in the longer term. In addition, this study suggests that when language learners are given the liberty to decide on what is right and what is needed for their future success, they are making wrong decisions. Iranian EFL learners take only what comes from the authoritative power of the class, that is, teachers, as the information to be learned and do not take material as seriously as when it is presented by their teacher. Thus as long

as teachers take the full responsibility of teaching, and learners see themselves as the sole recipient of the presented knowledge to them, independent, autonomous approaches like the one in this study will falter.

Conclusion

In the traditional classes the responsibility is two-folded; on one fold there is teacher, on the other students, whereas in hypermedia classes this responsibility turns out to be three folded where part of the teacher's knowledge disguises itself in the form of hypermedia. The considerable amount of information either needed by students or imposed by the material poses a great force on teachers, but using computers to take some of these pressures will liberate some time for teachers to think of other important issues.

As for extra textual annotations, the assumption was to provide learners with the background knowledge needed to understand the materials easily. It is quite clear that background knowledge plays a crucial role in understanding the materials, but heterogeneous classes in addition to the nature of traditional approaches make presenting background knowledge in the classroom impracticable while in hypermedia activities, learners found the information tailored to their needs. If they lacked any information needed to comprehend the passage, they would refer to extra textual information. The results showed that more than of the subjects used the use of encyclopedia, if available.

Hypermedia as one of the multidimensional tools of CALL approach plays a significant facilitative role in developing short-term vocabulary retention and recall. In long-term vocabulary retention this is not necessarily the case but we need to examine the hypermedia efficiency cautiously due to the parameters of the study as well as the effect of the Iranian setting as an EFL context. The study has provided preliminary work on using hypermedia concerned with WBLL tasks in teaching vocabulary. Thus there is a need to conduct further experimental research to discover the role of hypermedia annotations in teaching vocabulary and its effects on learners' vocabulary retention in the long run.

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Open education videos in the classroom: exploring the opportunities and barriers to the use of YouTube in teaching introductory sociology

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(Received 20 March 2011; final version received 21 June 2011)

The use of open education resources has become more commonplace in classroom teaching and this has been an observable and growing trend. The accessibility of the same materials further reinforces the change in roles of the teacher, from gatekeeper of knowledge to learning facilitator. Our research question is that if a student has free and easy access to the same materials that are being used to teach them in class, how does this affect their perceptions when they are presented with this material in the classroom environment? What are their perceptions regarding the perceived value for money, efficacy and authority of the material?

This research specifically investigated the use of open education videos in the classroom environment and their incorporation into an associated space in the virtual learning environment. The research questions of this investigation surrounded the practical, technical and pedagogical issues that arise from the incorporation of these resources within class and online course materials as well as exploring student perceptions about the use of this material in the class and online.

Keywords: YouTube; online video; open educational resources

Introduction

This project is a case study of the use of YouTube videos in learning and teaching in a 10 week introductory sociology course at the Foundation Centre at Durham University, which prepares mature and international students for their undergraduate degree. This course was taught across two campuses to three classes of students a week, with 75 students in total. The foundation year at Durham teaches a range of subjects to its students, with specific courses relating to the degree programme for which they are registered. The nature of the Centre means that there is a diverse student body in terms of age, nationality and subject specialism. This has an impact on the design of the course, which is intended to be a stimulating introduction to a wide variety of sociological topics such as class, gender, crime and media.

During this programme, online education videos were integrated into the classroom practice of the lecturer. In addition to this a YouTube playlist (Pearce 2011) was established and made available to students in the associated online environment. The research questions are focussed on evaluating student perceptions of this teaching approach and investigating independent use of the created playlist.

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ISBN 978-91-977071-4-5 (print), 978-91-977071-5-2 (online)

DOI: 10.3402/rlt.v19s1/7783

Videos were used to illustrate topics and followed by further explanation and discussion, both class-wide and smaller group.

Literature review

Since 2005 YouTube has emerged as a major host of online video content and is now the third most popular website behind Google and Facebook (Alexa 2011). The site hosts an enormous range of material and is popular for sports clips and music videos but has also been used within higher education as a way to communicate with current and potential students and disseminate research and teaching-based material (Wilkes, Pearce, and Barker 2011). As of September 2009 there were 102 university YouTube channels in the UK, and at the time of writing this report over 400 university channels worldwide (Azyan 2011). There is a creative tension within YouTube as a platform for mainstream broadcasters (maybe even including universities) and as a community of individual content creators who see the site as a social network (Moran et al 2011). This has resulted in a wide range of content and uses/users which has been widely studied in the social sciences (Burgess and Green 2009; Lange 2007; Snickars and Vonderau 2009; Wesch 2008).

The site offers a wealth of multimedia content that could be used for sociology teaching. This will include material specifically developed with sociology in mind such as interviews with leading theorists and teacher-created content, as well as more general content that may be useful in illustrating key concepts and theories.

Talking about technology more generally, Weigel argues that it has the potential to improve both the quality and access ('richness' and 'reach') of teaching, that is the level of engagement with learners and the numbers of learners engaged. In practice institutions tend to focus on the reach potential of the internet (Weigel 2002; Wilkes, Pearce, and Barker 2011). In the context of YouTube this is shown by the number of institutions hosting content on their YouTube channels for promotional purposes. However Weigel argues that new technologies can enhance the richness of the learning environment through combining 'bricks and clicks': where online video resources can "enrich and extend the students' exploration of new territory" (Weigel 2002).

The potential impact of YouTube on teaching has begun to be explored in the academic literature. A recently published literature review examined 188 peer reviewed journal articles and conference papers with 'YouTube' in the title (Snelson 2011). The recent arrival of YouTube and the length of time typically involved in peer review, as well as the review's narrow focus, would suggest that 188 peer reviewed scholarly artefacts represent an under-estimate of the academic interest in the use of online video. Whilst the review considered a wide range of articles, of interest to this project was a subset of 13 articles that included instructional strategies and general tips for incorporating YouTube videos in the classroom. Many of these were from fields with limited application to sociology (e.g. medical education, where videos could be used to demonstrate complex procedures).

Of particular relevance is an article about the incorporation of multimedia content in a sociology course in the USA (Miller 2009). Here the author incorporates multimedia content (audio as well as video) into their introductory sociology course and states:

> [The] most critical function in terms of cognitive learning appears to lie in their capacity to serve as representational applications for key ideas. Whether in the form of a news story, movie clip, interview or documentary, information and illustrations afforded by media are particularly valuable in helping students acquire the initial mental imagery essential for conceptual understanding. (Miller 2009)

This quite clearly relates to Weigel's idea of the internet enhancing the richness of the educational experience. In addition to this use of multimedia a variety of other uses are suggested, including as an icebreaker for initiating classes. This is similar to another US sociologist who uses topically relevant songs to start his sessions (Palmer 2011). The Miller article provides a good list of some of the potential issues and problems that may arise from employing online media, and these include student resistance (possibly as a result of technological limitations) and technical issues such as broken links, poor image quality and classroom technical problems, although he concludes that "multimedia integration is not a daunting task" (Miller 2009).

John Seely Brown discusses a case study where video materials were viewed by groups of students who were unable to access more traditional lectures. They viewed the videos as a group in a social setting. Viewed in this way students collaboratively constructed their own meaning of the material, and went on to outperform the students who had only attended lectures (Brown 2000). This is an important point: this project does not just propose incorporating videos as a replacement for lecture material, or as a way of 'flipping the classroom' where information transmission takes place outside the class allowing for other classroom activities (which might usually be set as homework), but uses videos as a means of supporting and enhancing learning within the traditional classroom environment.

Using videos in the classroom can be the starting point for class discussions where students use the multimedia potential of YouTube to engage with new and diverse topics and apply their knowledge and understanding of new topics within and beyond the classroom. This specifically social consumption of online video in class has yet to be explored in the literature that has been surveyed, and is the basis of this study which examines the role of online video in students' learning both within the classroom and outside of it.

Methodology

The first activity carried out as part of this project was the collation of videos from YouTube and the creation of an online playlist which at the time of writing contains 32 videos. This playlist covers a range of topic matter from a wide variety of sources. As an indication it includes a feature length documentary about Pierre Bourdieu (in seven parts), a 10 minute animation video produced by an further education (FE) lecturer about Weber's Protestant Work Ethic and the Spirit of Capitalism, and a comedy sketch from John Cleese, Ronnie Barker and Ronnie Corbett illustrating social class in Britain. Some of these have been produced specifically for a sociological audience and others have not, but they have all been selected by the lecturer as a useful resource for students taking an introductory sociology class.

The initial intention was to publicise the playlist via the C-SAP community and encourage contributions from other sociology teachers. This achieved a certain degree of success although not the impact hoped for. The playlist was embedded within the virtual learning environment (VLE) and promoted to students. The playlist was viewed 290 times (as of 20th June 2011) but there are no further data on

unique viewers or their location. This figure may seem relatively disappointing but only relates to users who accessed the playlist, rather than aggregating users who viewed the individual videos within it, which were linked to independently within the course materials.

The next stage of the project was incorporating the videos into the course. Not all of the videos were used in class (e.g. the Bourdieu film) but many were incorporated into the class sessions, which were three hours long. There was a range of videos used, and they were used for a variety of reasons. Some were used to introduce key sociologists to the group, others illustrated key points or data in an engaging way and yet others provided light relief whilst still reinforcing key concepts. These videos were included as links or embedded within the PowerPoint slides which were available in the VLE alongside the separately embedded playlist. Questions were displayed whilst the videos were being viewed by the students to stimulate discussion, encourage critical analysis and promote deeper learning on the part of the students.

In the ninth week of the course a series of three focus groups (24 students in total) was held across both campuses with representation from international, mature and domestic students. The focus groups were promoted in class and through an e-mail list. They were conducted by an experienced co-ordinator who was not linked with the course in any way; this was to ensure that the students could be open about their views of the use of video in class, and confident in being critical if need be. Food and beverages were provided. These sessions were recorded, and the notes were anonymised before being analysed.

Results

In-class use of videos

In the first place the students were asked about watching the videos in class and whether they believed that this was a valid and effective way of supporting and enhancing their learning. The results suggested broad support for this practice and the students also raised certain elements that they believed added to their understanding of the subjective nature of sociology with comments including:

> I think it's desperately important to get the opinion of others than the lecturer. That's where ideas come from, you get discussions going and you bounce back ideas and this leads to something new doesn't it? If you only just had one opinion you wouldn't learn anything.

Acceptable use

The students presented their opinions as to when it was both appropriate and acceptable for the use of videos in class. One theme that frequently came up was the inclusion of further explanation and proper integration of materials. Many of the students commented on specific issues with ensuring that the videos were relevant and integrated into the class.

> The tutor kind of explains the video afterwards as well, which is key.

This also relates to a discussion about the suitable length of video to be used in class. There was no real consensus on this, but it was felt that short 'taster' videos were

preferable and there was evidence that some students would follow these up in their own time.

Facilitated value

One of the key benefits of using videos in class was this ability to initiate class discussion based on the video that had been watched in the whole class environment. In one of the focus groups a student mentioned that they felt that they could easily watch the videos at home, and so did not need to watch them in class. This was disputed by the rest of the group, with comments such as this:

> We've got to understand that not everyone has that time at home to watch these things. People are not just students, they have jobs they have kids. In class they actually get the time to watch the video

> If you watch things at home, I've watched things and just thought 'ah that's pretty' but to watch it in a lecture situation, you analyse it and the lecturer's saying this is because of this [. . .] and you read so much more into it because you're watching it with someone who knows what they're talking about they're explaining it to you.

This suggests that there is quite a lot of benefit in watching the videos in class as a group, as discussed by Seely Brown. Bringing in other sociological voices, by video, is an option that may be more applicable to the social sciences with multiple competing paradigms.

Recommended 'viewing'

Students were also asked about how they assessed the usefulness of the online videos that they watched. There was a range of responses to this with a common theme being the importance of the lecturer as a gatekeeper or trusted guide.

> I hold this as better than anything I could find myself. I could Google sociology and YouTube it, but you just don't know what you are going to get, but if you use something that's been recommended it seems more relevant to me.

> It's the modern version of just being given a reading list isn't it? It's just the same as being given something to read in class. It's quicker, you can learn more and make more connections.

There was some concern about the user generated content as in the comment below:

> I do worry though. We're told not to go onto Wikipedia, and with YouTube it's exactly the same, it's just people uploading things as well, I mean is everything vetted? I mean are things updated between him showing us the link and us going and seeing the material?

This is a valid point, and highlights the overall way in which education engages with social media in (e.g. Wikipedia, Facebook etc.). The user community of YouTube was also mentioned in relation to assessing the quality of the videos:

> You have to look at the comment on it, and how many stars there are on it.

Clearly there is an issue with using the user community ratings to assess the educational value of content. The user community will be rating the videos on their own terms for things such as entertainment value, which may not overlap with

educational quality. Another student took a more measured view on assessing video quality:

> I usually rate the quality of a video by comparison, once you've watched 4 or 5 you sort of know the first one was really good, the second two pale in comparison.

Discussion

Role of the teacher: retention of imparter of knowledge

The results of this research highlight a number of factors surrounding the use of videos in education. Firstly the role of discussion is highly prized by the students, and the video's role in stimulating this was frequently mentioned. Secondly the students valued the teachers' input into these discussions and appreciated the additional commentary provided whilst watching the videos in class. The results indicate that the students felt that the combination of being able to ask questions and offer opinions as well as the benefit from the additional expertise of the lecturer, meant that the video's quality was somehow 'added to'. It would seem that, even though students had access to and were given exactly the same resources, they still felt that there was added value when these were viewed collectively and the role of the teacher in this process was key.

Establishing a benchmark

The students in this group, when asked about how they evaluate the quality of video online stated that they referred to the videos provided by the lecturer as a way of judging the value of a video that they had found themselves. The students appreciated the presentation of differing opinions within the classroom, although they seemed to require an evaluative framework when presented with the choice of selecting their own additional learning material. It was mentioned by several of the students that they saw this material provided by lecturer input as having been 'validated'. This is interesting as it contradicts the assumptions that students are happy to find their own material online and calls into question the extent to which they use this as a mechanism to support their own learning, preferring more traditional approaches of lecture handouts and textbooks to sourcing their own material. It seems that the students on this course were overwhelmed by the variety of learning resources available and as such welcomed a seemingly 'validated' resource as a way of creating a comparative framework and a means of charting a course through other self located material.

Diversity and democracy

One interesting aspect to come out of the research is surrounding the use of videos in the sociology course to highlight the subjective nature of social science. The students recalled incidents where the lecturer had used videos that opposed information he had just outlined to them as a way of representing other views and described these incidents positively, stating that this had 'helped [them] make up [their] own mind(s)'. Being able to analyse different arguments and weigh the merit of these is a process involved in deep learning, where a learner has to actively engage with material and make value judgements based on their own opinion. In this use of video, there is

evidence to suggest that by providing these other opinions and opposing arguments, the students were critically analysing information with which they were presented and synthesising their own conclusions, a fundamental feature of deep learning. This indicates that the facilitated use of video can be escalated on Bloom's taxonomy to reach higher order thinking skills and not simply the lower order of understanding and remembering. The students spoke about 'humility' on the part of the lecturer in allowing other oppositional arguments be shown and as such felt 'freer to express [their] own opinions in class discussions'.

Social and sharing

The students used the videos almost as a social currency between members of the class and as a way of fostering bonds in social networking sites. They spoke of how they would often post videos, (not always education related) onto their friend's walls, and use this as a way of starting conversation that would sometimes lead to conversations about work. The students also had positive feelings and were actively seeking to share materials with other members of their class. In the focus group, the students asked about the possibility of sharing videos that they found online with a wider audience than just friends on facebook. When asked about what format they thought that this could take and what could be done with it, they suggested it could be given to the next year's cohort as a way of finding some of the resources that they had found useful during the time on their course.

Conclusions

The focus groups discovered a wide range of complex issues surrounding the use of online videos in learning and teaching. These included the extent to which video was already incorporated into some of their learning, the willingness to collaborate and contribute to the communal playlist and the strategies that students used to assess the quality of videos that they discovered and are actively establishing their own mechanisms for quality assurance and benchmarking. Some of these strategies will be effective, but there is a danger of being exposed to misleading or incorrect material, in particular about potentially contentious issues such as feminism. The lecturer was sent a link to a video by a student which was a satirical description of feminists by a right wing American group, confusingly presented as if created by a feminist group. To a student unfamiliar with these kinds of debates it could have been taken as an entertaining look at a complex issue, despite the educational content being negligible. This might suggest that in future some form of video literacy could be included within key skills provision, to encourage the kinds of critical thinking that students are already being encouraged to develop with text-based resources.

The results of this research indicate that the students interviewed felt that the use of videos was an effective way of supporting their learning. They offer a number of explanations for this, providing alternative views and opinions on subjects, providing variety in delivery mechanisms, and using every day examples to illustrate points. The students overall did not feel that the use of videos represented poor value for money and felt that the facilitated use of these teaching materials surpassed any autonomous use of these as they valued the additional explanations and discussion that accompanied them.

What can be determined by the results of this research is that the students interviewed had a traditional assumption of the role and authority of the teacher and that these views are not easily displaced by the introduction of video resources. The aspect which students valued most was the discussions surrounding the resources. This is an interesting outcome as it supports a constructivist approach to teaching and learning that whilst including content is an important element, the focus should be on the discussions that surround this.

The results of this research confirm that the use of video in education can be an effective way of engaging students and supporting their understanding. Video production can be a costly and time consuming activity, in both staff time and if done to a high quality, equipment. The results show that the use of open educational resources is not viewed by students as a poor alternative and that, as long as properly facilitated and integrated into the lesson, the perceptions of students of this material do not diminish the perceived effectiveness of this method. In a *'colder climate'* this has implications since the use of open access content can allow staff to focus the ways in which to facilitate the delivery of these open access educational resources instead of being concerned with generation of new content thus encouraging deeper learning and, in the case of this research, potentially improving the student learning experience by supporting communication, increasing interaction and giving a wider view of their chosen subject. The use of freely available online materials in class can enhance students' learning if it is used to stimulate class discussion and not as a substitute for it.

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Effectiveness of technology to support work based learning: the stakeholders' perspective

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(Received 2 March 2011; final version received 4 June 2011)

Higher education provision typically requires learners to physically attend sessions on campus. The economic climate has changed significantly over the past few years in the UK and globally. Inevitably changes to student funding and the increased competitive nature of the job market have impacted on university teaching. The use of work based learning (WBL) is an alternative flexible form of learning that attempts to tackle these issues. It enables students to learn whilst they work, addressing the funding issues, and enhancing their employability through the acquisition of higher professional qualifications. Often such WBL programmes are designed, delivered and supported from the view of the student and academic staff with little consideration of other stakeholders such as employers, workplace mentors and professional bodies and the input they can bring to enrich the learning and teaching provision. This paper presents the findings from a survey conducted among stakeholders from all four pillars of WBL, namely the learner, the academic environment, the workplace and the external context. Online questionnaires and interviews were carried out with students, tutors, program leaders, employers and professional bodies from four postgraduate programmes at the university. The results show that while there is a reluctance to embrace technology among some academic staff, students are generally positive about using the technology. The survey also demonstrates that there is a lack of creativity and imagination in the use of technology, where often platforms such as virtual learning environments are used simply as repositories for presentation slides, handouts, etc. The results of the study conclude or rather remind all involving parties to pay more emphasis on quality of online programme delivery by embracing technology and use it in novel and imaginative ways to provide a learning and teaching provision fit for the twenty-first century.

Keywords: work based learning; professional body; e-learning; distance learning; online learning

Introduction

Work based learning (WBL) is the term used to describe a class of university programmes that brings together universities and work organisations to create new learning opportunities in workplaces (Boud and Solomon 2001). Such programmes meet the continuing professional development (CPD) needs of learners, contribute to the longer-term development of the organisation and are formally accredited as university courses.

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ISBN 978-91-977071-4-5 (print), 978-91-977071-5-2 (online)

DOI: 10.3402/rlt.v19s1/7800

In this context, online WBL has been viewed as a way to increase access to higher and continuing education that attempts to engage seriously with the economic, social and educational demands of our time. Interestingly, it provides a fundamental challenge to existing practices.

This study looks at the technology aspects of WBL from a number of perspectives including the external professional and workplace environments, the academic environment and the student experience. The paper provides an overview of WBL concepts, the context in the UK and in particular that at Northumbria University. The case study research methodology is explained, results are presented as an evaluation of technology and the main findings and conclusions are given in terms of the various stakeholders.

Background

Work based learning has increasingly become an area of interest for the higher education (HE) sector and can support the personal and professional development of students who are already in work. The focus of learning and development tends to be on the student's workplace activities rather than a set curriculum (Brennan and Little 2006; Durrant, Rhodes, and Young 2009).

Deploying technology is one solution used to overcome the issue of increasing access to 'opportunity lost' or 'demand driven' students. How to effectively conduct distance education (DE) has been a key topic for researchers for many years. The primary difference between face-to-face and DE systems is that the former is mainly "teacher-centred" while the latter is "learner-centred" (Liyanage 2010), though this distinction is becoming blurred. Taylor (2001) describes the evolution of technological innovation in DE (see Table 1).

Context of WBL in UK

Evans (2001) explains that WBL for academic credit was developed in the UK in the 1980s to respond to the rapid change in the social and economic and hence educational life of the country and the perceived inadequate skills and knowledge levels of the workforce in general. It challenged the myth that learning at HE level cannot happen in the workplace.

Greater effort was put into expanding HE while urging companies and HE to be more active through collaborations to widen access and challenge previous boundaries. WBL introduced many mutual benefits for both institutions and employers with the main focus on 'learning from experience' and a shift away from the traditional curriculum and institutional structures. Flexible access into WBL was provided through the introduction of Accreditation of Prior Learning (APL) and Accreditation of Prior and Experiential Learning (APEL) (Boud and Solomon 2001).

WBL at Northumbria University

Northumbria University, a pioneering and leading institution for WBL, recognises it as a vital mode of learning for increasing participation and supporting professional development among employers and their staff. Several important endeavours have taken place in the University to support WBL. The Work Related Learning Services

Table 1. Generations of DE.

Models of DE and associated delivery technologies	Characteristics of delivery technologies					
	Flexibility					
	Time	Place	Pace	Highly refined materials	Advanced inter-active delivery	Institutional variable costs approaching zero
1st Generation: *Correspondence*						
Print	Yes	Yes	Yes	Yes	No	No
2nd Generation: *Multimedia* print, audio tape and videotape	Yes	Yes	Yes	Yes	No	No
computer-based learning (e.g. CML/CAL/IMM), and Interactive video (disk and tape)	Yes	Yes	Yes	Yes	Yes	No
3rd Generation: *Telelearning* Audio-teleconferencing, and video-conferencing	No	No	No	No	Yes	No
Audiographic communication, Broadcast TV/Radio and audio-teleconferencing	No	No	No	Yes	Yes	No
4th Generation: *Flexible learning*						
Interactive multimedia (IMM), online	Yes	Yes	Yes	Yes	Yes	Yes
Internet-based access to www resources, computer-mediated communication	Yes	Yes	Yes	Yes	Yes	No
5th Generation: *Intelligent Flexible learning*						
As 4th Generation plus computer-mediated communication using automated response systems, Campus portal access to institutional processes and resources	Yes	Yes	Yes	Yes	Yes	Yes

Source: Adapted from Taylor (2001).

(WRLS) established in 1999, developed a portfolio of innovative and relevant work-related learning products across the institution. The service explores current thinking to identify and advise on strategy, direction and new opportunities and develops and tests curricula, learning products and infrastructure responding to the demands of employers, students, the university and other agencies (Bennett 2010). Its role in WBL has been acknowledged by the Higher Education Academy (Nixon et al. 2006).

In 2005, Northumbria University developed a Work Based Learning Framework (WBLF) allowing organisations to offer their workforce highly relevant professional development programmes designed to fit their specific needs. The WBLF offers awards that can be customised to the learners' requirements and is designed to be flexible and accessible (University of Northumbria 2010). In addition a central university team of learning technologists (LTech) provides a service to academic staff and students on how "*to enable the best use of new and existing technologies to enhance the student learning experience*" (LTech 2011).

These initiatives have enabled Northumbria University to offer alternative modes of study effectively (Liyanage et al. 2010) and about a third of Northumbria's 30,000+ students study in part-time rather than full-time mode (HESA 2011).

Aim and background of the study

WBL endeavours have helped employees and their organisations access HE in a more flexible way. However, one area that needs further attention is the support provided during the learning experience itself, and evaluating to what extent it caters for the needs of all those involved in the WBL programme. Liyanage, Pasqual, and Wright (2010) illustrate that the expectations of various stakeholders in an online learning environment are very different from each other yet are rarely addressed. For example Chong, Martinsons, and Wong (2004) in their study of the factors that influence the learners' perception and adoption of work-based e-training only pay attention to the learner.

The current study builds upon a model of WBL with four pillars: the learner, the academic environment, the workplace and the external context. The key aim is to investigate the perceptions of the various stakeholders on the effectiveness of WBL programmes and their use of technology.

It draws on four contrasting programmes within the University of Northumbria, three being closely linked to their professional body (PB). These programmes are the MA/MSc in Information and Library Management, the MSc in Records Manage-

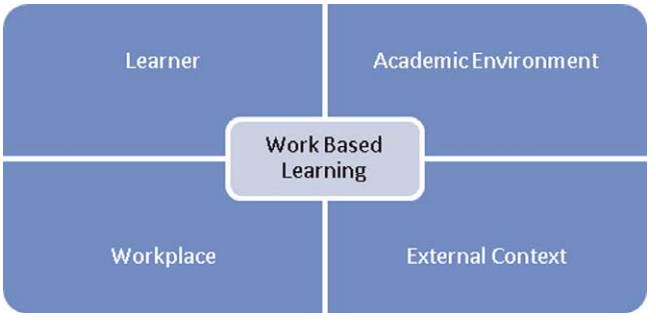

Figure 1. WBL and the stakeholder contexts.

ment, both two years distance learning delivery with supporting study schools, and the MSc Professional Engineering, a three year WBL programme. The fourth programme, MSc Computing and Information Technology (IT) is three years by distance learning and is not linked to a PB. It was initially set up for adult working 'women returners', although it now caters for anyone looking for a postgraduate IT qualification via distance learning.

Method

This research adopts the case study method, appropriate when the purpose of the research requires holistic, in-depth investigation of a phenomenon or a situation from the perspective of all stakeholders involved. Case studies are not intended to produce generalisations, they allow for transferability of findings based on contextual applicability (Pickard 2007, 93). Yin (2002) defines case study research as "empirical enquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident". A case study can be qualitative in nature, quantitative or a mix (Stake 2003). This study takes the latter approach with quantitative and qualitative data obtained via student questionnaires to maximise the numbers of students and qualitative data acquired from the rest of the stakeholders using interviews and documentation.

Triangulation is achieved within the case study by using multiple data collection techniques 'to pick triangulation sources that have different biases, different strengths, so they can "compliment" each other' (Miles and Huberman 1994). The design of the case study research is an iterative process which gives flexibility for discovery and exploration in the field as it goes.

Sample size in the case is representative of the human population that are involved in WBL at postgraduate Masters Level in the School of Computing, Engineering and Information Sciences of Northumbria University. All current students were asked to complete the online questionnaire while interviews were conducted with the four programme leaders, a representative sample of the module tutors and workplace mentors and relevant officials of the professional bodies.

Contribution

The significant difference between this study and others is the addition of both the workplace and the external context, to give a model with four pillars (see Figure 1). This four-way dialogue does not suit standard online learning platforms as the mentor and PB do not have the same contract with the university that exists between the academic staff and the learner. The results from the survey support this. When members of the PB were questioned about the type of communications that happen with the universities/employers' associations with regard to WBL, one answered "*As Head of the Accreditation Team, I will visit the programmes every five years, for the accreditation visit. All programme directors are free to contact the Team at any point between accreditation visits, although no formal meetings are arranged*". Yet it is also clear they want better communication as demonstrated by the following comment: *"Partnership, rotation, and proximity (or at least lack of barriers generally) between "academia" and "work" is much to be desired".*

Employers saw remoteness, lack of feedback and lack of student contact as a major disadvantage of WBL for their employees while students and academic staff

both indicated they would like to be able to communicate with each other and employers in an effective and easily accessible manner.

The significant contribution from this study stems from the efforts taken to understand and evaluate the link between the profession and workplace and the traditional learner-tutor academic environment. In the short-term this should aid understanding of these relationships, the support they require and determine to what extent technology can be an enabling factor. In the longer term this study should help improve the quality and effectiveness of WBL by catering for all the stakeholders involved and drawing on technology in more creative and valuable ways, leading ultimately to a more appropriately educated and developed workforce.

Results and evaluation

The collected data were analysed using *narrative* and *statistical analysis* using NVivo (QSR 2011) and SPSS (IBM 2011) software tools respectively. One hundred and fifty-five students were asked to take part in the online questionnaire and 60 responses were received giving an overall response rate of 38.7%. Fourteen interviews were conducted with programme leaders, tutors and professional bodies. The following presents the main findings in terms of five main areas of technology:

(1) eLearning portal (eLP)
(2) Communication
(3) Assessment
(4) Content
(5) Technological support to students

eLearning portal

The eLP is the main mechanism for supporting the delivery of learning and teaching and is used to replace the physical classroom environment for these learners. This has been customised from the 'Blackboard' virtual learning environment (VLE). Students and tutors had contradicting views on the user friendliness of the eLP. Among students 61.7% of students were happy about the user-friendliness of the eLP while a further 26.7% were neutral. Only 11.7% of students disagreed and found the eLP not user friendly. This contrasts with the results of the interviews held with academic staff (both module tutors and programme leaders) that generally held quite negative views on using the eLP. Typical academic staff comments included: "I wouldn't say it's perfect it's clunky and too many functionalities, which is frustrating which takes a lot of time. You have no other option you've got to live with it" and "It's tedious to upload content especially attachments because you cannot upload more than one at a time…. Formatting is a big problem in the ELP having to re-do documents/copy-paste content. Formatting is very poor and tedious".

One reason for this is that students primarily access the eLP as users to contribute to online activities and study content. Academic staff accesses the eLP to set up modules and populate and manipulate them to provide online content and activities for the students. Therefore their views reflect the difficulties in using the eLP from a control and management viewpoint rather than as a learner. Other than the eLP,

some academics and students prefer to use the PebblePad e-Portfolio for their teaching and learning activities.

Communication

The main communication channel among learners, tutors and programme leaders is email while telephone, eLP discussion areas and occasionally skype/video are also used. The main issue raised with regard to using skype was timing and issues with access at the university as noted in the following comments: "I want to do VC from my PC but the problem is due to the fact that as my students are working in other roles – they would not be able to sit at their desks and Skype about something not to do with work".

With regard to emails, tutors raised concerns about the response time and the overall time taken for each and every student's email queries: "My standard response time for student queries is 48 hours although I normally respond within 2 hours. But I do not access office mail after 5 pm on weekdays and entire weekends because do not want to become a slave to emails. I do appreciate that WBL/DL students' work style is different (after work hours and weekends) but I work full time during the week!"

Tutors also recognise that asynchronous chats and discussion boards (DB) are useful although they are not always used. "I have only discussions and asynchronous chats because we cannot synchronise with everybody's time schedules" and "My students don't make use of the Discussion Board even though it is available on most modules. They prefer to engage on an individual email discussion with the relevant tutor".

Only 23% of students indicate that they would prefer a physical community environment for learning. However 48% of students indicate they would prefer blended learning where distance online learning is supported by some physical classroom sessions compared to 'pure' distance learning with a further 27% being neutral on this issue. As one student comments "Although DB are helpful they cannot replace the classroom atmosphere with its spontaneous interaction".

Communication between the university, professional bodies and employers mainly happens via phone or email or in the occasional face to face meeting. This communication focuses on strategy and high level elements such as accreditation rather than operational issues or direct support for students. For example, one PB comments "We held a meeting of employers... to inform them how WBL might be incorporated in professional development" and another commented "Universities have a good relationship with the PB through the work of the Accreditation team and we are in regular contact".

The latest trend for communication is the use of social networking media like Twitter, Facebook, and Blogs and also for collaboration tools like YouTube, bookmarking and wikis. The university has a system that links the student information system to a texting system which enables the university to text students on their mobile phones. Currently used primarily to inform students of late changes to their timetables, etc. the system has been welcomed by staff and students alike although care has to be taken not to 'overload' students with too many texts, so use is restricted to a small subset of staff to control the overall number being sent.

Assessment

Tutors can choose the form of assignment submission from a physical hard copy to electronic submission via the eLP, email or a mix of these. Even within the eLP there are different methods of submission available. This causes confusion among the students. With last minute stress as the assignment deadline looms, students submit assignments using the method they find most easy or can remember and this sometimes leads to assignments being misplaced/not received by tutors for marking. Some tutors still prefer hard copy submission for two reasons: it avoids any technical issues (both with tutor set-up and student submission) and tutors prefer marking physical copies rather than online versions.

Providing marks and feedback is another area where technology could help but tutors have different views on this:

> I don't use the assessment facility – I do post up percentage grades – but not all module tutors do this, and my style of marking means I do not use the other facilities offered in Grade Center – it doesn't suit my marking approach – and would take me longer. I need to mark as efficiently as I can in a way that suits me.

> For assessments, I do not use any online facilities because I mark on the go in the train, at home, in the evenings etc so I mark on the paper by pen

> "Digital plagiarism is a problem for educators all over the world" (Butakov and Vladislav 2009) and (Rowe 2004). Online assessment submission raises serious security issues as methods of cheating are facilitated, some quite new, and it is inevitable that plagiarism will increasingly be automated and distributed as software packages. While there are countermeasures, online assessment in distance-learning programs should be done with caution, make use of the software tools available to uncover digital plagiarism and be continually reviewed. Tutors were aware of the dangers and commented "I have found one incident where collusion was established between home and distant students. I use video conferencing in assessments of projects where students have to demonstrate the project kind of a viva" and "We put suspicious papers through Turnitin software. Rather than creating them opportunities to cheat, if we can design assessments tactfully it would be better".

The main criticism against online learning is that students are more inclined to plagiarise than in face-to-face situation due to the fact that distance makes it hard for tutors to distinguish between genuine and plagiarised work, but the following tutor quote also held by other tutors, provides an alternative view: "DL students seem less inclined to plagiarise than face-to-face students".

Content

Unlike face to face, where tutor-student contact happens through lectures and seminars, online WBL students mainly rely on online content.

Questioned about their four most recent modules, the survey showed that for their most recent module, 78% (plus 18% neutral) of students agreed that the online learning material was of a high quality (and for their second module there was a 75% (plus 10% neutral) agreement rate. When questioned about the format of the content 67% of students prefer multimedia elements to aid learning/understanding, with a further 13% being neutral on this issue. One student comments "The learning materials could have been more varied (e.g. video casts or lectures, live chats)". Surprisingly, 18% of students either do not like the inclusion of them or can see no difference in having them.

Quality is subjective and for students, this could be their first online learning experience and thus they may have little to compare their experience against. The professional bodies are also satisfied with the quality of the online learning materials stating "... the Accreditation Teams are happy with the materials in terms of relevance, interactivity and currency".

The tutors' view on the quality and interactivity of the learning materials is valuable: "A lot of DL students like to have materials with interactions embedded into it through self-assessment activities and DBs but not necessarily have to be online to do them. Especially, they don't like to have online activities with deadlines which could become hectic with their other commitments" and importantly "I believe in "technology should not drive pedagogy but pedagogy should drive technology"". Interestingly the tutors recognise the university support provided in this area via the central learning technology support team, LTech but as two tutors comment: "University provides loads of training but I don't have time. Would like to use Podcasts and video clips in my materials but the time is the constraint again" And the content is "... essentially word documents – and not that innovative electronically – but at least they can be printed out in full, and contain exercises for checking understanding etc. They are updated – but the task is a mammoth one – and there never seems enough time to fully update materials".

Some of the tools being used for online content development are Flash, Wimbacreate, Podcasts, TurningPoint and SmartBoard.

Technological support to students

Universities must recognise the importance of this mode of education and provide due recognition and technical support wherever possible. There are two main ways that students can access university resources: firstly is via the university website and eLP, and secondly via a virtual tunnel and a thin client application called 'Desktop Anywhere'. This acts as a remote access facility to allow students to access specialised software and the shared drive similar to logging onto one of the campus PCs. Students find 'Desktop Anywhere' cumbersome to use due to technical incompatibilities. In the online survey, almost 50% of the students failed to access the questionnaire which was hosted on one of the servers through 'Desktop Anywhere'. Subsequently, a Microsoft Office version of the questionnaire had to be sent to students. Students' comments on this included:

> "'Desktop Anywhere' should be clearly explained as it allows non UK users to access the library in a timely manner" and "My computer doesn't like 'Desktop Anywhere' at all- have had real problems trying to use it- so it wasn't just your questionnaire.

Online learning mainly depends on technical support provided by the delivery institution therefore the IT services and online library fall into the category of 'vital' in this sense.

Students have assessed them as follows:

(1) IT – 70% satisfied
(2) Library – 75% satisfied

But academics were less favourable in their comments "I would prefer to have direct contact with eLP rather than going through IT helpline first. This would save time and effort".

The other concern regarding online learning is the challenges faced by students and tutors when coping with technology. When asked about the ease of adapting to online learning, 33% of students agree it was easy with 53% disagreeing. This response reflects the distribution of students across the disciplines and their individual backgrounds in terms of IT literacy and previous online learning experience. Academic tutors commented: "Students require appropriate equipment to access courses (PC + Internet) whereas F2F students can access or learn from university facilities" and it is "... costlier for students in some countries where communication infrastructure is less developed (3rd world countries)". They also commented on the challenges of keeping up with the technologies and the incompatibilities between different equipment and systems that students may have access to. Interestingly 'keeping up with technological developments' is seen by both employees and employers as one of the core benefits of WBL (Glass, Higgins and McGregor 2002). Currently there is no access to university IT systems for employers or professional bodies. Any information they need is communicated via email or in hard copy.

Limitations of using technology observed in the survey are

- eLP does not work on some mobiles due to embedded Flash content in learning materials or special software is needed.
- Students' and staff digital literacy plays a major role when implementing new media tools.
- Use of synchronous video conferencing is often not practical with distance learning students due to work commitments and time differences across different geographical locations.
- Sustainability over time is another problem with the rapid development of technology.
- Compatibility among different software/hardware systems and networks. As one tutor commented "Cannot update content with the rapid development of technology and evolution of Web 2.0 technologies which young 18+ under graduate students like to explore. Technical incompatibilities with different systems like Mac/Windows/Apple etc with different specifications".

The management of the university has taken several steps to address the issues identified in the research as follows:

(1) Appreciate and allocate WBL/DL time in the staff time table
(2) Enhance LTech support by allocating individual representatives/coordinators to each school
(3) Improve ease and speed of online access through DTA
(4) Provide better awareness about university facilities for WBL/DL students
(5) Create more friendly and efficient IT, library, finance and student services for DL/WBL students

Conclusion

There is previous research on technology-enabled WBL, but so far there has been limited consideration of all the various stakeholders. This study looks at four pillars of WBL: the learner, the academic environment, the workplace and the external context through a questionnaire survey of students and interviews with other stakeholders. The results show that a number of factors facilitate and/or obstruct the effective implementation of technology to support WBL and there are still a number of barriers to using technology in novel and imaginative ways to provide learning and teaching provision fit for the twenty-first century.

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Towards a personalised learning mesh: the implementation of a low overhead, multipath learning tool

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(Received 2 March 2011; final version received 1 June 2011)

Many studies have shown that students today live in an environment of multiple, simultaneous, short-lived stimuli which they access from wherever they may be. However institutional teaching is still based on traditional, long, sequential, attended presentations. In order to bridge that gap, there have been a number of moves over the past few years to develop and integrate lecture capture into the learning environment. Often these systems are large and require a major commitment from the institution in terms of licences and infrastructure. Given the constrained financial environment for many academic institutions, these systems are not a viable option for many. The authors have extended their normal lecture capture activity in their teaching to form an integrated learning resource. The captured media is mounted into a content management system which allows the media to be repurposed along with other content to provide an integrated support tool for student enquiry and self study which better matches their unstructured social experience. This paper describes the development of the pilot system based on a minimal hardware requirement and limited post processing. The evolution of the system pilot is described and the development of the specification which then led to the live prototype is discussed. Issues that impact on the effectiveness of the prototype are covered and the strategy (based on classroom feedback) for developing the prototype into a full system for deployment across a range of desktop and mobile platforms is introduced.

Keywords: Web 2.0; personalised learning; student centred; lecture capture; repurposing; integration

Introduction and goals

It has been generally recognised that lectures are not a particularly good mechanism for engaging students with course content. They do have several advantages however, when done well. These include:

- Allowing everyone to be presented with a common baseline of material.
- Enabling the lecturer to recognise areas where the concepts are not coming over well and to make digressions and expansions on the content as appropriate.
- Permitting students to raise queries and for the entire class to hear the response.
- Providing cost effective access to subject experts.
- Ensuring that information is presented in a structured and coherent manner.

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ISBN 978-91-977071-4-5 (print), 978-91-977071-5-2 (online)

DOI: 10.3402/rlt.v19s1/7815

The goals of the project were to make better and more efficient use of lectures as one of a range of learning resources and to support distance and asynchronous learning. In particular the aim was to move beyond normal lecture capture into the production of an integrated learning resource, where the lecture content was just part of the overall package. While a number of commercial products have been developed (ECHO 360 etc), in general these products can be classified as being enterprise level systems and require a major investment on the part of the institution. They are designed to be easy to use but normally require a significant infrastructure commitment and are not optimised for portable use (they are designed for fully equipped lecture rooms). Other products (e.g. Camtasia) will capture everything that is entered on the screen of the presenter's system. This can be a very powerful resource, capturing much of the content of the lecture and making it available in an easily downloaded format. They do however, miss out on the interactions of the lecturer as they miss the gestures and other forms of body language which are often used to reinforce meaning and content. In addition they are still focused on capturing the presentation.

Modern students and Web 2.0 resources

The digital environment within which modern students work has been characterised as being "continual partial attention", a concept developed by Stone (1998). In this type of study environment the student is switching between a range of resources and information feeds. This model does not fit well with the focused approach that is required to get the best results from lectures. Many students who use existing resources developed by the authors and discussed in the following sections, describe how they use the content as a "background activity" while they engage in other online content, switching to full attention when particularly challenging elements of the content are reached.

The students are also used to short, conversational interactions with content. This is exemplified not only in systems such as Twitter and Facebook but also in the feedback sections of sites such as YouTube. Students are used to asynchronous interaction with content and browsing through online media to find relevant content to support them in their studies. The challenge for the product was how to develop it in such a way to provide the level of interactivity that students now expect in their general online interactions, while at the same time retaining the benefits of the existing system as a learning resource.

Underpinning activities – pilot activity 1

The authors have been working for a number of years in the area of technology supported learning. Initially their work was targeted at providing support for deaf and hearing impaired students by the use of voice recognition systems to provide real time transcription of lectures. This led to a number of publications and the development of several prototype products. One of the interesting responses to the work was from the hearing students who also wished to access the transcript of the lecture as it provided a range of benefits to them.

- They found that, unlike captured audio or video, it was easy to scan through the content to identify the area that they wanted to review. In some cases the students used search tools to make this process more efficient.
- The compact nature of the file meant that it could be stored and displayed on devices with relatively little memory such as smart phones.
- The ability to print out the content and annotate the captured text was found to be extremely useful as a study tool.

The work moved on to the development of a low cost system for capturing and presenting the lecture content in a number of formats. These were integrated into an application which allowed the student to browse through the lectures in their own time. The interface of this product is illustrated in Figure 1 and is discussed in detail in McKee et al (2008).

Significant benefits were noted from this activity. A class of 50 students were used for the pilot project. They were surveyed by questionnaire after a series of 18 lectures, with 25 completed responses which were followed up by a series of random follow-up interviews. The key outcomes were:

- The deaf students were highly appreciative of the subtitles, both in the presentation and in the recording.
- Although the subtitles were intended for the deaf, several international students said they helped them to understand the local accent.
- No-one was concerned that the "production values" of the recording were not of "broadcast quality" – the content was clear.
- More than half of the class filled in a questionnaire, but even those who had not filled it in said they had viewed and used the recording.
- Virtually every student wanted the mechanism employed by other presenters.

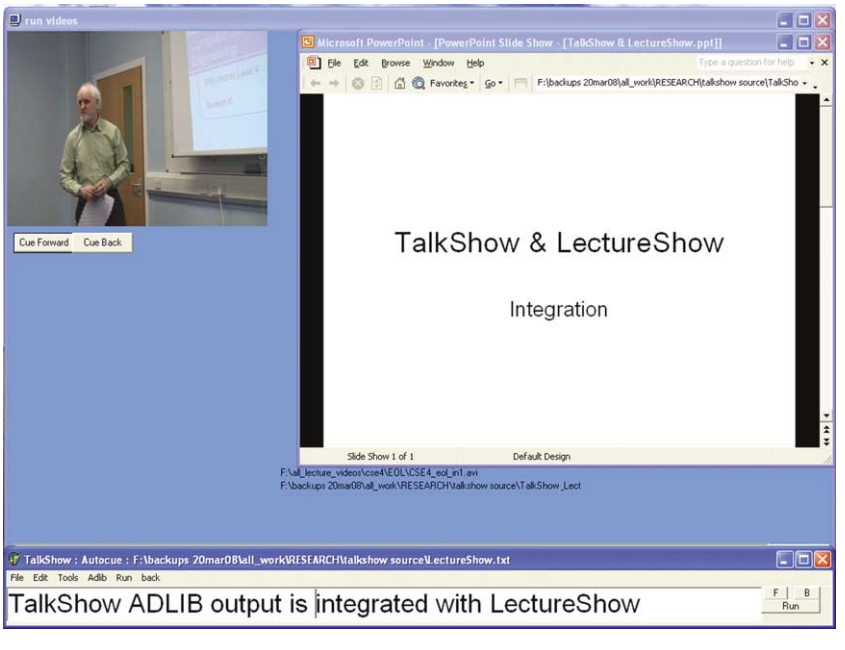

Figure 1. Initial lecture capture playback tool.

Underpinning activities – pilot activity 2

In parallel with the first activity, another set of lecture capture activities were undertaken which did not utilise voice recognition but were more concerned with making a wide variety of integrated learning resources available to support the learning styles of the students. The particular cohort that undertook the activity was working at honours level on a module with significant technical content, a large number of graphical examples and screen based demonstrations as well as a significant amount of supporting reading materials. The content was integrated into the Blackboard VLE for easy access and download. The students in this second pilot, who were utilising the captured lecture content to support their studies, were asked a range of questions in a questionnaire and also by an external facilitator. Seventeen students from the class of 31 provided detailed answers and engaged in discussions with the facilitator. The questions are listed in Table 1.

Table 1. Questions used to evaluate the second pilot.

Did you find the use of the technology impacted on the delivery of the lecture?
Did you use the captured lecture material?
If so, did you have a preference for the captured video or the captured Powerpoint presentation and why?
How did you use the captured media? (e.g. for general revision, to catch a lecture I missed, to deal with a specific topic in a tutorial or to revist a topic I was struggling with).
Do you consider the capture activity to be worthwhile/useful?
How could it be improved? (e.g. provide the media in more formats, split it into smaller sections to tie more directly into particular parts of the lecture, incorporate other media more tightly into the presentation)
Are you aware of your preferred learning style?
How could the captured media be modified to better suit how you study?

The key points that were extracted from the responses were:

- Approximately 50% of the respondents felt that the capture process impacted on the lecture presentation but everyone wanted the activity to be continued.
- The preference for video vs. audio synchronised to the slides was similarly evenly split across the respondents. In general those who expressed a preference for the video tended to use it to catch up on a missed lecture or to see the gestures, visual cues and other interactions which were not necessarily available from the audio content. The students who preferred the audio synchronised slides preferred it as a resource to review a particular element of the lecture.
- When questioned about their learning style, many of the students did not recognise that they had a particular learning style. However, when they were asked to describe how they would study a new topic, the majority described a process where they would take a section of content and review and summarise the content until they were comfortable with the concept. This suggested an alignment with the reflective category as defined by Honey and Mumford (1992). Further discussion showed that their approach was also strongly biased towards a logical sequential development of ideas and in addition in certain circumstances they would study in groups or apply other active learning activities. Overall it appeared that rather than having a particular

> learning style, many of the students were adapting their learning strategy to the content that was available and the nature of the subject being studied. This is consistent with the detailed discussion of the fragmented nature of much learning styles research in the work of Coffield et al. (2004).

This pragmatic approach to learning was likely to be in part due to the nature of the class itself which was in the final year of a set of technical programmes with a high level of applied content. Few of the students had experience of (or interest in) psychology or educational theory.

The students were generally very comfortable with using a wide range of digital devices to access the information in a variety of formats and when appropriate, to edit the content or change the format to allow access on devices other than those anticipated by staff when making them available. This level of comfort in working with digital media across a range of platforms tied in well with the concept of the Digital Native (Prensky 2001). In addition, the preferred approach for many students was to take parts of the content and to access these pieces when convenient rather than setting aside large blocks of time to concentrate on a specific area of study. In the discussions, some students described how they would run the captured presentation in the background while surfing the internet, and then when a particular topic or point was reached that was of importance or that they were struggling with, they would focus their attention on the presentation. This type of example tends to support the relevance of Stone's continuous partial attention concept which was outlined earlier.

Overall conclusions from the underpinning activities

The most important result from the analysis was that there was a general desire to be able to access the media in a greater variety of formats (e.g. more suited to mobile devices) and that the content should be broken down into smaller parts which would form part of a larger structure to allow more focused use of the resources and to allow them to be downloaded more quickly.

In terms of monitoring the effectiveness of the tool at that stage, it is worth noting that the module feedback for the modules where it had been deployed had been very positive, with a large number of comments stating how much the students appreciated the resource. This had also been fed back in comments from both of the external examiners who dealt with the modules and programmes where the work was being deployed. They noted in their reports:

> Recording of Teaching Material: Students appreciate the availability of teaching and learning materials on Blackboard and in particular the video recording of lectures that were very useful for revision on modules such as Multimedia Technology 2.

> Honours students were particularly appreciative of the effort made by one of the staff to make available video recordings of the main sections of his lectures, in addition to a wide range of other learning support materials. Students stated that their learning process was greatly enhanced by being able to revisit the lecture material.

Similarly the usage statistics from Blackboard show that almost every student had accessed and downloaded the content.

An additional benefit from this has also been that students who have had to miss the modules due to serious illness have been able to study the content over the summer and successfully pass the resit at a first attempt, which would not normally be possible as they had not been able to attend the classes.

Development of the specification of the integrated learning resource

While the previous activities and resources were found to be useful to themselves, it was always intended that the development process would be continued to try and produce a more effective learning tool. The issue with the product as it stood was that it was still (in the main) a passive resource where the student accessed the content of the lectures in a variety of formats and could review and revise from it. It was not possible to interact with the content. Any form of question and answer activity, linking to other resources or requests for clarification of the content after the lecture had been captured, could not be done within the product but had to be done through other mechanisms. In our case this was mainly via the Blackboard VLE. Despite these limitations the product was well received by the students and a significant amount of feedback was gathered to inform the development of the next generation of the product.

One of the key points that emerged from the feedback was that the "one size fits all" approach to education is not suited to the range of learning styles that the students use in their learning (Dimitrova et al. 2003).

The next stage was to take the wide range of content and fit it into a more flexible and adaptable framework while still ensuring that the structure and organisation of the information is logical. At the heart of this development was the creation of small learning elements or chunks. These included sections of a captured lecture, individual tutorial questions, links to online resources or simulations, FAQs or any other relevant educational item.

Key goals for this content were that it be integrated into the system in such a manner as to allow easy modification, adaptation and linking between the elements. These elements are to be mounted within a structure or "mesh", showing their relationships and allowing optimal learning sequences to be described. This allows the learner to choose their route through the content and the elements of the larger themes on which they wish to concentrate. The key features of the specification are:

- The system should be easy for staff to use.
- The system should not impact significantly on the ability of the lecturer to present the material in a manner that suits their lecture style.
- The presented content should be available in a variety of formats suitable for a range of delivery platforms.
- The content should be personalisable by the student
- The content should be able to be added to either by staff or students.

The ultimate aim is to allow the individual staff member or student to modify and adapt the content to suit their own learning style and to increase the student's engagement with the content.

This proposal ties in with the desire of students to work with web 2.0 technologies (Andone et al. 2007) which are an increasing element of their online environment. It is important to recognise that by providing greater flexibility and user control over the structure of the learning materials and hence potentially over the depth of the

learning experience, there is potential that some students may choose learning strategies which are not effective in achieving the learning goals. In recognition of this, the product will always allow a "non-interactive route" which basically follows the standard linear structure of the normal lecture/tutorial activity and provides a standard baseline experience of the content.

The next stage of the process was to design and develop a software platform to support the presentation and distribution of the content.

Technical design of the integrated learning resource

The prototype required multiple learning elements of different data types to be inter-related, linking content topic, presentation slides, captured video, tutorial questions, practice exam questions and FAQs. This would allow students the freedom of being introduced to a topic via different forms of multimedia.

To allow these relationships to be constructed, an XML-based approach was chosen. This allowed a schema to be quickly defined that identified all related materials, how they should be displayed to the student and at what point in time these assets are required. Synchronisation data between the captured video and presentation slides are also stored in this document, with each slide having start/end timestamps. Using an XML approach as a data source for the backend of the application allows the system to be hosted on low performance infrastructure, reducing operating costs as there is no intense processing of large data volumes which may be experienced when working with larger databases with complex relationships.

Most data processing and user interaction handling occurs client-side with the implementation of JavaScript. This allows the XML documents stored on the server to be converted into JSON (JavaScript Object Notation) strings and then parsed efficiently on the client's machine. JavaScript is also responsible for synchronising the video and presentation slides, utilising the timestamp information stored in XML documents to keep content presented to the student up to date.

The prototype in use

A prototype learning framework has been developed. The intent of the framework is to allow the lecture content and its related resources to be accessed in a variety of ways. The software development methodology being applied during the development stage is that of prototyping. This allows early versions with reduced functionality to be deployed and the feedback from the users incorporated into the subsequent iterations of the design. The current version of the software consists of three elements.

- A user view that the students can access.
- An edit view that allows the lecturer to organise the core content.
- A content management system to allow the uploading of the materials.

The core of the prototype is still the captured lecture content as is shown in Figure 2.

This allows the students to navigate through the lecture content via the slides or the video which are synchronised together. Where this product differs from previous developments is in the areas shown underneath the lecture presentation. Firstly, they provide access to all of the related content in a single space. Secondly, they provide an alternative mechanism to navigate the content.

Figure 2. Screenshot of the prototype showing the general interface.

The full navigation structure of the prototype is based around themes rather than around individual lectures. For example one theme is the generation of 3D graphics. This unit consists of a number of captured videos and slides (one set per lecture) merged into a single "presentation". As with traditional lecture capture, this content can be navigated linearly through the lectures. The other elements of the theme provide for other forms of navigation and interaction.

- Tutorial questions allow navigation of the content by relating sections of the presentation to the answers. Figure 3 shows how selecting the question jumps the lecture to the appropriate point.
- Exam questions provide access to relevant past paper questions and solutions as well as links to the appropriate presentation elements.
- Student FAQs allow regular questions from the class (either online or from tutorials) to be posted along with the response.
- Additional Materials provides a range of resources to extend the interaction (e.g. for the 3D theme this consisted of links to downloadable demonstrations and interactive learning resources relevant to the topic).
- Further reading linked to a range of relevant electronic articles and websites.

In almost all of these sections there is the ability for the students to add comments and feedback on the content and to discuss the particular topic on which they are currently working.

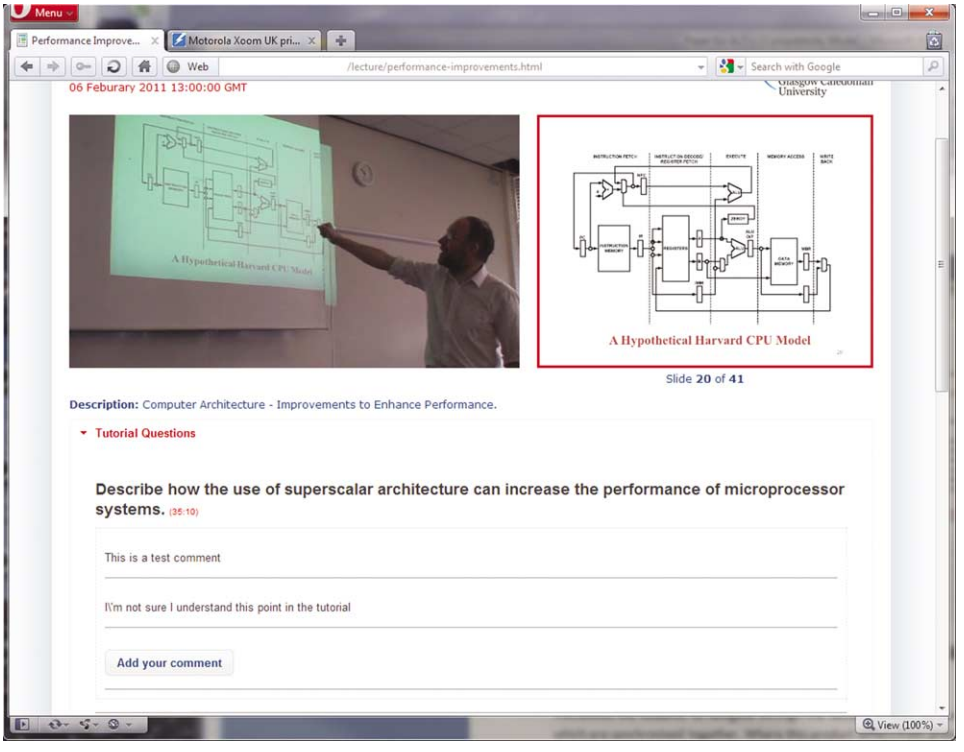

Figure 3. Screenshot of the prototype showing the linking of questions to content and the addition of comments.

The key area where this prototype can be considered to be innovative when compared to traditional lecture capture is that the lecture is just viewed as one of the learning resources available to the student in the environment. The environment provides a simple interface to the content of a particular theme of the module. Within this the student should find all of the related content of the topic in a clear, linked and navigable structure and be able to use the resources in a way that suits their particular needs and learning style at that time.

The initial feedback from users has been gathered in two ways. Informal discussions with the users were undertaken in class time and by email to pick up feedback on the prototype and to allow the rapid prototyping methodology to be applied to the development.

The final evaluation of the current version is still under way at the time of writing. It is being done using a fully anonymous web based questionnaire which has been sent to each of the 44 students who took the module. After 2 days of running the survey, 11 responses have been received. The survey uses a token based system to ensure that only one response per student is recorded.

In general the respondents recognised that there were benefits to having all of the resources integrated into a single interface and they find the navigation of the content easier than in the previous systems. There were issues with needing to scroll up and down the screen to see the video when navigating via tutorials. The ability to approach the content from different directions (e.g. to be able to go from a difficult question to the relevant parts of the lecture and supporting content) made the

material much more useful to them. The discussion tool as it stands is seen as of some value depending on how it is used, but the students were not clear about how it was meant to be used. Where it has proved most effective to date is when students have provided links to other resources that they have found useful and made these resources available to their colleagues.

At present the prototype has been tested across a range of digital devices. The original content was designed to be accessed by students using networked PCs/Macs and netbooks. The interface was designed to work best on those screen sizes. The choice of Flash as a video format with the other content based on XML meant that the content was accessible from any standards compliant browser on these platforms. Testing showed that PCs and Apple systems running a range of browsers had no problems presenting the content.

While handheld devices were not the focus of the original design, the interface was designed to support this form of access and the prototype can run successfully on many high end smartphones. Figure 4 shows the application running on a Samsung Nexus S Android reference smartphone. However it is recognised that the decision to use Flash as a video playback standard has excluded iOS devices from being able to access the full content. Part of the future development work will be a range of "Apps" optimised for mobile platforms, which will support offline access.

Discussion and further development

The overall goals of the project were to:

- make better and more efficient use of lectures as one of a range of learning resources;
- support distance and asynchronous learning;
- move beyond normal lecture capture into the production of an integrated learning resource, where the lecture content was just part of the overall package.

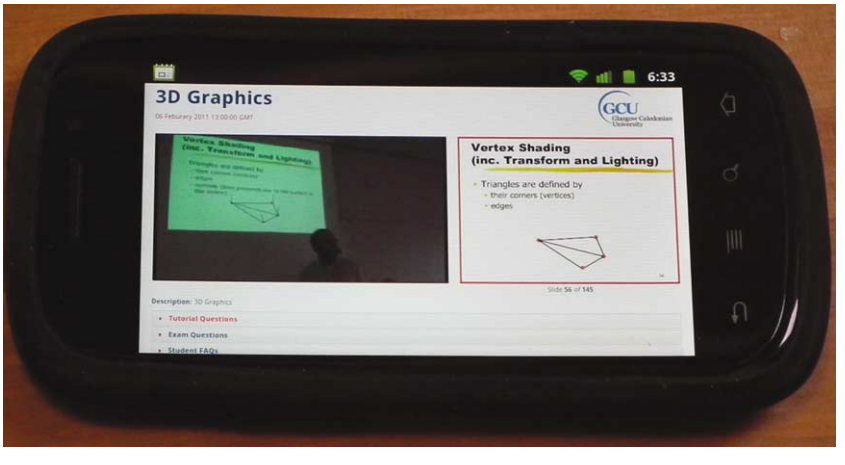

Figure 4. Screenshot of the prototype running within a mobile browser (Android platform).

The feedback from the students who used the resource is very positive with many comments supporting the work. The resources have been used by a number of students who missed classes through illness to keep up with the content. In particular, the integration of the resources into a single interface was appreciated as a means of allowing the students to approach the content in their own way rather than being constrained by the linear flow of traditional lecture capture.

The framework is currently being extended to better support distance access provision by incorporating an interactive element which allows questions and issues to be raised after the lecture and then linked back into the lecture content. In particular it is intended to encourage greater student involvement with the content of the course. By allowing the students to take "ownership" of the content and to manipulate it in a manner that is appropriate to their learning style and mode of access, it is hoped that the engagement of the students with the content will be increased.

Those familiar with Artificial Intelligence studies will recognise that there is a valuable way of looking at such a complex environment and mapping routes to satisfactory outcomes for approaches with differing input parameters – that of the "weighted mesh". In this model the individual elements (or nodes) are produced and then linked to preceding/succeeding nodes by a set of pointers given appropriate "weights" according to the likelihood of producing the desired solution. For example, a user having utilised a node can be directed to one of the following nodes depending on their expressed desire for sequence, or depth, or by the results of a test, or by the "learning style" they have chosen (overview/short topics/detail/etc.)

The current prototype is a first step in the way to such a system in that it allows the production of "nodes", in the form of learning objects, and a mechanism of implementing the links between them. At present this needs to be extended to provide greater flexibility and interactivity. Once this is done the prototype can be taken further to begin to incorporate a mechanism to weight the paths and to develop more personalisable elements.

While there is still work to be done to improve and extend the prototype, there is already evidence that it is encouraging the students to interact more with the material and to take a more active and engaged role in their studies. This has been recognised within the authors' university where the work has been demonstrated at workshops, nominated by students for a teaching award and one of the authors has been awarded funding by the institution's learning research centre to support the further development of the prototype to produce a tool which can be deployed more widely. Particular interest has been shown by colleagues who are involved with distance and part time learning programmes which form an ever increasing part of the educational delivery in higher education.

Acknowledgements

The authors would like to thank the past and present students who have supported the project and provided the feedback that has been essential to the development of the project.

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DeFrosting professional development: reconceptualising teaching using social learning technologies

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(Received 01 March 2011; final version received 27 May 2011)

In this paper we discuss the impact of redesigning a lecturer professional development course with the aim of embedding a community of practice (COP) model supported by the use of mobile web 2.0 technologies. This approach was based upon a model developed to support 30 mlearning projects between 2006 and 2010, which also informed the institutions' new elearning strategy developed in 2009. Participating lecturers were brought into the course as participants in an intentional COP investigating the pedagogical application of social learning theories and frameworks, facilitated by the course lecturers who took on the role of technology stewards guiding the COP in the appropriation of mobile web 2.0. Three examples of participants' journeys of discovery throughout the course are highlighted to illustrate the impact of this approach to professional development. Reflections on the first 2010 iteration of the course are then used to inform the following iterations in 2011.

Keywords: professional development; communities of practice; social learning theories; pedagogy-andragogy-heutagogy continuum

Introduction

In the 2010 movie "Kick-Ass" (Vaughn 2010) Nicholas Cage plays a fanatic vigilante (Damon Macready) fighting crime and training his daughter to do likewise through experiential learning. Cage fires a round of a pistol at his character's daughter (Mindy) wearing a bullet-proof vest:

> (Mindy) Daddy I'm scared
> (Damon) Come on Mindy, Honey, be a big girl now, there's nothing to be afraid of.
> (Mindy) Is it gonna hurt bad?
> (Damon) Only for a second sugar. A handgun bullet travels at more than?
> (Mindy) 700 miles an hour.
> (Damon) So at close range the force is going to take you off your feet for sure, but it's really no more painful than a punch in the chest.
> (Mindy) I hate getting punched in the chest.
> (Damon) You're going to be fine baby doll.
> *Shot*
> (Damon) How was that? Not so bad, kinda fun huh? Now you know how it feels, you won't be scared when some chunky asshole pulls a glock. (Vaughn 2010)

In a similar way to Cage's Kick-Ass character, the researchers developed the Social Learning Technologies (SLT) course as an experiential learning environment for the

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ISBN 978-91-977071-4-5 (print), 978-91-977071-5-2 (online)

DOI: 10.3402/rlt.v19s1/7796

participants, while informed by a graduate-level critique and reflection upon emergent learning theory. The goal was to provide participants with a model and experience of both a community of practice (COP) and enabling mobile web 2.0 tools that they could then continue to develop within their own teaching and learning contexts after the completion of the course. This was underpinned by a rigorous investigation of social learning theories and frameworks throughout the course, and scaffolding the experiential learning via the establishment of the course as a supportive COP.

Development of the social learning technologies course

The Graduate Diploma of Higher Education (GDHE) is one of the institution's primary methods of lecturer professional development. However the learning technologies paper of the GDHE had become dated and antiquated. The authors were tasked with redeveloping this paper and bringing it into alignment with the institution's new elearning strategy.

The context

Unitec is New Zealand's largest polytechnic and is in the process of differentiating itself from New Zealand's eight Universities by the roll-out of a distinctive pedagogical approach termed the Living Curriculum and exemplified in the institution's new elearning strategy.

The COP model for professional development

A COP model was developed (Cochrane 2007; Cochrane and Kligyte 2007) to support the implementation of over 30 mlearning projects managed and implemented in partnership with a variety of lecturers by the authors between 2006 and 2010, and has become a core element of the institution's new elearning strategy (Cochrane 2010). The 2006–2010 research was interested in bringing about sustainable and transferable pedagogical change that would benefit lecturers and students, transforming pedagogy from a face-to-face classroom based instructivist paradigm to a context bridging social constructivist paradigm. Mobile web 2.0 tools were used as a catalyst for this pedagogical change. To achieve this goal, the second problem was creating an implementation approach that did not rely upon (or never go beyond) already techno-savvy ('geek') lecturers, but was capable of supporting and scaffolding the average lecturer to become confident integrating innovative technologies into their curriculum. Rather than relying upon a series of workshops, the sustained engagement of a COP was found to achieve significant ontological shifts for both lecturers' conceptions of teaching, and students' conceptions of what it means to be a learner.

Research methodology

A participatory action research methodology was used for evaluating the impact of the redesigned SLT course, which was embedded within the roll-out of the institution's new elearning strategy, developed with strategic input from the authors of this paper. All SLT students signed ethics consent forms and an acceptable use policy relating to the use of the mobile web 2.0 tools throughout the course. The 2010 SLT class began with

nine enrolling students with two students withdrawing in the first week of the course due to time constraints, leaving a small but committed class of seven students, and two facilitating lecturers. The course participants were expected to have a wifi capable laptop computer for use during the course. The one student who did not have access to a laptop was supplied with a netbook for use throughout the course. Additionally, all of the course students were supplied with an iPhone 4 for use during the course, allowing them to experience the affordances of mobile web 2.0. The introductory session of the course established the core collaboration tools used to enable the COP to operate beyond the face-to-face sessions, including: Twitter (including a course hashtag), personal Blogs, a group wiki page (http://ctliwiki.unitec.ac.nz/index.php/Social LearningTechnologies), Gmail and associated Google Apps, and a course Moodle hub where students added their web 2.0 contact details to their Moodle profiles. The Moodle LMS (Learning Management System) was therefore used as a scaffold while students established their own PLE (Personal Learning Environment) consisting of a mashup of web 2.0 tools.

Data collection and triangulation

Data collection consisted of:

(1) Beginning of course surveys of lecturers and students, to establish current practice, expertise and experience.
(2) Post-course surveys and focus group, to measure the impact of the mobile web 2.0 environment, and identify emergent themes.
(3) Lecturer and student reflections via their own blogs and eportfolios throughout the course, collated via RSS feeds. The research used the technologies that were an integral part of the redesigned course assessment, such as participant blog posts, peer blog comments, and VODCast reflections to capture data on the progression and impact of mobile web 2.0 on the participants' learning experience.

Communities of practice

'Communities of Practice' (COP) is a social learning theory. The concepts were proposed by Lave and Wenger (1991), while studying the apprenticeship model of learning. Wenger (1998) later further developed the concepts, and then simplified the concepts for wider contexts: "Communities of practice are formed by people who engage in a process of collective learning in a shared domain of human endeavour" (Wenger 2005, 1). Though not originally intended as a pedagogical strategy or teaching technique, rather an analytical viewpoint on learning (Lave and Wenger 1991), the concepts of COP have found popularity within educational contexts. The main differences between traditional teacher-directed (didactic) educational environments and COP are: an emphasis on inventiveness with a continual evolution of ideas and direction of the community (Brown 2006), a lack of hierarchy (Head and Dakers 2005; Langelier 2005) and teachers take on the role of expert mentor (Herrington et al. 2006) rather than delivery of content.

The SLT course was designed as an intentional COP. Wenger's (2005) definition of COP "allows for, but does not assume, intentionality" (1). While COP often form organically and spontaneously, they can also be created intentionally and cultivated

for specific purposes. Intentional COP share the same characteristics as organic COP, but have at their core a plan.

One of the key concepts developed out of COP has been the importance of 'technology stewards' (Wenger, White, and Smith 2009; Wenger et al. 2005) within COPs to guide the use of technologies supporting the COP. Within the context of the SLT course, the course lecturers took on the role of technology stewards, attempting to model the pedagogical use of mobile web 2.0 as part of a collaborative partnership with the course students.

Social learning theory and frameworks

The SLT course was explicitly founded upon a social constructivist pedagogy (Vygotsky 1978) and focused upon students investigating related pedagogical theory and frameworks and the appropriation of web 2.0 tools to implement these theories and frameworks within their pedagogical practice. These included both established and emerging theories and frameworks such as: COP (Lave and Wenger 1991), the conversational framework (Laurillard 2001), learner-generated content and learner-generated contexts (Luckin et al. 2008, 2010), authentic learning (Herrington and Herrington 2007; Herrington and Oliver 2000), connectivism (Siemens 2004) and activity theory (Engestrom 1987).

Links were provided to educational research organisations that publish regular reports and RSS feeds to new resources, thus keeping the course 'readings' up to date rather than reliant upon rapidly aging set texts. These included:

- Educause, 7 Things You Should Know About Series [http://www.educause.edu/7Things]
- JISC reports [http://www.jisc.ac.uk/publications.aspx]
- New Consortium reports [http://www.nmc.org/publications]
- Educause Resources [http://www.educause.edu/resources]
- Becta [http://research.becta.org.uk/]

Redesigning the GDHE SLT paper

The redesign of the GDHE Learning Technologies paper into the new SLT paper was a collaborative process by the two authors during 2009. The final course was approved late 2009 and ran for the first time in semester two of 2010 with the two authors as the course lecturers.

Course outline: 2009 vs 2010

The original Learning Technologies paper centred round the course participants creating a resource for their students to use, i.e. teacher-generated content. The redesigned SLT course focused upon modelling the use of mobile web 2.0 tools as a catalyst for pedagogical transformation, leading to the participants' developing their own theory and experience-informed teaching and learning framework. This framework was to establish links between new and emerging learning technologies and social learning theories, and then became the basis from which they developed student-centred learning activities for their context, i.e. enabling student-generated

content and student-generated learning contexts. Table 1 outlines the key differences in the redesign of the SLT paper.

The SLT course ran over the period of a semester, with six 3-hour long face-to-face sessions. Figure 1 illustrates the structure of the course, within the framework of an intentional COP.

Results

This section discusses the findings of the research into the impact on the professional development of the participants resulting from the design of the SLT course around an experiential COP.

2010 participant profile

The bulk of the participants in the course were from the vocational training departments at Unitec, including: Boat Building, Automotive, Carpentry and Electrical trades. The students were skilled tradesmen, but not necessarily skilled teachers, and most had limited experience of integrating technology into their teaching practice, but were keen to explore the potential beneficial impact for their students. The participants' ages ranged from 29 to 59, with an initial enrolling cohort of seven male and two female participants.

Table 1. Key differences in the redesign of the social learning technologies course

	Old LT course	New SLT course
Design	Prescribed course resources (Book and printed journal articles provided to learners in class)	Open – students determine appropriateness of the content according to discipline, their own contexts and learning technologies chosen
	Only theory	Applied theory
	Exploring potential use of learning technologies	Exploring potential use of technology and applied within the learner's own context
Facilitation	Focus on individuals in class (learning alone)	Focus on the community and the role the individuals play in the community (learning together – collaboration, co-creation, peer-feedback and communication)
	Emphasis on strategies for delivery of content (passive learning strategies)	Emphasis on active learning, learner-generated content and authentic learning
	Learning context control by the teacher	Learning context determined by the needs on the community and individuals
Assessment	Two separate assessments	Assessments embedded within the learning process, each building on the other
Department involved in teaching the course	Lecturers from the education department	Academic advisors from Te Puna Ako (Learning and Teaching Development Unit)

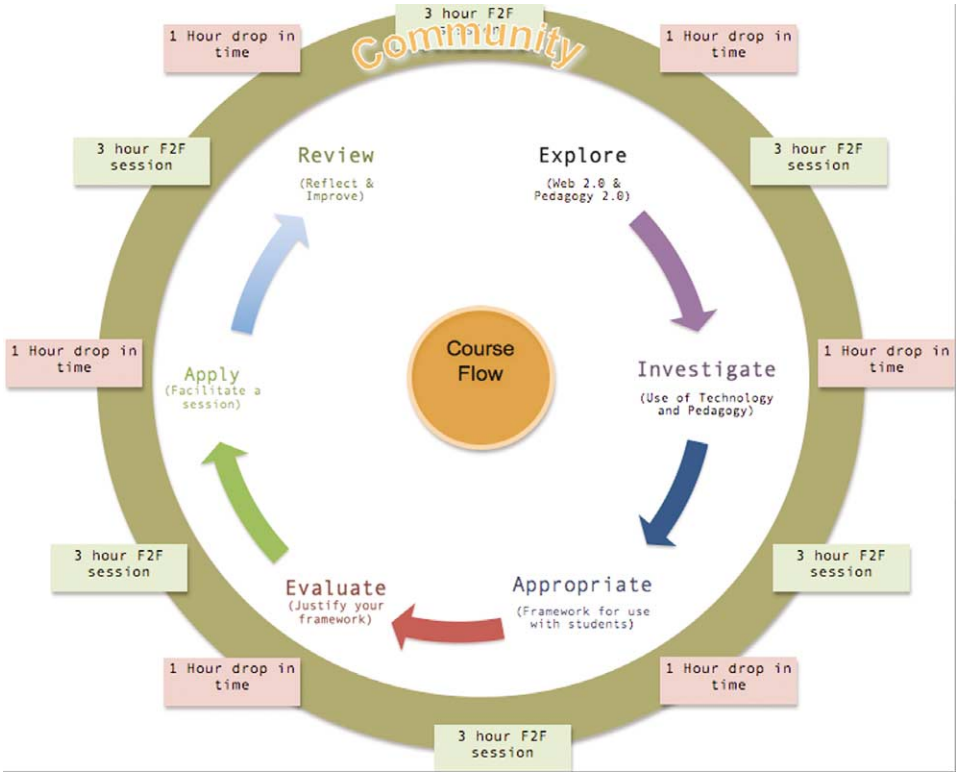

Figure 1. Outline of the SLT course.

Student surveys

The beginning of course student survey provided data on students' previous experience. Figure 2 indicates that while the SLT participants all had computer and Internet access, and the majority owned a cellphone, most of their web experience had previously been as consumers of information and media rather than producers. There was minimal use of interactive web 2.0 technologies prior to the course, with those that were already engaging in web 2.0 having previously worked with the authors on projects.

The students' responses to the end of course survey were overwhelmingly positive about their experience of mobile web 2.0 during the course.

Transformational journeys

The key goal of the course was for the lecturers to model the pedagogical use of mobile web 2.0 tools embedded within an intentional COP comprised of the course lecturers and the course students. The course students were then guided to apply their experience to create a personal framework for authentic experiential learning within their own teaching contexts. This represented a significant process of reconceptionalising the participants' notions of identity and agency within teaching, i.e. an ontological shift. For many lecturers this will require an 'ontological shift' in their understanding of what it means to teach, and can represent a fundamental challenge to the lecturer's understanding of self within the context of the nature of teaching and learning. An

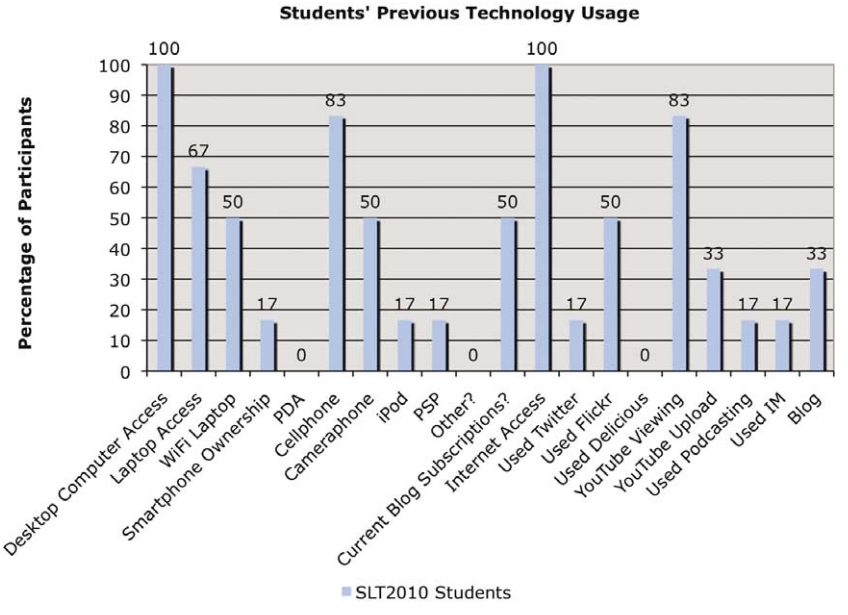

Figure 2. SLT students' previous technology experience.

'ontological shift' is "the re-assignment or re-categorising of an instance from one ontological category to another" (Chi and Hausmann 2003, 432), or simply put, a reconceptualisation. This shift involves a reconceptualisation of lecturers' understanding of teaching and learning from their prior experience to understandings built upon the foundation of learning theory such as social constructivism. This ontological shift can take significant time as lecturers reconceptualise and develop new and appropriate forms of assessment, collaboration and communication strategies. For several of the course students the course facilitated an ontological shift from tradesman to teacher. Examples of the impact of the SLT course on participating students are discussed in the following sections.

Boat building lecturer 1

This participant became a key peer mentor and driver for the group. He helped to establish a real sense of community, encouraged the group to try and contextualise their learning, and he modelled collaborative discussion and critique using a range of technologies. For example, he initially experimented with creating personal reflective VODCasts and then extended the concept to establish Skype video call discussions between the SLT students, screen captured these, and shared them on YouTube as examples of critical reflection upon the theoretical pedagogical frameworks (http://www.youtube.com/watch?v=BPLYQIRSVhU).

The social collaboration built into the SLT course was very important for the participant's transformational journey, as he expressed in a blog post, contextualised using boating terminology:

> The fog is still at sea level. But I'm hearing others sounding off, so there is hope out there. Some are still at a distance but I can feel that others are close by. I think at last I'm starting to get my mind around what links might look like. The links I'm starting to see

> are those that are between emerging learning technologies (Web 2.0 and stuff) and social learning theories. (SLT student blog post 2010)

The experience of the SLT course impacted this lecturer's own teaching practice by enabling him to form a theoretical foundation for his approach to teaching based upon social constructivism that he has explicitly implemented with his students in 2011 http://www.youtube.com/watch?v=qoJEggkvygw.

Carpentry lecturer 1

This participant synthesised his experience as a student on the SLT course and his own teaching practice to create innovative ideas for use with his own students. His goal in participating in the SLT course was to explore how to more closely link the theory and practical components of his carpentry course by getting his students involved in capturing, sharing and critiquing their practical on-site work via short videos recorded on their camera phones and uploaded to their blogs. He enjoyed the experience of the course:

> This has been a very interesting course and I have gained a lot from my peers, Vickel, Thom and the readings. Also getting the chance to use the iPhone has been a real learning curve and an eye opener to what we could possibly achieve with our students and some interesting thoughts about empowering student ownership and responsibility. I have enjoyed experimenting with different web 2.0 tools and having the opportunity to participate as a student and also facilitation possibilities from a teacher's perspective. (SLT student blog post 2010)

By the end of the course this participant also demonstrated a new level of critical pedagogical reflection:

> Key new knowledge gained for me is Vygotsky's zone of proximal Development and the fundamentals that almost feel specific to our learners, although I realize it is for a wider community. This is an important aspect to our frame work, understanding where we are, where we need to be, and what we can build on to eventual empowering students negotiation and enquiry. (SLT student blog post 2010)

The experience of the SLT course impacted this lecturer's own teaching practice in 2011 by enabling him to conceptualise ways of integrating mobile web 2.0 tools into the context of bridging the theory and practice of building onto the building site with his students. This led to the design and building of a portable 'eshed' for theory lessons on site http://www.youtube.com/watch?v=-tEDxHcV-4w.

Boat building lecturer 2

This participant began the SLT course with the least previous experience of computing and web 2.0 of all of the 2010 participants. Initially he was dubious of the benefit or applicability of mobile web 2.0 to his teaching context. However, during the process of investigative reading around theoretical frameworks for educational technology, he experienced a 'eureka' moment: a dawning of how the combination of reading social constructivist theory, his SLT experience, and his previous teaching

experience aligned to create a deeper understanding of teaching and learning. The participant reflected upon what brought about this eureka moment in a blog post:

> Where did the learning finally happen? Was it in a societal environmental? You bet it was, the daily collegiate banter between colleagues in the SLT group and staff that just get into it, with lunchtime discussions, items of interest being distributed freely, online bog posts from a variety of educationalists and tutors, suggested readings that then promoted surfing wider topics and views, all had a hand in it. Has web 2.0 tools played a role? Of course. (SLT student blog post 2010)

Following this experience this participant became an educational technology evangelist, to the point of buying his own iPad and iPhone, and presenting his transformational journey using his brand new iPad at a subsequent minisymposium organised by the researchers (http://www.youtube.com/watch?v=zGEquKzzMyU&feature=feedf). The experience of the SLT course impacted this lecturer's own teaching practice by providing him with a foundation to conceptualise how his own students could utilise iPod Touches to record and document their learning via blog-based eportfolios in 2011.

Discussion

While the number of participants in the 2010 SLT course was small with a 2010 cohort of six students (although average for the GDHE courses in general), the results are indicative of those observed by the researchers' throughout over 30 mlearning projects using the developed intentional COP support model between 2006 and 2010. The SLT course serves as an example of the impact of mobile web 2.0 integration supported by COPs involving over 50 lecturers, from 13 different Departments at Unitec.

The authors redesigned the course around a social constructivist pedagogy that leveraged several emergent learning frameworks. Creating the foundation and circumstances for pedagogical transformation was the goal. This transformation is aptly described by the Learner-generated contexts group and the concept of bridging the Pedagogy-Andragogy-Heutagogy (PAH) continuum. Luckin et al. (2010) argue that Heutagogy (student-directed learning) need not be the domain of post-graduate research students only, and propose the concept of learner-generated contexts as a framework to help achieve this. Garnett (2010) describes the process of this transformation of lecturer's reconception of pedagogy in three steps following the PAH continuum: moving from Pedagogy (teacher-directed) to Andragogy (student-centred, student-generated content), and towards Heutagogy (student-directed or negotiated learning).

(1) The ability to understand how to use their subject for teaching, that is an effective *pedagogy*?
(2) To understand how to manage the learning environment they are working in and treat each learner as an individual, that is the *andragogy* of learning relationships
(3) Then having learnt how to manage the learning process related to their subject they then turned their control over to their learners, enabling the *heutagogy* of creativity to kick in (Garnett 2010)

Achieving this reconception takes significant time, involving sustained engagement.

Sustained engagement leading to ontological shifts

The case study illustrates that creating sustained engagement around the integration of mobile web 2.0 tools supported by COP can facilitate ontological shifts among the participants. Two key issues around reconceptualising teaching and learning representing ontological shifts in the participants' understanding were identified:

(1) Shifting lecturers from pedagogy to heutagogy, reconceptualising teaching as proposed by Luckin et al. (2008, 2010) and McLoughlin and Lee (2008).
(2) Shifting students beyond their previous experience, reconceptualising learning, and using the mobile web 2.0 tools to engage students via a focus upon student-generated content and student-generated contexts.

There were certain elements of the SLT course that the participants found harder than others. For example: the participants took a while to get used to using correct referencing and bibliographic tools, particularly within the context of blogging. This was important to underpin the course experience with graduate level critical thinking. Some students took a while to get into the swing of using Twitter for communicating, with several 'lurking' until a momentum developed, and then they became quite engaged by using Twitter once a community had been established around its use in the course, effectively moving from legitimate peripheral participation to full participation in the core of the COP.

The 'intentionality' of the SLT community of practice was embedded in the course design and assessment activities, with the authors purposely building the course as a learning experience. In contrast to an organic COP active participation in the course COP was mandated as an assessed activity. However, this intentional COP kick-started the participants' experience of COP formation, and has led to the organic development of a continued COP of the course graduates. As the majority of 2010 SLT students were located within the same faculty, these SLT graduates have continued to build their own COP after the end of the SLT course, inviting their peers to join this COP. The 2010 graduates have also taken a keen interest in the 2011 iteration of the course: joining in Twitter conversations with the 2011 participants, and offering links to resources and even technology support for the 2011 cohort, effectively becoming brokers of their own transformational journeys.

Participant feedback informing 2011 implementation

Feedback was gathered from a variety of sources from the 2010 participants, including: analysis of participants' blog posts, a face-to-face debrief between each participant and the course lecturers at the end of the course, final student surveys and feedback elicited by an independent course reviewer after the course had finished via email and personal phone call interviews with participants.

Feedback indicated that some participants initially felt a bit thrown in the deep end with the new learning experience represented by the SLT course and the embedded use of mobile web 2.0 tools. However, by the end of the course, feedback from the students indicated that they were ''no longer fearful'' of trying new technologies. Some participants suggested adding extra scaffolding of the mobile web 2.0 tools via extra drop-in tutorials (these were offered during the course, but no one took up the offer). Bridging the other GDHE courses into the SLT course was also

suggested. The integration of elements of the SLT course throughout the rest of the GDHE is one of the goals of the authors.

Limitations

As an assessed course, the researchers attempted to model an intentional COP as far as possible without the assessment becoming the core driver for participation. The SLT course was designed to provide students with an experience of social constructivist learning, underpinned by reflection upon sound pedagogical theory, and enabled by mobile web 2.0 technologies. As such we (as the 'teachers') of the course attempted to model this approach in our facilitation of the course, for example: we used alternative web 2.0 tools for in class presentations including Prezi (http://www.prezi.com), we used web 2.0 communication tools such as Twitter for remote and in-class brainstorming, and we modelled the pedagogical use of Blogs and moblogging in our own practice. These helped the students conceptualise how to use these tools in their own practice. However this generally required significant time and reflection by the students, for whom the 'lights came on' near the end of the course.

We also allowed a certain amount of negotiation with the students around the course goals and assessment activities (as far as the redesigned course descriptor would allow) – allowing the COP that developed to be unique to the participants, which students tended to find a new experience.

Conclusions

The SLT course demonstrates the transformative impact of a COP model of lecturer professional development. The 2010 course graduates have now become technology stewards within their own departments, effectively drawing in their peers from the periphery of the SLT community of practice and forming spin-off COPs within their own departments. Scaffolding the integration of mobile and social technologies within the SLT COP involved a range of approaches, including modelling by technology stewards, peer mentoring and the utilisation of flexible technologies beyond the face-to-face contact. As Nicholas Cage stated "Now you know how it feels, you won't be scared" (Vaughn 2010).

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Implementation and sustainability of a global ICT company's programme to help teachers integrate technology into learning and teaching in Germany, France and the UK

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(Received 2 June 2011; final version received 20 June 2011)

This paper will discuss the implementation of the professional development programme "Intel® Teach" in Germany, the UK and France, as a public–private partnership. The programme is designed to help school teachers to effectively integrate technology into learning and teaching and to help students develop key "twenty-first century skills". The implementation of the programme, which has so far involved over 400,000 teachers spread across the three countries since 2004, followed different models in the three countries, as a result of differing national education policies, systems and needs. Data from the external evaluation of the programme in Germany are used to examine the factors on a systemic level, which affected the implementation, effectiveness and sustainability of the programme. These factors are grouped into three categories: (1) concept transfer, (2) experience transfer and (3) establishing standards.

Exploring these factors provides a framework for analysing how the changing conditions in the three countries and the global trends in education will influence the further development of the programme. Recent developments in the programme will be discussed, including:

- open-source solutions
- integration of new features (including e-Portfolio);
- improved collaboration and sharing.

The paper will also address the introduction of new content and approaches that target specific current issues in teacher professional development, for example:

- project-based approaches;
- collaboration in the digital classroom;
- technology-based approaches to assessment;
- educational leadership.

The experience from the implementation of the programme through public–private partnerships in different countries shows how such collaborations can shape the educational landscape in a way that makes educational provision more effective and efficient, and of greater relevance and value to students.

Keywords: teacher professional development; technology integration; sustainability; public–private partnership

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ISBN 978-91-977071-4-5 (print), 978-91-977071-5-2 (online)

DOI: 10.3402/rlt.v19s1/7802

Introduction

Recent policy developments towards e-readiness and e-skills have confronted national education authorities with the question of how to effectively foster teachers' skills in integrating information and communication technologies (ICT) in teaching and learning processes. Education authorities attempted measures such as implementation of ICT-related policies, introduction of ICT certification for teachers and provision of pre-service and in-service training in the technical and pedagogical use of ICT. Despite these measures, recent evidence in international perspective showed that ICT teaching skills is one of the areas with the greatest need for professional development (OECD 2009). This finding reveals a necessity to gain a better understanding of the complex set of factors, which determine the long-term effects of programmes and initiatives aiming to enhance teachers' ICT competencies. Professional development literature categorises the factors which mediate the impact of programmes and initiatives, according to different criteria. Ottoson (1997) distinguishes between educational, innovating, predisposing, enabling and reinforcing factors affecting teachers' adoption and application of what they have learned during their professional development courses. A broader categorisation of the factors influencing the impact of professional development programmes places them into two main groups – individual (teacher) and school, programme and system factors (Smith and Gillespie 2007).

System-level policies and practices are considered to influence indirectly the effectiveness of teacher professional development to integrate technology (Darling-Hammond and McLaughlin 1995). Such policies and practices can promote and legitimatise particular professional development programmes and their goals, as well as enhance or inhibit the ability of schools to support them (Smylie et al. 2001). Education authorities can positively affect the implementation and effectiveness of professional development by promoting professional learning, by ensuring consistency between system-level policies and school-level actions (Elmore and Burney 1999), by providing human, financial and material resources and by establishing supportive policies (Darling-Hammond and McLaughlin 1995; Youngs 2001).

National ICT strategies have already prioritised the use of technology in education in many countries (Adamali, Coffey, and Safdar 2006). However, the successful implementation of such strategies depends to a large extent on large-scale governmental efforts which are sustained over time (Voogt and Knezek 2009). In addition to policies, education authorities can influence technology professional development programmes in various ways, which are specific in every case. This is particularly true when such professional development programmes are implemented in public–private partnerships (PPP) – a model becoming more accepted and frequent as the technology industry takes a more proactive role in ICT integration in education.

Exploring the factors at educational system level which influence the successful implementation and sustainability of a particular professional development programme sheds light on the existing barriers and facilitators. This paper will discuss findings from the evaluation of the large-scale professional development programme aimed at integrating technology in the classroom "Intel® Teach – Advanced Online", and particularly the identified system-level factors for its implementation and sustainability. Furthermore, the paper will review the current developments in the implementation of the programme in relation to the identified factors and educational contexts in Germany, France and the UK.

Intel Teach – Advanced Online

The teacher professional development programme "Intel Teach – Advanced Online" is one of the projects designed and implemented within the Intel® Education Initiative of Intel Corporation for the advancement of education through technology. Along with environment and community development, education is one of the focus areas of the company's social responsibility actions and engagement with social issues. As a technology company, Intel's success rests on the availability of skilled workers, a healthy technology ecosystem and knowledgeable customers. Therefore, Intel strategically invests in improving education globally, partnering with educators, governments, and other companies to develop a range of transformative programmes and technology solutions. Intel has over 200 programmes in 70 countries that provide professional development for teachers, support student achievement in science, technology, engineering and math, and enable access to relevant digitised content.

One of the main components of the initiative is the Intel® Teach[1] Programme – a programme for professional development aimed at training classroom teachers to effectively integrate technology in instruction to enhance student learning. The programme was developed in collaboration with Ministries of Education and educational institutions. Since 1999 it is provided to elementary and secondary school teachers around the world and encompasses a portfolio of courses targeting different aspects of integrating technology in classroom teaching.

"Intel Teach – Advanced Online" is one of the offerings within the Intel® Teach Programme, developed in Germany in 2004 in co-operation with the Academy for Teacher Training and School Management in Dillingen – a teacher training centre run by the Ministry of Education in Bavaria (Ganz and Reinmann 2007). The professional development programme was developed following the successful implementation of a basic course for technology use for teaching and learning offered within the Intel Teach programme in Germany.

The implementation of the advanced programme was organised through individual arrangements with the ministries of education in every Federal State in Germany. This lead to different models and intensity of teacher participation in the programme. However, the main structure and the content were delivered in the same format across states. The programme was subsequently localised, and a new version of the programme supported by a Moodle-based online platform was implemented in England, France, Ireland, Israel, Italy, Jordan, Spain and Sweden.

Intel Teach – Advanced Online is based on a blended learning format of face-to-face meetings and individual and collaborative learning. The programme is organised through an online platform, designed to support and drive all steps in the process and to enable self-paced on-the-job professional development. The delivery is organised through "train-the-trainer" approach, in which senior trainers are trained in advance and subsequently guide and support regional mentors (master teachers), who train and assist the participating teachers in the programme. Supported by the mentor, the participants form teams and choose a pedagogical approach or technology tool to learn about. Subsequently, the participating teachers work collaboratively to develop a unit plan, implement it in their classroom practice, evaluate and enhance it for further use.

Evaluation

In the period from 2005 to 2008, the programme "Intel Teach – Advanced Online" in Germany was externally evaluated by the Institute for Media and Educational Technology in the University of Augsburg. The first phase of the evaluation aimed to determine the direct effects of the training. The evaluation findings are reported in detail elsewhere (Ganz and Reinmann 2007). Overall they show that the programme had a positive impact on teachers' skills to integrate technology in the classroom, on their attitudes towards technology-enhanced and student-centred learning and on their practices of technology use. According to the self-assessment of the participating teachers, the programme improved their technical and methodological competencies for using digital technology in instruction. As a result of their participation in the programme, teachers reported that they had a lot of new ideas to use digital media in teaching and that they increased their confidence to use new media in the classroom, and their appreciation for self-evaluation and collaboration.

Regarding the effect of the programme on students, teachers reported improvements in students' skills for using digital media in terms of handling applications and using technology to reach the class objectives, and increase students' use of digital media for individual learning at home. It was indicated that using technology in class had a positive effect on students' motivation and collaboration, and on students' active, self-regulated learning in terms of generating more own ideas to reach the objectives of the lesson and raising questions.

During the second phase of the evaluation, the Institute for Media and Educational Technology in the University of Augsburg conducted research to determine the external factors influencing the success of the programme and its sustainability. The sustainability of the programme was examined through case studies of 16 schools in four Federal states in Germany (Häuptle, Florian, and Reinmann 2008). Target population were teachers in the schools who participated in the programme ($n = 40$), teachers who did not participate in the programme ($n = 24$) and headteachers ($n = 15$). The chosen federal states represented different policies of federal education authorities regarding the use of mentors for the implementation of the programme. Thus, states supporting (Bavaria, Thueringen) and not supporting (Rheinland-Pfalz and Hamburg) regional and region-wide mentorship concepts were included.

In order to explore how the education policy of a federal state in Germany and the implementation approach of the senior trainers influence the sustainability of the programme, the evaluators conducted group discussions with 12 senior trainers. Further findings from questionnaires filled in by the senior trainers during the evaluative period 2006 were also included. The results and implications from the qualitative analysis of the collected data were validated in discussion with nine senior trainers within a workshop in October 2007 and in written commentaries by five senior trainers. The report from the evaluation, including a detailed description of the method and all findings regarding school-level and system-level factors, is available online in the German language (Häuptle, Florian, and Reinmann 2008). The current paper focuses on the results concerning the system-level factors and how they relate to the implementation of the programme in the context of other education systems.

System-level factors influencing the implementation and sustainability of the programme

The findings from the external evaluation provide evidence for the system-level facilitators and barriers to the sustainable implementation of the programme Intel Teach – Advanced Online. Factors at the level of the school system were grouped into three categories: (1) concept transfer, or dissemination and transfer of the professional development; (2) experience transfer, or learning from experience and lessons learned; and (3) establishment of standards.

Factors supporting the dissemination and transfer of professional development

According to Häuptle, Florian, and Reinmann (2008), system-level sustainability of a professional development programme is demonstrated by the extent to which the professional development concept is accepted and implemented by different schools in an administrative region. The implementation of the programme is facilitated when the authorities provide support for it, integrate it in the structure of professional development and are directly engaged in its promotion.

According to the senior trainers, educational policy developments in the federal states can both benefit and hinder the dissemination of professional development. Factors for the sustainable implementation of the programme in this group are related to educational policy developments, the mechanisms for reaching teachers and for motivating them to participate in the professional development offering, as well as communicating the objectives and nature of the programme effectively (Table 1). As an example, curricula provide for the integration of digital media in subject teaching, and increase the openness and readiness of teachers to participate in the programme. In some federal states, the policies allowed greater autonomy for schools, which was used by senior trainers to align the professional development programme to increase personal skills and promote teaching standards and school development.

External influence in the form of evaluation and standards positively affected the dissemination and transfer of the professional development programme. In the federal states where the quality of teaching and of the school was assessed through external evaluation, the consequent recommendations for improvement were incorporated into the content offered by the advanced programme. At the same time, the programme included content relevant to some national educational standards, and the implementation of the education standards presented an incentive for taking part in the programme.

One of the impeding factors for the sustainability of the programme was the low value associates with the classroom use of digital media in school policies. In such cases, after the end of a media project the related activities and innovations are discontinued. In some cases authorities preferred customised professional development offerings, whereas the programme "Intel Teach – Advanced Online" was considered as supplemental.

Further factors on the level of the school system were related to the mechanisms for reaching schools and teachers. Informing teachers about the offering of "Intel Teach – Advanced Online" and stimulating their interest in participating in the programme were improved when senior trainers provided clear information on how the programme could fulfil a task prescribed by education policies. Such positive influence was also observed when the programme was offered in flexible formats,

Table 1. Factors with positive and negative effect on the dissemination and transfer of the professional development programme Intel Teach – Advanced Online in Germany.

Factors influencing the dissemination and transfer of professional development		
	Positive	Negative
Factors related to educational policy developments	• Digital media is a component of the curriculum and syllabus • Greater school autonomy • External evaluation for quality development • Establishment of educational standards	• Policies place low value on the use of digital media in teaching • High workload due to restructuring of the work • Preference for customised offerings
Factors related to reaching the target population	• Demand due to obligation for professional development Alignment of the programme with the objectives for professional development of the education authorities • Flexibility in implementation • Mentors integrate different functions • Informing teachers through various channels • Appealing to teachers not interested in technology • Activating positive experiences	• Objectives of the programme do not represent current school policy of the education authorities
Factors related to the programme presentation	• Stimulate interest with presentation of specific content: teaching scenarios; connecting content to the current interest of teachers; introducing the online platform • Sufficient preparation and support of the school mentors for their role	• The frequency and place of information meetings is regulated by demand • Insufficient staff to organise programme presentations • Absence of mentors

allowing for different arrangements with educational authorities and for structuring of the introductory events and communication with schools. Using different channels to inform teachers about the programme was also found to be advantageous, especially when the offering was presented through official communications of the education authorities and professional development institutes, such as direct mail, newsletters and portals, through public relation releases and information events.

Additional positive impact was attributed to effective ways to approach teachers who were not interested in using technology in class. Reaching this group of teachers could be accomplished through indirect pressure through teaching quality control, such as school evaluation practices. Another method was for senior trainers to clearly communicate the goals of the programme and the advantages of participation, removing the negative attitudes towards technology. In some cases, senior trainers integrated different functions, such as working on education standards, being in charge of school ICT equipment or media adviser, or being school principals or teachers, which facilitated establishing contact with teachers and increasing their receptiveness and acceptance of the programme. According to senior trainers, willingness to participate in the advanced course was affected for some teachers by prior positive experiences with ICT basic courses, and by recommendation from other teachers.

Another set of factors influencing the dissemination and transfer of the professional development programme was related to the structuring of the information events, during which the programme was introduced to school mentors and teachers. Such information meetings were effective when the benefits of participating in the programme were exemplified with specific teaching scenarios and demonstration of the online platform, and when the content was related to currently interesting topics for teachers, e.g. how the programme supports teachers in the implementation of school policies regarding education standards, media competencies, self-evaluation and others. An important feature within the successful meetings was the preparation of school mentors to present the programme. A lack of support by senior trainers and a lack of school mentors limited the potential of information meetings to motivate teachers to participate in professional development courses.

Factors supporting learning from experience and lessons learned

In the context of experience transfer within Intel Teach – Advanced Online, sharing of practices between schools, however, was not supported in the federal states due to the school-based implementation of the programme. An annual symposium in Dillingen and further meetings of the senior trainers at education fairs (Didacta Systems) facilitated the exchange of experiences and ideas, and made it possible to discuss how to take things forward.

Factors supporting the establishment of standards

The last set of factors on system level is related to the establishment of standards, which refers to the systematic implementation of professional development requirements and technology integration policies within and across federal states. Due to the differences

in federal policies and conditions in schools, the establishment of standards could not be an influence to improve the sustainability of the programme.

The outlined factors on the level of the school system bear the specific characteristics of the federal state structure of the education system in Germany. Thus, the influence of different policies and mentor support on the implementation of the programme could be observed. In comparison, the delivery of the programme in France and the UK demonstrates different approaches to offering the same concept for professional development to teachers.

Implementation of the programme in different contexts: the role of system-level factors

"Intel Teach – Advanced Online" was developed originally in Germany with the aim of being implemented in the country. The consequent introduction of the programme to other national states through public–private partnerships required more than simply localising the model and content for the different national contexts, but also tailoring the delivery mode according to the specifics of the education systems and the cooperation partners involved.

France

In France, the training of teachers is highly decentralised in regional academies but the organisational and administrative framework is set nationally. The project "Pairform@nce", within which the concept of the professional development programme "Intel Teach – Advanced Online" was implemented in France is driven nationally by the Department for teaching curriculum, teacher training and digital development in education. The project combines different partners and currently includes all 30 academies – regional structures of the Ministry of Education in charge of implementing national directives and policies. The objectives of the programme are in reference to the IT certificate C2i level 2 (C2i2e) for teachers, which aims to validate the professional skills required by all teachers to perform the pedagogical, educational and societal aspects of their job. For the implementation of the programme, Intel provided the royalty-free programme, and has facilitated the linking with the different national and European partners.

The implementation of the programme in France is fully integrated in the national and regional education policies and structures, through the authority of the regional teacher training academies. The dissemination and transfer of the professional development concept and the transfer of experiences is facilitated by the support provided by the central education authorities. Thus, the training is implemented on a remote and dedicated national virtual environment for learning featuring a wide range of training courses, educational resources, information and discussion tools. The content of the resources is developed in the "Factory" by volunteer teachers under the education authorities, based on needs identified by inspectors and school principals. The reference of the programme to the national IT standards for teachers and the support for the delivery of the programme are major factors for the current successful implementation of "Pairform@nce" on a large scale in France (Soury-Lavergne et al. 2010). The plan is to expand Pairform@nce usage to other disciplines where IT is not more than a tool.

United Kingdom

In the UK, at the time that Intel Teach was implemented, the Government's e-strategy aimed to transform the management and interaction capacities of educational institutions for the benefit of learners and parents (Becta 2007). Schools are controlled for use of the technology, trainee teachers are required to pass a test in ICT literacy, whereas practicing teachers are expected to improve their own ICT skills to the same level. The Intel Teach – Advanced Online programme is implemented in the UK in partnership with the Specialist Schools and Academies Trust (SSAT) – an independent, charitable trust with a network of over 5600 schools and organisations. The trust works with head teachers, teachers and students for developing and sharing new and effective teaching and learning practice, with the object to raise standards and levels of achievement of schools. The programme was offered under the name "iCPD Online" through SSAT, which determines the way of dissemination, transfer of experiences and reference to standards. The total number of teachers trained under iCPD online is just over 36,000.

The programme has now developed in the UK and the SSAT have decided to implement the iCPD tool into their developing leaders training. This model is quite different and allows teachers to be more autonomous in their usage of the tool but still maintains the benefits of peer reviewing and submitting content online. This has been implemented in the latest cohort of developing leaders from September 2010 and at the end of the 2010/11 the SSAT and Intel can evaluate the model and its outcome.

The UK has benefited from this open approach to the implementation of Intel Teach Advanced Online and has been able to make it integral to other programmes which could be a more sustainable model.

The different models of public–private partnership in the three countries, the level of integration of the programme in the education policies and structures and the amount and type of support by education authorities, but also the current conditions and trends, determine to a large extent the new developments and changes in the programme's design and delivery.

Current developments

The programme is currently being expanded and transformed into an offering with increased flexibility and is taking into account the preferences of education authorities, as well as factors at the level of the education system, which affect the implementation and sustainability. Some of the new features of the programme enable better collaboration with education authorities, organisations and other companies. A major change is the development towards open-source solutions and flexibility of the new platform of Intel Teach – Advanced Online, which is a customised application built on the Moodle 1.9 platform. The codebase is written in PHP and supports the MySQL or PostgreSQL databases, using Moodle's standard database abstraction layer. The new platform also enables the integration of external software. Thus, local education authorities can provide teachers with all training opportunities available in the region through a single platform or integrate the programme with other trainings to meet specific needs. This is particularly useful in the context of the different policies and requirements in every Federal state in Germany and for the implementation of the programme in France through regional education authorities.

Another development includes expanding the open education resources available to teachers, to meet their specific needs for professional development. A new offering of free, just-in-time courses – Intel® Teach Elements, target specific learning concepts, such as project-based learning, assessment of twenty-first century skills, or collaboration with Web 2.0 tools. Additional resources are provided to teachers for self-directed learning and classroom use, such as MS Office courses, different tools and the learning resources on skoool™ Interactive Learning and Teaching Technology programme.

The new programme also provides an improved environment for collaboration between teachers through the collaboration features of Moodle, the integration with external platforms for communication and collaboration, such as Live@edu in Germany, and through the added functionality of e-Portfolio. A key new feature is the concept of e-Portfolio and, for this purpose, the new platform can be bundled with the Mahara e-Portfolio application, which adds resource sharing and additional social networking elements to the platform. Mahara is an open source system comprising electronic portfolio, weblog, resume builder and social networking system, which connects users and creates online communities. A different ePortfolio system is integrated with the programme in the UK, within the Virtual Leadership & Innovation Academy on the SSAT online platform. This "Active Portfolio" will be driven by a dynamic profile, smart use of meta-data and automatically harvested evidence of achievement.

After a revision of the significance of collaboration between teachers and the influence of tutors, a different concept is implemented in the new version of the programme – peer coaching. It is expected that this additional support will enhance teachers' acquisition of competencies and skills, according to their individual needs. This can also be addressed by the introduction of e-Portfolios as part of the professional development, as a mechanism to identify gaps, track development and find peers with relevant knowledge and skills for coaching and collaboration. Further possibilities for interaction between teachers and for forming a virtual community of practice or community of professional learning will contribute to the impact of the programme on teaching practices and on the sustainability of the programme.

Conclusion

It has been shown that there are various factors on the level of the education system to be considered, which influence the effectiveness and sustainability of a professional development programme for technology integration. The different models of implementation of Intel Teach – Advanced Online in Germany, England and France are linked to different expectations for the reach and scaling of the programme, according to the national policies and standards, and the support by education authorities. Some of the challenges for the current and future implementation of the programme are how to align the programme to changing policies and standards, and target hot issues in national education systems with flexible content and modes of implementation. These challenges are partly addressed in the new version of the programme, organised through a Moodle-based online platform, which offers more flexibility and improved capacity for online visibility and for reaching and engaging teachers. The development towards open-source solutions in this case reflects the preference of education authorities for cheaper, more flexible and easy to customise training system. Additionally, linking the programme to other initiatives, school and

teacher networks can increase the alternatives for communicating the content and objectives of the programme and for dissemination.

Identifying the factors which contribute to or impede the effectiveness and sustainability of a professional development programme allows for planning to strengthen the beneficial conditions and to avoid some negative conditions. Understanding such factors can contribute to improving the programme and achieving a greater impact both on the level of the individual schools and on the of the educational system level.

It has been identified that the countries involved would like to see the platform develop as a general collaboration tool for their professional development provision. Particularly in France, but also in Germany and the UK, the tool was seen as a necessary way to communicate with their peers. The challenge is to see how other activities can be introduced into the platform as teachers do not want to have multiple platforms for such collaboration, but a central place where they can collaborate and share best practice. Intel hopes to develop the platform despite systemic challenges, to promote the platform as a social media tool and a place for the development of twenty-first century skills among teachers and the consequent positive impact on the teaching and learning experience.

Note

1. The Intel Teach® Advanced Online programme discussed in this paper forms part of Intel's Intel Teach programme which is a worldwide teacher training initiative. The objectives behind it are improving teacher effectiveness through professional development, helping teachers integrate technology into their lessons and promoting students' problem-solving, critical thinking, and collaboration skills. Worldwide, the Intel Teach programme has trained more than 9 million teachers in over 60 countries. Intel Teach is part of Intel's corporate responsibility strategy which is run by their Corporate Affairs department which works solely on non-profit initiatives.

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Index of Authors

The Trustees of ALT are grateful to the following organisations for their generous support for the 2011 conference

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ALT is Registered Charity Number 1063519

ISBN 978-91-977071-4-5