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Time past: impacts of ICT on the pedagogic discourse in the Interactive project

The ‘pedagogic discourse’ is a conceptual framework developed by sociologist Basil Bernstein that can describe the power relations and fields of influence within schools. This paper extends the approach to ICT-mediated teaching, and is used to consider evidence from the InterActive project undertaken by the University of Bristol in 2000-2004. ICT is presented as a ‘recontextualising field’ that exerts influence by weakening the classification and framing of the discourse. Successful uses of ICT tend to favour ‘invisible’ pedagogies: collaborative modes of active working with shared competences, where the teacher is a facilitator of lessons containing elements of ‘discovery’. Tensions can arise if the dominant discourse is a ‘visible’ pedagogy that favours individual performance, with the teacher as the voice of authority and controller of the discourse. These tensions can lead to ICT being marginalised or discredited or lead to new modalities of pedagogy.

Keywords: pedagogy, Basil Bernstein, pedagogic discourse, ICT, Web 1.0, recontextualising field, visible pedagogy, invisible pedagogy, InterActive project.

“Time present and time past are both perhaps present in time future,”

TS Eliot (1936)

Introduction

Re-imagining education in the light of social and technological changes has always been a valid aim of pedagogy. Dewey (1900) asks us to:

“pay attention ... to effort[s] to conceive...the “New Education” in the light of larger changes in society...If we can, it will lose its isolated character; it will cease to be an affair which proceeds only from the over-ingenious minds of pedagogues dealing with particular pupils.”

For Basil Bernstein, the ‘pedagogic discourse’ is a dynamic process, as its Latin root implies (*discursus*, running to and fro, (late) intercourse, argument, OED). Like activity theory (Engeström, 2001) and mediated action theory (Wertsch, 1991) it can apply as much to the professional relationships between doctors and patients or lawyers and their clients, as it does to teachers and students in schools. The pedagogic discourse is a sociocultural theory with epistemological similarities to ecology in the biological sciences.

It is the aim of this paper to use Bernstein’s ideas of pedagogic discourse (Bernstein, 2000) to re-consider the impact of ICT on pedagogy during the period 2000-2004, by considering the power relations and boundaries between the fields of influence that impacted upon a teacher’s choice of pedagogical style and knowledge content.

Bernstein’s work is more than a meta-theory, since it has a heuristic capacity. It develops rules (distributive, recontextualising and evaluative rules) for the internal ordering of the pedagogic discourse (Bernstein, 1990, 180) that allow various pedagogical modalities to be envisioned. Subsequent papers will apply the model to two schools using ipad tablet computers with all of their students and consider the possible impacts of future trends (associated with Web 3.0) on pedagogic practice.

Bernstein’s work has gained international recognition, (Bernstein and Morais, 2001), yet is not widely understood or used. This is partly because it is complex and often opaque. Bernstein’s ideas have developed and changed over time and his frequent revision of the key papers does not always lend clarity to his thought (see Bernstein, 2000, p. xv). For these reasons, this paper contains an extended introduction to the key ideas of Bernstein’s thought.

Aspects of Bernstein’s work have been used to study the micro-management of classroom practices (Morais, 2002), the significance of hypertext and online learning (Tyler, 2001) and the importance of subject ‘sub-cultures’ affecting teachers’ perceptions of the role of ICT in learning (John, 2005). However, the application of the pedagogic discourse, arguably Bernstein’s most significant achievement (Atkinson, 1985), to ICT-mediated education remains a relatively unexploited approach, although Erixon (2010), building on the work of the InterActive project,

used certain aspects of the pedagogical discourse to consider the impact of digital technology on lower secondary education in Sweden.

The InterActive Project of the University of Bristol was a collaboration between teachers and University researchers on the impacts of ICT on learning in the classroom between 2000-4. The aims of the InterActive project are set out in John and Sutherland (2004) and its methodology in the appendix of Sutherland, Robertson and John (2009, pp. 216-228). Some of the evidence from the project presented in this paper has previously been unpublished.

The years 2000-4 were interesting ones, for although ICT had an established presence in schools, its uptake and effectiveness were, at best, patchy. Sutherland, Robertson and John (2009) present a thoughtful review of the extensive best practice seen in the InterActive project.

ICT in schools was, at that time, rooted firmly in a Web 1.0 tradition, with students acting as 'consumers of content' from the web, Cormode and Krishnamurthy (2008), and users of office-based applications, although their products were often only for internal use within the schools. The social media applications associated with Web 2.0 (eg Wordpress blogs, Skype, YouTube, Facebook and Twitter) were in the early stages of development and were yet to impact upon these schools in any significant way.

Mumtaz (2000) provides a meta-analysis of the literature and provides an insightful commentary that broadly supports the evidence from the InterActive project. She lists a number of factors that influence the impact of ICT on education, including: access to resources, quality of software and hardware, ease of use, incentives to change, support and collegiality in their school, school and national policies, commitment to professional learning and background in formal computer training. These factors have emerged from a detailed critique of the literature and there is no theoretical model underpinning the analysis. This paper will provide a theoretical rationale for her conclusions. It can provide a satisfactory theoretical explanation of the full range of evidence of the InterActive project and from Mumtaz (2000).

ICT as a mediating process in the pedagogic discourse

Much of the research into the impact of ICT on education is process orientated. Mayer, for example, considers e-learning from the perspective of working memory and other cognitive processes (eg Mayer, 2003; Mayer & Moreno, 2003). Garrison and Anderson (2003) consider e-learning for the twenty first century in terms of the formation of communities of virtual learners. Many of these studies are inductive generalisations from specific learning interventions (eg Lindquist, 2006; McFarlane, 1997).

White and Le Cornu's (2011) online paper proposing a new taxonomy for online engagement ('visitors' and 'residents') argue that the metaphors of 'tool' and 'place' most appropriately represent the use of technology in contemporary society. Digital media extend human capabilities (McLuhan, 1964) and are examples of 'tools of intellectual adaptation' in Vygotskian and post- Vygotskian thought, that are 'placed' in social (or sociocultural) contexts.

Wertsch (1991, 1998) develops Vygotsky's ideas of action as 'mediated' between human agents and cultural tools within a sociocultural setting. He sees an 'irreducible tension' between agents and cultural tools that bind the agents and tools together and allows the action to take place. He discusses the use of an internet site (Amazon.com) to prompt the recall of a forgotten piece of information, where the act of 'remembering' was distributed between agent and tool:

“From the perspective of mediated action there are good reasons to say that neither I nor Amazon.com did the remembering in isolation. Instead, both of us were involved in a system that distributed memory and both were needed to get the job done. In short, in irreducible tension between active agent and cultural tool was involved. The nature of the cultural tool specific use made of it by the active agent may vary greatly but both contributed human action understood from this perspective.” (Wertsch, 2002, 13).

For Wertsch, this mediation involves new kinds of “search strategies, new storage strategies, new memory access routes” (Wertsch, 2002, 11).

The idea of mediation through ‘tool’ and ‘place’ are also central to Engeström’s work on activity theory and expansive learning (1987, 2001). Figure 1 presents the second generation model developed by Engeström (1987, 78).

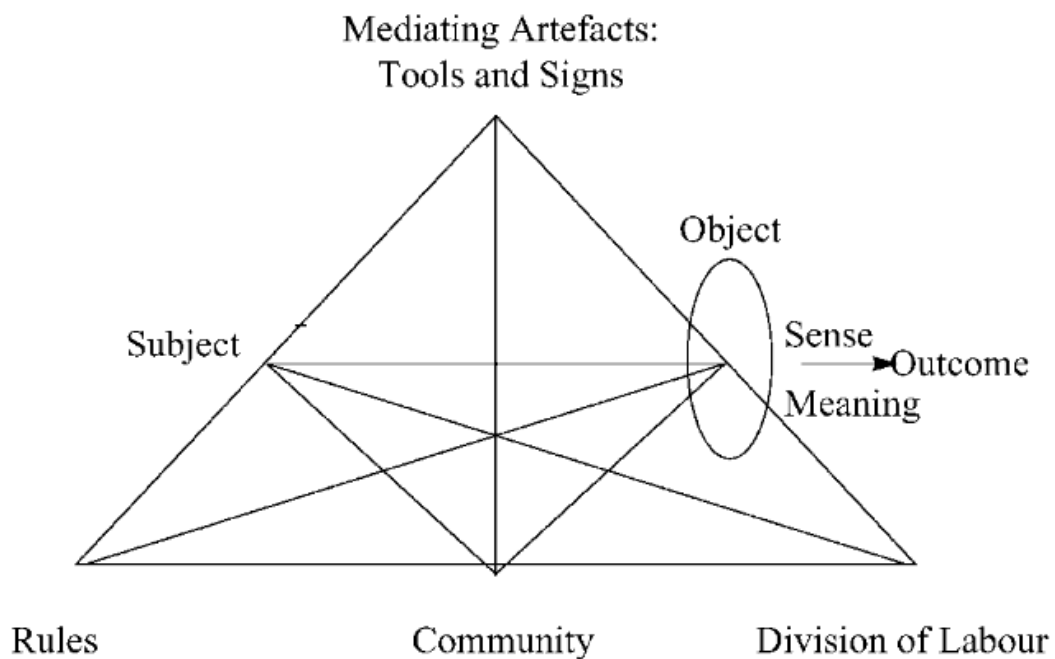


Figure 1. The second generation model of Activity Theory, Engeström (1987, 78).

The community is the collection of individuals or groups who are all concerned with the same object. The division of labour refers to both the division of tasks and the status relations between the actors in the activity. The rules are the principles of regulation of action and interaction.

Bernstein presents the pedagogic discourse as a generalised framework, defining the inter-relationships between those factors and agencies that exercise power and control in the discourse. Bernstein places considerable emphasis on the boundaries between

the factors and agencies, because this is where interaction, conflict and transformation will occur.

The pedagogic discourse contains both teaching and learning. The discourse prepares a 'code' for the transmission of valued content, such as knowledge or skills. The discourse is also a "cultural relay" for power relations external to it, Bernstein (1990, p. 168), explicitly or implicitly, relaying class relations, gender relations, religious relations or regional relations.

Students are described as 'acquirers', although this does not imply any particular mode of acquisition. The early writings of Sfard (1998), for example, clarified and debated important distinctions between acquisition and participation metaphors for learning. Each of these extreme positions is a modality within Bernstein's framework, as is her intermediate 'commognitive' position (Sfard, 2008).

The pedagogic discourse consists of two main components: the instructional discourse (ID) that classifies what should be taught and sets the limits of any discourse and the regulative discourse (RD) that frames the way in which the ID is taught. Framing 'legitimises the message' and 'regulates the realisation rules', so that it is in accord with the power relations, values and attitudes of the school. In any discourse, the classification and framing can vary in strength and these shape what is taught and the way that it is delivered. Bernstein (2000, xvii) states:

Classification strength (C) is the means by which the power relations are transformed into specialised discourses, and framing (F) is the means whereby principles of control are transformed into specialised regulations of interactional discursive practices (pedagogic relations) which attempt to relay a given distribution of power.

Bernstein (1990, p. 65) considers that, in general, schools can demonstrate two kinds of pedagogy, visible pedagogy (VP) or invisible pedagogy (IP). These are defined by how strong or how weak are the classification and framing that contribute to the pedagogic discourse.

Visible pedagogy, normally associated with secondary education, has strong classification and framing. Subjects have clearly defined boundaries and characteristics. The sequence, pace and control of lessons are tightly defined by the teacher. Visible pedagogies place the emphasis on the 'performance of the child, upon the text that the child is creating and the extent to which the text is meeting the [success] criteria. Thus acquirers will be graded according to the extent to which they meet the criteria (Bernstein, 2003, p. 70).

Invisible pedagogies, by contrast, have a weaker classification and framing. Work may be organised into cross-curricular themes and the child has considerably more ability to determine the content, sequence and pace of the learning. It is considered more 'progressive', in that the emphasis is not placed on creating differences in competencies between individuals but on developing shared 'commonalities' within groups of people (Bernstein, 2003, p. 71)

ICT as a recontextualising field in the pedagogic discourse

For Bernstein, the classification of the instructional discourse is always embedded within the framing of the regulative discourse and the regulative discourse is the dominant factor that shapes a single discourse (Bernstein 1996, p. 46). This means that although teachers play the central role in formulating their pedagogic discourse, they are influenced and constrained by fields of influence external to the discourse.

Bernstein calls these fields of influence 'recontextualising fields' because they change the nature of the discourse. Recontextualising fields can act at international, national and local levels. Recontextualisation creates 'a space in which ideology can play. No discourse ever moves without ideology at play' (Bernstein 1996, p. 47).

ICT acts as a recontextualising field that sits between the discourse and the code, because it 'selectively appropriates, relocates, refocuses, and relates other discourses to constitute its own order and orderings' (Bernstein, 1990, p. 184). Significantly, it has the potential to influence, and be influenced by all of the other parameters in the model.

Figure 2 shows the relationship between ICT and other recontextualising fields in the pedagogic discourse, and is based on Bernstein (1996, p. 50).

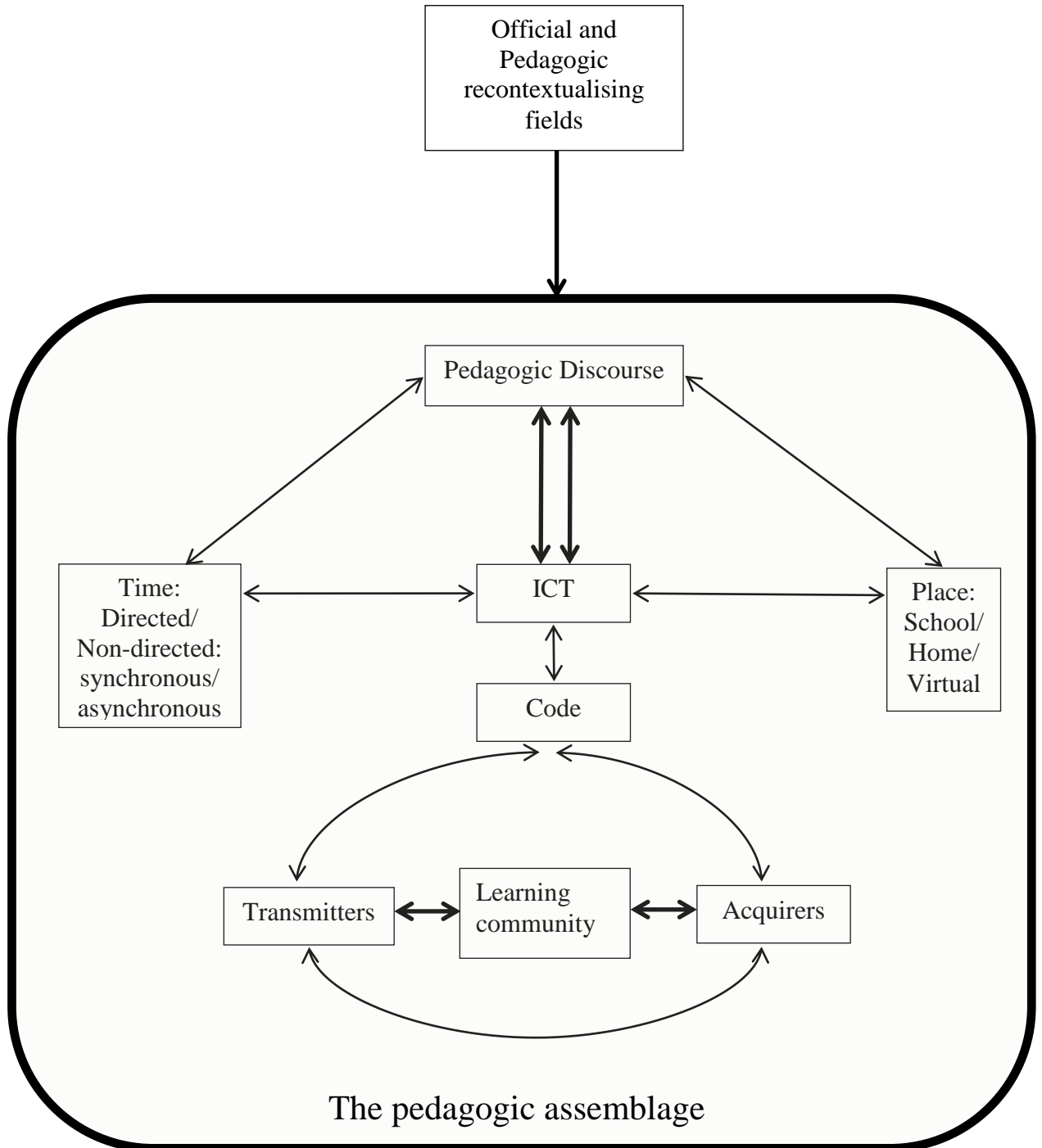


Figure 2. The impact of ICT and external recontextualising fields on the pedagogic discourse, based on Bernstein (1996, p. 50).

ICT will shape the code to the extent it is allowed to by the other interacting fields external to the pedagogic discourse (such as government agencies, professional bodies, examination groups (the official recontextualising field) and the sociocultural ethos of the school (the pedagogic recontextualising field).

ICT sits in dynamic tension with the pedagogic discourse: its presence can be felt. As a secondary science teacher in the InterActive study put it:

“Before it was me and the students. Now it’s me the computer [and the] students.” (InterActive project, Science teacher interview 245).

This is evidence of a tension between the teacher and the ICT that is at the heart of the mediation process. The teacher is used to working in a visible pedagogy with hierarchical one-to-many relations and control over the pace and sequence of learning. ICT acts as a potential threat to this order:

“It’s a totally different classroom management—in fact you have to go on a separate course I feel to actually be teaching that. You’ve got screens there—they [the pupils] could be doing anything. So that I think, managing is very important and I haven’t cracked it and ... it’s something I’m trying to develop, learning how to do it, how to manage it.” (InterActive project, Science teacher interview 245).

These comments reflect concerns about framing of the discourse and recognition that ICT is weakening the framing of the discourse, because the teacher is ceding control to the students when they ‘look at the screens’. The honest response of the teacher is that this will require adjustments in his teaching style (specifically the regulative discourse) if the activity is to be successful. Equally, the teacher could reject the use of the ICT altogether and continue to teaching in his strongly framed style.

Mumtaz (2010), reviewing Evans-Andris, M. (1995) suggests that:

“the dominant style of computing among teachers was that of avoidance. Here teachers typically distanced themselves from computers and otherwise reduced the amount of time they spent attending to computer-related activities. Their pupils had limited and repetitive use of software intended for drill and practice or word processing. Generally these teachers sustained a low level of interaction with students while they worked with computers.”

At this time, teachers were still able to exert considerable power and influence on the classification of the subject content they taught. Two science teachers interviewed by the InterActive project have concerns about how ICT could affect the classification of the subject they are teaching:

“But I think there is a lot of scope for using ICT—but it has to be integrated with other practical lessons I think. Because science is a practical subject, I think, you know, you’re not going to be able ... It’s not just going to be the saviour of science to have everything on ICT. It just doesn’t work like that. Sometimes a basic demonstration is more interesting than using a computer to demonstration. And I think there’ll always be exciting practical work that really excites some students.”

(InterActive project, Science teacher interview 245.)

“If I had to teach science theoretically using just ICT I’d be bored stiff. To me it’s just another tool amongst many to deliver the content really.”

(InterActive project, Science teacher interview 204.)

Potentially, ICT has a powerful weakening effect on the classification of knowledge. As Somekh (2004) puts it:

“The nature of the Internet is inherently individualistic, anarchic, exploratory and disruptive. It gives control to individual users to access vast quantities of information which have not been subjected to quality control.”

The Internet is multivocal, (Tyler, 2001), rhizomatic, with a nomadic system of growth and propagation (Deleuze, and Guattari, 1980), and is a potential threat to the strong classifications associated with visible pedagogies. When balanced against the practical limitations of supply, accessibility and quality highlighted by Mumtaz (2000), it is little wonder that the successful impacts of ICT in these years were so sporadic.

External recontextualising fields

There is a multiplicity of factors that affect the pedagogic discourse, impacting at international, national, regional, school and departmental levels. Figure 3 shows the relationship between the fields that influence the classification of the knowledge in the instructional discourse (ID), and their likely impacts on the discourse. The pedagogic discourse emphasises the relationships of power and control which are especially apparent at the boundaries between the fields in the model. The potential value of ICT in the classroom has to compete against the cumulative effects of each of these factors.

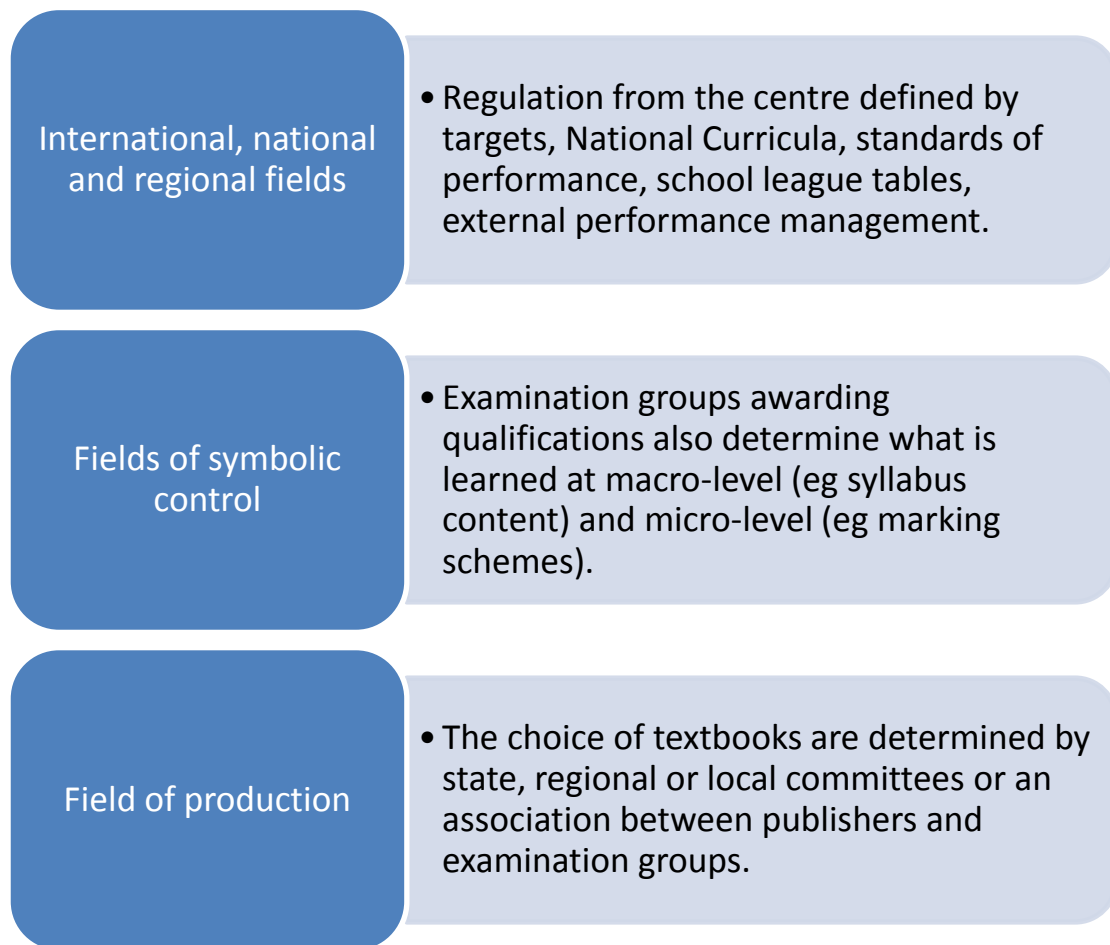


Figure 3. Official recontextualising fields that impact on the classification of knowledge taught in the instructional discourse (ID) of the pedagogic discourse.

The increasing centralisation of power by regional boards, national authorities and even international agencies like PISA have a marked effect on the knowledge, skills, attitudes and values that are approved for teaching in schools. Traditionally subjects with strong classifications (like Chemistry and Mathematics) have clearly defined boundaries, which are ‘policed’ by their professional bodies in the field of symbolic control. Only national agencies have the authority to change these boundaries (such as happened in the 1989 National Curriculum review in England and Wales, when the topic of Earth Science was ‘re-located’ from Geography to Science).

John and Baggott La Velle (2004) suggest that recontextualisation that threatens subject boundaries leads to the emergence of “retrospective” traditional pedagogic identities. They suggest that natural counterbalance to this increasing state ‘influence’

over knowledge is to train students to develop independent life-long learners, motivated to think for themselves in and out of the classroom’.

The influence of regulatory bodies (such as the English Ofqual) and those examination groups awarding qualifications determine what is learned not only at the macro-level (through the content of syllabuses), but also at the micro-level (eg through marking schemes that regulate credit worthy responses). Inspection agencies (eg the English OFSTED, Figure 3.) also impact on the framing of the discourse, by imposing specific outcome criteria, through which teachers and schools are judged. These agencies act in the official recontextualising field (ORF) and become ‘sites for appropriation, conflict and control’ (Bernstein, 1996, p. 42).

Schools, departments of education and other professional bodies act in the ‘pedagogic recontextualising field (PRF). If the PRF can have an effect on pedagogic discourse, then there is both autonomy and struggle with the official agencies. Bernstein correctly predicted that the state uses the ORF to weaken the PRF, in an attempt to reduce relative autonomy over the construction of pedagogic discourse and over its social contexts (Bernstein, 1996, p. 48, pp. 74-75). The removal of many English schools from the control of local education authorities into centralised academies is a contemporary example of this.

Schools that prepare students for public examinations invariably have strong classification, because government agencies create national curricula, examination groups produce syllabuses, examination questions, marking schemes and reports. These fields can exert tight control over the nature of the discourse, even down to the level of specifying the specific form of words that can gain credit in examinations.

Producers of textbooks and media resources are acknowledged ‘voices of authority’. Increasingly, the choice of textbooks is determined by state, regional or local committees or a commercial association between publishers and examination groups (see Ofqual, 2012, for a critique of this practice). This recontextualises the discourse still further by limiting the content of the discourse to only what is in the textbook.

Howard and Maton (2011) discuss Legitimation Code Theory (LCT) to consider the epistemic and social relations between different forms of knowledge that could form the basis for a rational classification and potential use of information obtained from searching the Internet. It is possible that the development of the semantic web in Web 3.0 could allow educators to influence the selection of information delivered by search engines (Anderson and Whitelock, 2004, Carmichael and Jordan, 2012).

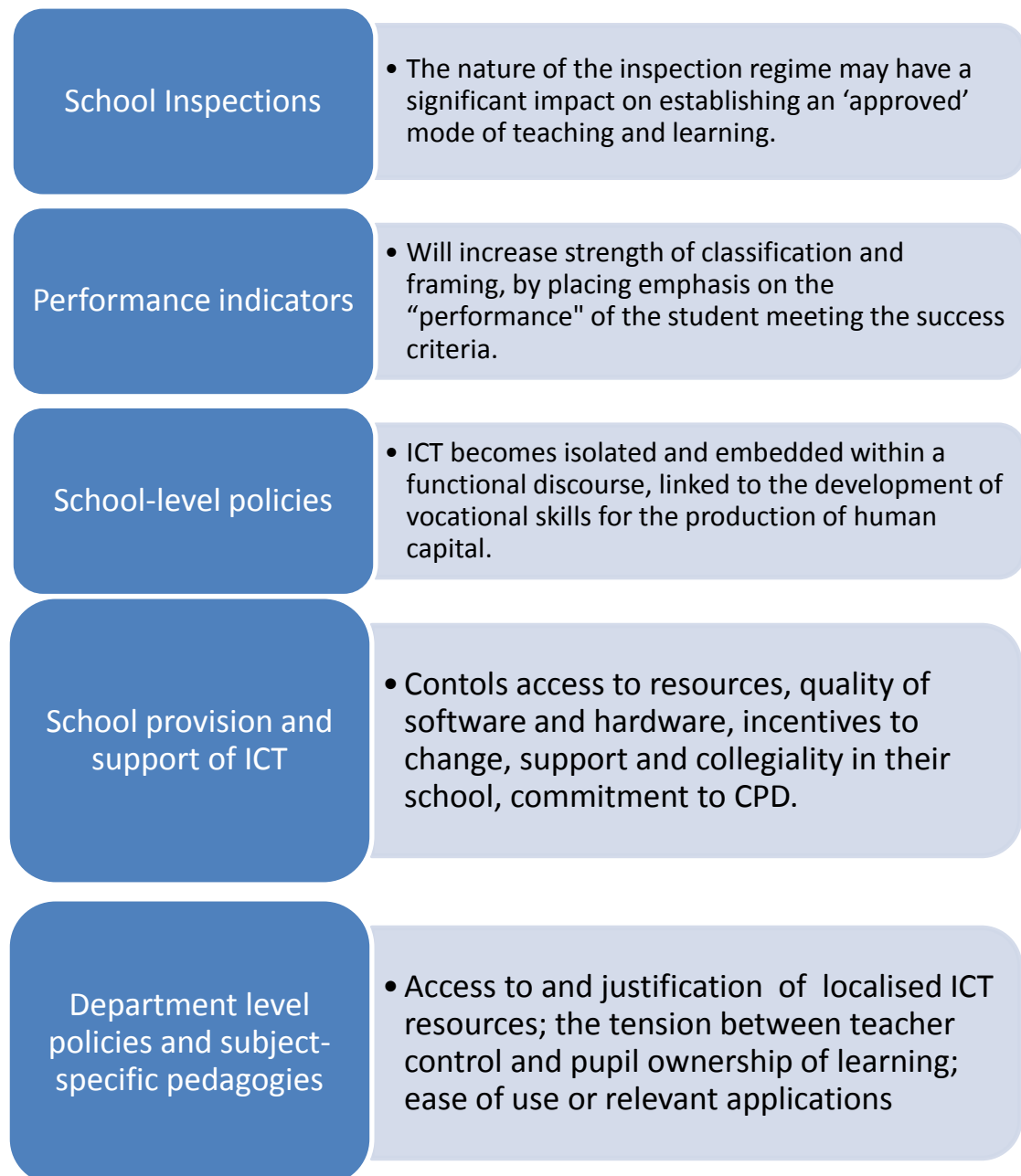


Figure 4. Pedagogical recontextualising fields that form the impact on the framing of (RD) of the pedagogic discourse.

School-level policies (Figure 4) have significant impacts on pedagogic discourse, since they shape the administration, values and 'ethos' that determines the classification and framing of the teaching. Figure 4 provides a theoretical framework for Mumtaz's empirical findings in her meta-analysis of the literature. The same factors will be influencing contemporary and in future classrooms.

For a teacher in an English primary school in 2001, the National Literacy Strategy, a state-controlled initiative, demanded a daily 'literacy hour'. Prescribed in content and in mode of 'delivery', it shows the power of the ORF (official recontextualising field) to centralise teaching, restricting the independence of primary schools to teach literacy using their own approaches. This pressure was reinforced by changes in the external inspection framework, which made schools responsible for their continued self-evaluation and improvement.

"There is pressure on senior management to put a school to be self-evaluating. And that means putting in place paperwork which tracks children's progress through the school. But the problem with that is that, you know, it's very targeted on Literacy and Numeracy SATS results."
(InterActive Project: Primary teacher interview, 207)

It might be possible for a teacher to use an ICT application (like PowerPoint) in a poetry exercise within the literacy hour. Yet, would this be an appropriate activity to allow the learning objectives of the literacy hour to be fulfilled?

"You teach ICT and you may use a poem to teach it but you're still focussing on using Powerpoint and making it look good rather than focussing on 'Ah, but what sort of word's that?'" (InterActive Project: Primary English teacher interview 247.)

Changing from the prescribed literacy hour activity can only be permitted after approval by a curriculum manger:

“But yeah I think generally as long as you can justify why you’re changing something I think it’s pretty much accepted.” (InterActive Project: Primary English teacher interview 247, previously unpublished.)

By requiring approval, the pedagogical recontextualising field operating at the levels of the senior and middle managers shapes and modifies the discourse, bringing it in line with local targets for literacy. Assuming the proposed discourse survives, there is then the issue of booking resources. In 2001:

“The computer... is purely going to be used for ICT lessons, not including music. ICT lessons as in, how we use the computer, how we do word processing. We may do literacy lessons...with 21 classes in the school, splitting that up throughout the week we’d only have forty minutes, and time-wise it’s impossible.” (InterActive Project: Primary English teacher interview 207.)

There are several mitigating factors operating: limitations of resources, times of access and the unfamiliar equipment in the unfamiliar computer room. Each factor adds complexity to the activity. The pupils show considerable variation in their ICT competences. Some will finish in minutes what others will struggle to start. For them, the teacher becomes a teacher of PowerPoint, which detracts from the literacy learning objectives, which brings the argument back full circle:

“But if you’re teaching children to use PowerPoint and it’s going to take a lesson, two lessons, of literacy, then I don’t think that’s necessarily a valid use of the literacy hour. Well, no it is, but the benefits will be for all the subjects so it should be taught as a subject.” (Interactive Project: Primary teacher interview 236, previously unpublished.)

The quotations above were taken from interviews with primary school teachers in several schools. The interviews tell consistent stories of frustration, of the enthusiasm for creative use of ICT being dissipated by external factors. The ORF and the PRF are constraining the pedagogic discourse, preventing it from moving in this new ICT-mediated direction.

Kranzberg (1986) observes that: “technology is neither good or bad, nor is it neutral.” In this context, a ‘good’ use of ICT will enhance the achievement of the literacy learning objectives, whereas a ‘bad’ use of ICT will detract from the learning objectives. The context determines the outcome, and the context is defined by the factors in the pedagogic discourse. Kranzberg’s relativistic position is strengthened by the observation that ‘technology is not neutral’.

Using Craik and Lockhart’s (1972) Levels of Processing framework, the pupils were actively engaged on the structural level of the poem, (selecting attractive fonts and backgrounds), rather than the semantic level requiring analysis of the deeper linguistic relations between the words on the screen. It is what Matthewman and Triggs (2004) described as ‘obsessive compulsive font disorder’. The failure to address the deeper literacy learning objectives ultimately prevents this kind of activity from flourishing in these schools. The ICT is promoting active engagement, but not necessarily active learning. In this example the use of ICT is driving the engagement away from the intended learning objectives. It is acting as a recontextualising field, changing this discourse by relocating it within the PowerPoint application.

Changing the modality of the pedagogic discourse

Olivero, Sutherland and John (2009) present insights from the InterActive project that show how the ICT acts as a recontextualising field, often with “unintended and unpredictable” outcomes. They make the point, often made by others in the project, that placing students in front of new technology does not automatically lead to learning. The multiplicity of interacting factors within Bernstein’s model clearly shows that the situation is far more complex than early advocates of ICT-mediated learning suspected. Turkle’s writing (eg Turkle & Papert, 1990; Turkle, 2011) consistently show just individual is a person’s response to new technology.

To explain their observations, Olivero, Sutherland and John (2009) developed mediated action into an ‘instrumentation framework’, (Verillion & Rabardel, 1995 and Mariotti ,2002). Each new software application is an artefact that a user shapes into an instrument that can be appropriated for use in a classroom. Since the user

brings new experiences and insights into the appropriation process, the instrument might be used in ways not foreseen by the designer of the original artefact. As McLuhan's famous aphorism puts it:

“We shape our tools and then our tools shape us.” (McLuhan, 1964)

The instrument facilitates the weakening of classification and framing, so that collaborative working and shared group competences become more important than individual performances.

This dynamic process can lead to changes in pedagogical practice, as Triggs and Sutherland (2009) observe:

“the kinds of pedagogical change that new technologies make possible frequently challenge current practice; so this is dangerous country, an uncomfortable place to travel for many schools and teachers.”

It is also an exciting place, as many of the interview transcripts show:

“To ask them ‘Well what do you think about that?’ ‘Well have you seen this somewhere before?’ and then the children to actually turn round and say ‘Well yeah, you know, it’s a bar chart’ or ‘It’s a pictogram’...And I think that kind of ... it almost inspired me in a way to be a little bit more daring about where I would go next. And to take it then a little bit further. And then actually looking to see what the children knew and what they could do. You know, and then building on that. And I think that that’s what happened in second week. I suddenly realised that ‘they know a lot more about this than I actually realised.’ And building on what they knew and moving forward.” (InterActive project, Secondary Maths teacher interview 268, previously unpublished.)

The pupils are taking more control over the direction, pace and sequencing of their learning. The teacher's role is changing from that of a sole voice of authority controlling the transmission of knowledge to that of a facilitator. The pupils are

learning for themselves and from each other. This move towards a more independent learning style is characteristic of the invisible pedagogy. Rather than close down the activity the teacher was “inspired ... to be a little bit more daring.” By building the lesson around “what the children knew and what they could do”, the classification and framing of the discourse weakened and a memorable learning experience emerged.

“But I think that it got to a point by the end of the week that I didn’t actually care that they were Year 4s, what I actually cared about was that we had a dialogue going on in the classroom about things that we were learning and things that we knew. Children were all over the room, they were constantly picking things up.

I think it was quite exciting was that I was almost the last person to learn something at times within the room.” (InterActive project, Maths teacher interview 268, previously unpublished.)

Anderson (2002) reviewing the international collaboration, SITES, observed that associated with significant learning gains were the following characteristics of learning activities, each of which weakens the framing of the discourse:

“extended learning tasks; personal meaning and relevance of the learning tasks; involvement of significant others outside of the classroom in the learning process; and availability of suitable facilitation. They concluded that the most significant outcome of innovative learning activities involving ICT was empowerment, particularly of students.”

Discussion and conclusions

The framework of the pedagogic discourse is highly developed and can act as a reference point for many other theoretical constructs in pedagogy. It would be overstating its value to describe it as a ‘Grand Unified Theory’, but it does have significant functionality. White and Le Cornu’s (2011) metaphors of ‘place’ and ‘tool’ are at the heart of the discourse illustrated in Figure 2.

The power of Sfard's analysis (1998), apart from her extraordinarily fluent writing, lies in its use of dichotomous metaphors (acquisition, participation). This is an approach which was favoured by Bernstein, and it is clear that her models of learning are modalities within the pedagogic discourse. She throws up challenges for those who believe that socially constructed learning mediated by ICT is likely to be a successful pedagogy, since, sooner or later, learning has to be transferred within the community of learners:

“Learning transfer means carrying knowledge across contextual boundaries; therefore, when one refuses to view knowledge as a stand-alone entity and rejects the idea of context as a clearly delineated "area," there is simply nothing to be carried over, and there are no definite boundaries to be crossed.” (Sfard, 1998)

This could form a rationale for researchers' questioning learning in ICT-enabled schools.

Sfard's conclusion to her analysis, that learning involves the interaction of both metaphors is the basis of her 'commognitive' model, which implies the need for a more versatile and dynamic pedagogy where the strength of the classification and framing will be adjusted to suit the purposes of individual discourses.

The value of Engeström's activity theory models is their wide-spread applicability to different workplace situations, whereas the pedagogic discourse is primarily applicable to situations where there is a hierarchical relationship of status between transmitters and acquirers. The similarities between Figures 1 and 2 are apparent, given that the mediating tools and artefacts are embedded within the interactions of the pedagogic discourse.

It is unlikely, however, that Engeström's model has the heuristic features of Bernstein's pedagogic discourse that could develop the sort of versatile pedagogy that Sfard's commognitive pedagogy requires.

For Bernstein, visible and invisible pedagogies represent extreme points of a continuum of modalities:

“As [classification and framing] change in values, from strong and weak, then there are changes in organisational practices, changes in discursive practices, changes in transmission practices, changes in psychic defences, changes in the concepts of the teacher, changes in the concepts of the pupils, changes in the concepts of knowledge itself, and changes in the forms of expected pedagogic consciousness”. (Bernstein, 2000, p14)

It would be possible to use the heuristic features to describe a versatile pedagogy of value to ICT-mediated classrooms of the future. Such an instrument would allow teachers to make rational choices about how much control to cede to their students in the selection of the communication, the sequencing of the communication, its pacing, the success criteria and the hierarchical nature of the control of the social base.

Bernstein has been criticized for saying nothing about the individual students who are learning in the discourse. For this reason, Vygotsky’s ideas are often considered more relevant to learning situations. Daniels (2004) has brought the two schools of thought closer together. He writes:

“Vygotsky’s approach lacks that which Bernstein explicitly has set out to provide—a theoretical framework for the description and analysis of the changing forms of cultural transmissions...

Bernstein seeks to link semiotic tools with the structure of material activity. Crucially he draws attention to the processes that regulate the structure of the tool (e.g. the pedagogic discourse) rather than just its function.”

Wertsch (1991, p120) writes that ‘mediated action is the irreducible unit of analysis; and the person(s) acting-with-means is the irreducible agent involved’. This is entirely consistent with the arguments presented here, since his

‘mediated action’ arises from and is regulated by the interacting elements of the pedagogic discourse.

This paper argues that the irreducible unit of analysis is the ‘pedagogic assemblage’ and that this is likely to become more complex in a world where students have mobile computers connected ‘24/7’ to the internet via wireless networks. Figure 2 describes the ‘pedagogic assemblage’, following Robertson and Dale (2009). ICT-mediated interactions are part of wider ‘assemblages’ that include all of the factors (at school, at home and online) that make up the ‘fluid, interconnected nature of classroom life’. For them, understanding ICT-mediated discourse is about the ‘local ecology of knowledge production’.

By developing Bernstein’s pedagogic discourse to consider different uses of ICT-mediated teaching and learning, we are placing ‘knowledge production’ in the wider context of the whole educational ecosystem. Thus, the theoretical framework provides insights into the successful and less successful uses of ICT. It also provides an explanation for tensions that exist in using ICT within visible pedagogies, such as with examination-focussed classes. Central to unlocking the potential role of ICT here will be a consideration of the ‘local ecology of knowledge formation’ and this will be a primary focus of future papers in this series.

By treating ICT as a recontextualising field that exerts its influences on classification, framing, space and time we have a toolkit that will enable us to deconstruct assemblages: to open up “the 'black box' to understand better the changing form of the technology-society relation”. (Robertson and Dale, 2009, 142). Different, stable, forms of pedagogy will emerge, each of which could be of value as the Web 3.0 future starts to unfurl. In doing so we will be re-considering pedagogy in the light of larger changes in society, as Dewey (1900) suggested we should.

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