Introducing Information and Communication Technologies into Schools: the blurring of boundaries

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ABSTRACT This article considers the impact of Superhighways technology on schools in the UK, in terms of the debate concerning the development of the conditions of postmodernity. In particular, it charts how the collapse of boundaries associated with postmodernism may have affected traditional divisions within schooling, following the introduction of broadband connectivity and Internet capability to schools and colleges. The authors review the broad approaches taken to the introduction of new technologies, such as the Utopian and Dystopian, transformative and incrementalist. By drawing upon the findings of the Education Departments’ Superhighways Initiative, the authors explore the effects of new information and communication technologies on a number of traditional boundaries, including those between curriculum subjects, between pupils and teachers, and, more generally, traditional conceptions of space and time. The article concludes that, although initial indications suggest that the impact of Superhighways capability may be a transformative one, the effect on boundaries is mixed. While some boundaries such as those of space and time seem to be dissolving, others such as the division between academic subjects are much more resistant.

Introduction

One of the prominent themes in the literature of postmodernity is the idea that the boundaries associated with ‘modernity’ are dissolving under the impact of technological and social changes that are global in nature. For example, Hargreaves (1994) argued that the shift from ‘cultures of certainty’ (where boundaries between aspects of social life were seen as solid and immutable) to ‘cultures of uncertainty’ (where boundaries are fluid and amorphous) occurs because of increasing rapidity of communication and technological developments, which allow information to be readily available, regardless of geographical location. The loss of certainty associated with the postmodern condition works through society in many different ways, and it is unlikely that schools and schooling world-wide are exempt. For instance, as scientific knowledge comes to be seen as less of a meta-narrative and more ‘provisional’, then a curriculum based on the transmission of certain knowledge becomes dissonant. The impact of global competition and technological developments have been characterised by Kanter et al. (1992) as leading to
organisations in which roles are ill-defined and shifting, and where ‘projects’ become more important than hierarchical position or organisational charts.

The fluidity that Kanter et al. see developing in productive organisations is also likely to develop in schools, subject to the same postmodernising forces as other organisations. However, the ‘moving mosaic’ that Toffler (1990, p. 216) offers as an analogy for the postmodern organisation, in which there are few solid divisions, but ‘shifting, see-through panels, one behind the other, overlapping, interconnected ... continually blending, contrasting, changing’ is at odds with the situation of most secondary-school organisations throughout the world, with their solid hierarchies, jealously guarded departmental divisions, and with the knowledge base sub-divided into discrete and hardly connecting compartments.

An important element of increasing technological advance and the explosion of knowledge has been the rapid spread of the Internet and other communication technologies over the past decade. In the case of Great Britain, as these technologies are moved into schools, partly as a result of individual school or local education authority [1] initiatives, but more systematically as a result of the creation of the National Grid for Learning[2] (see, for example, Tilke, 1997), their impact on schools will become direct rather than mediated through changes in the economy and society. Tolhurst et al. (1994) argued that the Internet is composed of a ‘cloud’ of computers, constantly shifting, never stable and that will therefore have a direct effect on our notions of time and space, and the traditional boundaries associated with those concepts when they are fixed rather than fluid. Under the conditions of modernity, time and space could be segregated into controllable units, with the nation-state able to police communications in effective ways. In cyberspacetime, there is little chance that governments can any longer act as gatekeepers, manipulating the links and messages between the citizens of the world. Rather ‘on the Internet, boundaries—temporal, spatial, associative and identity-forming—all dissolve’ (Nguyen & Alexander, 1996, p. 99). Shields (1996) therefore argued that the Internet creates a ‘crisis of boundaries’, not just between time zones and geographical spaces, but also in a blurring of the boundaries between our sense of a ‘real’ and ‘virtual’ self and the different roles we play in the real and virtual worlds. Indeed, Bell (1980) argued that the boundaries between the new telecommunications technologies would themselves become blurred as standardisation (and, more recently, digitalisation) allows the inter-changeability of telephonic, video, computer and cable formats.

The claims for the effects of the introduction of communication technologies, including the Internet, on schools have been varied. Schofield (1993) developed the distinction between those who believed that the effect of the new technologies would be gradual and would make the delivery of a traditional curriculum more efficient (‘incrementalist approach’) and those who believed that the new technologies would fundamentally alter the means and ends of education itself (‘transformative approach’). From the incrementalist view-point, Mason (1995) rejects the idea that new technologies, in his case ISDN, will transform education, arguing that the history of new technology is a history of disappointed revolution. Rather, the conservative mass of teachers will adapt the opportunities presented by new technologies to deliver a traditional curriculum but in a more efficient way. In other words, new technologies may quicken education, but they will not transform it. Interrogate the Internet (1996) also rejects a postmodern reading of the new technologies as transformative. Rather, they see the Internet as an expression of high modernism, giving swift access to information that enables individuals and societies to achieve the enlightenment project of control. Rather than transcending reality, the Internet reflects and imitates reality, while blurring the boundaries between the real and
the virtual. Indeed, the Internet is the ‘scientific solution to the death of God’ (Interrogate the Internet, 1996, p. 125), in offering to users a ‘sense of mastery’ over an uncertain world.

From the transformative position, Rust (1991) argues that information technology had overcome the structural boundaries of traditional schooling, and he explores the extent to which this could be seen as empowering for education or as simply serving commercial interests. Bigum & Green (1995) believed that the introduction of new technologies into schools was not just a matter of a more efficient way of delivering the same, but a means of creating a new social context for learning. Muffoletto (1996) believed that the transformative impact of the new technologies would not just be restricted to the curriculum and its delivery, but would extend to teachers themselves, in terms of the processes they would adopt and the skills they would be required to have: ‘Teachers as we now know them will be different’ (Muffoletto, 1996, p. 145).

Underlying the incrementalist and transformative positions are, respectively, a Dystopian and Utopian approach to the impact of the information superhighway. The Dystopian view is concerned with issues of surveillance and commodification. The potential for new technologies to document and track the activities of individuals and groups is seen from this perspective as an extension of the ability of the state to control the activities and thought processes of the citizenry. For example, the Internet has the potential to identify the spending habits and preferences of all those who use it, and provide commercial organisations with the ability to target individuals with their goods and services (see, for example, Ratcliffe, 1994). The ability to work remotely through the information superhighway is also likely to impact upon both home and work in ways that will increasingly blur the boundary between work and leisure (see, for example, Burstein & Kline 1995). The Utopian view, on the other hand, stresses the potential of the information superhighway to empower individuals by allowing them to promote on the Internet their own ideas and information rather than just passively receive the messages of others. As Weston (1994; quoted in Kenway, 1996) put it, ‘the mouse is more powerful than the remote control’. Even more fundamental is the argument that the Internet offers the opportunity for more democratic forms of community and organisation to emerge, through multi-directional networking and the decentralised structure of the Internet (see, for example, Reingold, 1994).

A more historical approach has been taken by Casey (1996), when he explores the use of computers as innovations in American schools. He argued that early examples of the introduction of new technology were exemplified by a grafting-on process, where computers would be used in the context of traditional ways of working and with a strictly differentiated curriculum. Only by the end of the 1980s did many teachers begin to utilise the potential of computer technology to present curriculum materials in innovative ways. Yet, such usage still remains the exception rather than the norm, with most classrooms still looking the way they did 50 years ago.

However, Goodenow (1996, p. 198) argued that the societal impact of communications technologies and especially the information superhighway was enormous, ‘changing the nature of work, learning, commerce, discourse and arguably, relationships of many kinds’. Goodenow identifies the features of the information superhighway that make it potentially transformative as the ability to access huge reservoirs of data and the ability for participants to interact irrespective of national boundaries on a 24-hour basis. Kenway (1996) takes this further in suggesting that the transformative potential of the information superhighway is only beginning and, as we move towards universal broadband transmission, the ‘economy of communication’ will be fundamentally altered. Not only do we
have access to one-to-one or one-to-many communication, but broadband connections will allow multicasting and many-to-many communication. This represents what Poster (1994) claimed was a ‘second media age’. In examining education, Kenway (1996, p. 219) identified ‘access to more and better information unrestricted by geography, institutional location or teachers and on new opportunities for global communication between students and between students, teachers and “experts”’, as the innovative aspects of the economy of communication made possible by the Information Superhighway. However, there has been little empirical investigation, as yet, of the effects on schools of an introduction of the new technologies.

So, the question remains, ‘what impact will the introduction of information and communication technologies have on schools and schooling?’ In particular, ‘what will happen to the traditional boundaries associated with schooling as the potential of ICT unfolds in the classroom?’ One of the largest investigations in Great Britain of the introduction of information and communication technologies (ICT) into schools was conducted during 1996–97 through the Government’s Education Departments’ Superhighways Initiative (EDSI[3]). As part of that Initiative, the ICT research team from Leicester University School of Education was responsible for evaluating seven curriculum projects in England and Wales, from a small one-school project to large, multi-school and industry partnerships. The evaluation, conducted over the period of a school-year covered 51 schools and colleges. Information about each of the seven projects was gathered via semi-structured interviews with project co-ordinators during ‘acclimatisation’ visits prior to the commencement of each initiative. Further visits for the purposes of systematic data collection took place in each of the 51 participating institutions at three points during the evaluation period. This involved systematic observation of ICT-related classroom activities, questionnaire surveys of students’ computer attitudes and experience, weekly logs of project-related computer use, and semi-structured interviews with selected students actively engaged in curriculum projects using the Internet, and with teachers involved in using Internet access to enhance their curriculum (see Galton et al. (1998) for further details of this evaluation). The range of new technologies investigated was broad, and included use of the Internet, video-conferencing, e-mailing, digital cameras, cable television and text-based discussion (see Scrimshaw, 1997).

The conclusions of the study regarding the issue of boundaries must be regarded as tentative for two reasons. First, the focus of the evaluations was on the ways in which educational institutions might deploy the new technologies to assist the learning process. While this necessarily involved the team in looking at the impact of the new technologies on wider issues than just learning (Comber & Lawson, 1998; see Comber et al., 1999; Lawson & Comber, 2000), our observations about boundaries emerged from discussions of what we had seen and heard beyond the immediate focus of the evaluation. Second, the projects themselves were at a very early stage of development, and while some issues concerned with blurring boundaries clearly emerged in the initial stages of adoption, others are likely to emerge as the new technologies become an accepted part of a school’s teaching repertoire. In arriving at our conclusions, we have relied mainly on the teacher interviews and our observations of the practices in the classroom adopted by the teachers. In doing so, we agree with Hargreaves’ (1994) argument that the loss of certainty associated with a postmodern society should lead researchers to attach a greater credibility to the ‘practical wisdom’ of those involved directly in the changes.
Training for Technology and Training for a Subject

The first boundary on which we focus concerns professional development in the field of ICT. The importance of training for the successful implementation of any computer-based learning system is the pre-eminent finding of research into the area (see, for example, Eurich-Fulcer & Schofield, 1995). However, training in the use of the technology has often been separated out from training for implementing the technology in the classroom. This boundary is created out of the logic that suggests teachers need to know the skills of using an application before they can think of ways in which it might be used to meet learning objectives. This is despite a recognition from many researchers that, unless the training for the technology involves an element of education (see Kortecamp & Croninger, 1996), it is unlikely to be transferred easily into the classroom setting. As Casey (1996, p. 15) puts it: ‘We derive little benefit by ‘wowing’ teachers with demonstrations of new computing technology if we fail to connect its use to curriculum’. However, one of the problems with merging technical training and curriculum needs is that often there is a multi-disciplinary group of trainees present in any session. If Becker (1992b) is correct and teachers will only continue to develop their information technology (IT) skills after their initial training if it also meets their individual classroom needs, then it is important that the boundary between skills training and classroom integration is broken down. This factor leads Ritchie & Wiburg (1994) to advocate the provision of schemes of work that show teachers how to integrate new technology into their classrooms as part of their training. The difficulty with this position is in finding the experts who can provide both the technological expertise and the experience of curriculum planning for a particular educational phase and for a particular subject.

Much of the ICT training carried out in the UK Superhighways Initiative schools was beset by the usual problems associated with an innovative programme. In most of the projects, the time-lag between the initial training in central locations and subsequent training in schools and colleges was too great to allow for a smooth implementation. For example, in one of the larger projects, involving a secondary school and nine ‘feeder’ primary schools, technical problems that resulted in delays in connecting schools to the Internet meant that the training provided at the beginning of the project was largely forgotten before participants had a chance to implement and practice their learning, proving both costly and time consuming, since this often required re-training at a later date. More generally, much of the training on offer (from various quarters) to project participants focused on the acquisition of technical skills. Given the lack of experience in Internet use of the majority of the project teachers, such training was often pitched at either too high a level for the computer-literacy levels of such participants or, conversely, was too simple for the more experienced and confident users. In either case, this approach tended to dampen enthusiasm and lead to reluctant learners. Much more fruitful, however, and effective was the model of training that was concerned to explore the use of ICT in a purposeful and relevant learning context, i.e. focusing upon using technology for learning, rather than learning to use the technology. In this way, teachers were able to catch a glimpse of the potentiality of ICT in the classroom and, in the process, often became the most enthusiastic advocates of the new technology.

This occurred most frequently where the ICT co-ordinator contextualised the processes of access in individual curriculum needs. As one co-ordinator put it:

Once you can show them something directly applicable to what they are doing then they are very interested and dead keen to incorporate something new into whatever is existing already.
In other words, when the boundary between training for technology and training for the curriculum was breached, individual teachers were more likely to be motivated to explore the application of the Internet in their classroom.

However, it was arguably the nature of the Internet itself that enabled teachers to explore their particular and different disciplines, while in a multi-disciplinary group learning about Superhighways technologies.

**ICT Location Boundaries**

Casey (1996, p. 21) described part of the implementation stage of the process whereby schools adopt computers as when ‘Computers are put in labs where a “special teacher” is in control and other teachers only slowly get involved’—what Wellington (1993) calls the ‘vertical provision of IT’. This reproduction of the traditional boundaries of a school, certainly in secondary schools where department or faculty is defined by a discrete subject area, has implications for the successful deployment of new technologies. Ritchie & Rodriguez (1996) described this as akin to locking up all the pencils in a school and allowing only restricted access to them.

Access to and availability of computer networks have been identified by many researchers as the key element in effective usage (see Eurich-Fulcer & Schofield (1995) for an account). In the case of the Internet, access may be further restricted because of the costs of unrestricted access or wide-area connectivity. However, in the EDSI schools, the effect of introducing Internet capability on the more advanced integrative schools (see Lawson & Comber, 1999) was to create demands for the breaking down of this boundary. The central location of Superhighways resources in a library or resource area did not resolve issues of access and control, but exacerbated them. As the participating teachers began to appreciate the benefits of having a vast resource at their fingertips, requests were made for, at first, access through an individual machine in the classroom and, later on, for a heavier concentration of Internet-capable machines in the classroom, or close to departmental areas. As a biology teacher said:

That will be the next step—getting the Internet into a lot of classrooms.

In the most advanced schools, by the end of the project, plans were well under way to creating dispersed networks of Internet-capable computers, either located in individual classrooms or in hubs based in departmental areas. These advanced schools had therefore overcome the location barrier to create a horizontal integration of IT, as identified by Wellington (1993).

**Subject Boundaries**

The issue of subject boundaries is more pertinent for secondary schools than the traditionally more integrated curriculum of the primary sector, although, even here, the emphasis of the 1997 Labour Government on literacy and numeracy, and its reform of primary training may lead primary teachers to move towards a more secondary model (Galton et al., 1999). For postmodernists such as Schlechty (1990), postmodern economies demand new skills and new types of knowledge from the workforce, and it will take new ways of organising schools to educate the young into these new skills. If Schlechty is right, schools will be required to produce independently minded, flexible workers, who are able to collaborate with others in creative ways and draw upon a diversity of knowledge bases, rather than specialising in a particular discipline. Clearly, a school structure that
continues to stress subject boundaries and departmental areas is unlikely to provide such workers (see Hargreaves, 1994). In the case of schools in England and Wales, the imposition of a National Curriculum has reinforced these subject boundaries in the secondary and primary sectors (see Hargreaves, 1989).

The literature suggests that there is a mixed response from subject specialists to opportunities provided by the Internet. Friedman et al. (1995) argued that the Internet had allowed students to cross over traditional subject boundaries in visible ways, while Collier & LeBaron (1995) found that subject specialists were, in the main, uninterested as yet in the inter-disciplinary potential of the Internet. Hargreaves (1994) sees the departmental organisation of secondary schools as the reason why many teachers adopt reactive rather than pro-active attitudes towards the potential of the new technologies. Teachers, in resisting the blurring of traditional divisions, may be demonstrating a sensible caution in the face of new developments, rather than exhibiting a Luddite reflex. They may be rightly questioning the usefulness and appropriateness of the new technologies to their educational purposes.

In the case of the EDSI projects, the blurring of subject boundaries did not occur in any of the secondary schools to any great extent, and where it did, it was often incidental to the plans of the teachers in charge rather than as a result of a deliberate strategy. This was particularly marked among those teachers who were in charge of examination classes, where utilisation of material from the Internet took place within the subject context, with the aim of improving grades:

I think it’s increased the children’s ability to deal with coursework. One (Examination) Board said to me that they were very impressed by the way the children were using the computer and (Internet) resources and the examiner felt that this was improving grades.

Evaluations made of the Internet were expressed in terms of its utility for the subject (‘a marvellous resource for Business Studies’) rather than in its potential for transcending traditional boundaries. Where students drew upon material from the Internet outside of the ‘focus’ subject, teachers were willing to give rewards only where that material was applied to the specific task in hand in a relevant way. Frequently, more general searches of the Internet (despite being an important element in the development of IT skills) were seen by teachers as ‘time-wasting’. The benefits of access to the Internet were perceived to be about giving access to otherwise unavailable up-to-date materials cheaply and/or access to experts in the discipline for which they were responsible.

More cross-curricular activity was observed in the primary schools involved in the project, which followed from the more theme-based approach that some of the primary teachers tended to adopt. In the secondary schools, Superhighways work that did transcend traditional boundaries was with students outside a particular subject context. For example, a group of refugee children with little spoken English were accessing sites with a great deal of information from their countries of origin. This was very much the exception that proved the rule, however, so the EDSI observations support the conclusions of other writers that it is very difficult to develop cross-curricular activities in schools where subjects are compartmentalised (see, for example, Weston et al., 1992) unless there is a very specific purpose planned.
Traditional Roles of Teacher and Pupil

The impact of postmodern developments on the traditional boundaries of the teacher’s (and pupil’s) role has often been acknowledged in the literature. Hargreaves (1994) argued that the pervasiveness of the image in contemporary society meant that traditional modes of delivering knowledge through textbooks, worksheets and the like were unlikely to hold the attention of young people inhabiting a media-saturated world. Teachers would therefore have to engage in pedagogical change through a greater awareness of the potential of the new technologies, while at the same time devising strategies to avoid the trivialising effects of a society obsessed with images. The integration of technology into schools has been argued to lead to better teaching and learning (see, for example, Brunner, 1992). Most researchers have identified this shift as one from teacher-centred learning to a more student-centred approach (see, for example, Prawat, 1992). The use of computers, according to Stuhlman (1994) utilising the work of Becker (1992a), creates a situation where there is greater emphasis on student learning; for example, a greater use of small-group instruction, with the teacher taking on the role of facilitator rather than disseminator of knowledge. Further claims are made by Hoffman (1996), who argues that increased use of technology led to co-operative learning, as well as individualised instruction, rather than whole-class teaching. Watabe et al. (1995) point out that students derive benefit from being exposed to viewpoints that they would not ordinarily have access to, while lessons on the Internet can be structured to require students to present their findings to their peers, rather than reporting to their teachers.

There is also a shift in power relations, as the teacher no longer acts as gate-keeper for the pupils, who have direct access to sources of knowledge outside the control of the teacher (see Toffhurst et al., 1994). Communication via the Information Superhighway allows traditionally subordinate pupils to mask their age and status, in such ways as to create a virtual equality between communicators via the Internet (see Eurich-Fulcer & Schofield, 1995). This shift in relationships is not always comfortable for either teachers or students (see Friedman et al., 1995), precisely because the blurring of the boundaries cuts across the traditional perceptions of what teachers and pupils should do. By creating unfamiliar situations and relations, teachers and students can experience a loss of certainty in their own roles and status, which may account in part for resistance to the new technologies.

In the EDSI projects’ schools and colleges, there was evidence that such a shift in traditional roles had occurred in a few situations, but that there was a great deal of variation in responses to connectivity by both teachers and students. In terms of an image-saturated world, teachers who were involved in subjects where images were central responded very positively to the opportunities provided on the Internet for access to animated graphics, for example. Thus, one geography teacher argued that it was access to maps and animations of physical geographical processes that was the most important part of the Internet for his purposes. Art teachers were also enthusiastic about the access to art collections that the Internet provided. However, other teachers were critical of the way in which heavily imaged sites took a long time to down-load, especially where those images added nothing to the learning experience.

As to changing teacher–pupil relationships, there was compelling evidence from both observation and interview that using the Internet did promote a different style of teaching. There were, for example, instances of peer-to-peer tutoring in ICT skills at both primary and secondary levels, while (particularly in primary schools) there were
cases of pupils instructing teachers in multimedia techniques. In the secondary sector, many teachers used their students as a resource, giving them the task of identifying and logging useful sites for other students. Similarly, while the teachers provided an overall framework for Internet-focused lessons, using examination tasks as the organising principle behind their planning, the actual pace and direction of the lesson often lay with individual students or groups of students, depending on the task in hand. With younger secondary students, the most integrated lessons combined whole-class instruction with a clearly set out Internet task involving small groups of pupils. Older students tended to be left more to their own devices when accessing the Internet, and were thus helped to become more independent learners, with a shift in the role of the teacher:

There is more freedom—they are more independent. I say to them ‘I’m going to give you guidance and then it’s going to be down to you at the end of the day to present something which relates to what you have researched.’ Although I’m in the class, I’m there to guide. I’m not in control.

This shift in emphasis relates also to the issue of gate-keeping. While many teachers and ICT co-ordinators were anxious to control access to the Internet, their concern was in the main about the cost of access and/or the potential for students to reach unsuitable (pornographic or abusive) sites or situations (for example, in e-mail or video-conference exchanges). The strategies for dealing with this problem were varied (see Lawson & Comber, 2000), but demonstrated a switch from the traditional role of the teacher in providing the material to one where the teacher’s role is to prevent access to information or to give students the skills to evaluate the usefulness and appropriateness of particular items of information. Therefore, while some teachers pre-selected or disbarred sites on the grounds of suitability, this partly defeated the object of giving relatively open access to a large number of sources, and was moreover an approach that was often resisted by students. For example, one age 16–19 student, investigating AIDS for a sociology project, complained about being denied access to sites that might include the term ‘gay’. There was a residual concern among some of the teachers about the subject content of the Internet, i.e. that much of the material found there was of a pitch unsuitable for younger students, or that too much time was wasted in searching for suitable material. However, this was out-weighed in the majority of the teachers’ eyes by those sites that were of use.

Spatial and Temporal Boundaries

The most fundamental boundaries that are claimed to be dissolving under the impact of new technologies are those of space and time. At the most abstract level, ICT overcomes our very conceptions of space and time. The limitations on communication presented by geographical location and different time zones are overcome, so that ‘real time is no longer compelling’ (Ullman, 1995, p. 133). Our exposure to cyberspace first undermines our experience of space as something that is directly constructed out of our senses; and, second, our sense of time becomes disjointed and loses its flow, as we communicate in asynchronous ways (see Jones (1997) for a discussion of these ideas). Jones (1995) argued that the Internet represents a new limitless frontier, which will have transformative effects on society at large and which will be an essential component of the global village. On a more pragmatic level, the Internet makes possible immediate communication, regardless of geographical distance or social station. This has an obvious implication for distance-learning programmes, where barriers of distance and time are removed by use of electronic communications.
However, there are also important benefits claimed for this dissolving of space and time in ordinary classrooms. Robinson (1994), for example, argues that science students appreciated the opportunity to exchange data and information with other students across the globe, unhindered by the lack of speed associated with traditional communications. The result is, according to Eurich-Fulcer & Schofield (1995), that ‘the walls of the classroom may become transparent as communication and information exchange are no longer controlled by geographical boundaries’. Global education therefore becomes a possibility and a challenge to ethnocentrism in all school subjects, but also allows pupils to become connected to more meaningful sources than are available locally (see Hargreaves, 1994). However, Hargreaves also pointed out the problems that the dissolving of boundaries of space and time can cause, as the certainty of traditional modes of communication disappears. These include information over-load, the raising of unfulfilled expectations for speed and responsiveness, a focus on form not content, and a potential loss of time for reflection rather than reaction. Stahl et al. (1995) also identify the problems that teachers have with the unlimited nature of the Internet, which is in finding appropriate sites and adapting them to their own pedagogic purposes. In questioning the applicability of the Internet to learning, teachers focus on the central problem with access to unlimited information and communication. While, for example, exchanging data with students from another area might be exciting, the question remains of how much this is actually enhancing learning. This needs to be demonstrated rather than just taken for granted.

The EDSI projects provided a myriad of examples in support of the more pragmatic aspect of the dissolving boundaries. Students were able to access global information, communicate cross-culturally, and exchange ideas and data with others without regard for time and space. Thus, an A-level Sociology student carried out a comparative analysis of British and Tamil Women’s magazines through accessing Tamil language publications in Sri Lanka. Contacts were made between schools in different parts of the world and information exchanged. Video-conferencing between French and British students allowed them to develop their own ‘netiquette’ to increase their fluency in the target language, as a modern foreign language (MFL) teacher observed:

Well, for modern languages the great thing about the Internet is that you can have direct contact with foreign countries where the language comes from, and meaningful resources in the language available.

However, there were limitations placed upon this dissolution. Many schools and teachers restricted access to the Internet to particular times in the school day, or to particular groups of students or to particular locations. While, on one level, the asynchronous nature of the Internet made such restrictions less important, they did place barriers in the way of unfettered communication. Some schools developed Intranets that limited the accessibility of information to ‘approved’ sites, often because they felt that unrestricted on-line access would prove too costly for the budget of the school. Moreover, the students themselves often approached the use of the Internet in very pragmatic ways, either utilising information to fulfil given assignments or, at the first chance, going to the chat lines for entertainment. In interviewing students, there was also a sense in which they were unaware of the ‘distances’ they were travelling, taking it much more for granted than their teachers did. Many teachers (especially with younger pupils) tended to be more wary of the unbounded nature of the Internet and sought to re-establish manageable boundaries through controlling where pupils went. However, in most of these cases, the students managed to ‘slip the leash’ easily, so that a class which was purportedly
following the same sequence of web sites would quickly be found to be dispersed widely across the Internet.

**Technophreaks and Technophobes**

While there have been some optimistic views on the ease with which people are willing to use computers (see Nguyen & Alexander, 1996, for example), most commentators have accepted that there is a constituency of reluctant users among teachers—the technophobes (see Rosen & Maguire, 1990)—as well as those who enthusiastically embrace new developments—the technophreaks. Technophreaks are often characterised as mainly young males, often with some sort of social inadequacy that prompts them to spend hours on the computer. Shields (1996) rejects this as a stereotypical and inadequate conceptualisation. On the other hand, teachers are often seen as resistant to technology and only begin to deploy it when they are forced to do so by management (see Lawson & Comber, 1999). Goodson & Mangan (1996) capture something of the more complex reaction of teachers to new technologies, when they argue that most teachers recognise the importance of computers for the future and want to do their best for their students in relation to them (see Comber et al. (1999) for a model of adaptation). However, they are often hampered by a lack of confidence, knowledge and skill, which makes them reluctant to engage fully in computer-aided learning. They also recognise that ‘residuals’—those who continue to resist all computer use—often have cogent educational arguments such as fear of loss of literacy to support their continued resistance.

In the EDSI projects, the boundary between enthusiast and resister tended to become blurred under the impact of access to the Internet. Those who participated were neither uniformly technically competent nor drawn from particular faculties. Rather, the EDSI teachers tended to be those who experienced the curricular usefulness of the Internet in their first few (and often the first) training sessions. It was the sheer salience of the Internet to their pedagogical concerns that acted as a transformative catalyst in many cases. There were numerous examples of teachers who had begun the project with some degree of reluctance, but ended up as enthusiastic advocates of the Internet—and who were also beginning to explore the other potential uses they could make of electronic communications in their classroom. For example, an English teacher in one school had been having difficulty in getting hold of Old English poetry for use with her students, because of a limited Departmental budget. In her first training session on the Internet, she was able to access and down-load exactly the sort of material she had been looking for. This led her to demand a connected computer in her classroom immediately. While obviously an extreme example based upon a fortuitous first session, this kind of reaction was not uncommon. When teachers experienced solutions to their teaching problems—access to up-to-date materials, practice in another language, illustrative animations of important processes—they quickly overcame any technical skills deficit or devised strategies to get their students to help them deploy the new technology effectively. The Internet is therefore unlike other technology inputs into schools. Whereas the use of spread-sheets, databases and the like demand a relatively high level of technical proficiency before any useful product is developed for the classroom, with the Internet, a couple of points and clicks can get even the most machine-nervous teacher to sites of utility.
New Barriers for Old

The breaking down of traditional barriers is not the only process that occurs during the adoption of ICT in schools. On the contrary, new boundaries are created as schools wrestle with the potential of such a powerful tool. Despite the apparent ease with which teachers can arrive at educationally useful sites, some teachers continue to avoid using computers, no matter how easily available (see Brosnan, 1997). This residual group are further marginalised in schools where a process of conversion has taken place, i.e. where other, previously reluctant, teachers have taken the new technology on board. As the constituency of the residual declines, they are in danger of being marginalised. Moreover, the absence of any computer work in some teachers’ classes becomes more noticeable by the students when use of computers is widespread, as in connected schools. Or as Interrogate the Internet (1996, p. 129) put it: ‘Refusing to get on the Net is still conceivable, although like everything else, there will be consequences’. Brosnan (1997) argued that this is likely to affect older female teachers the most as this is the constituency that has been identified as the most likely to be residual. Although conclusions from the EDSI project have to be tentative, we did not observe any gender bias among the participants.

One of the reasons put forward by the residuals for not using new technologies was a lack of time to get to know applications and develop ways of integrating them into their classrooms. However, lack of time has been often cited by otherwise interested teachers for their slow progress in integration. McNabb (1994) has pointed out the difficulty of teachers finding the time to do it all themselves, and how they need to be freed to attend training and development sessions. Schrum (1995, p. 226) also identified the need for time to ‘explore, digest and experiment’ as important factors identified by those involved in the Internet themselves. However, there are factors in schools beyond issues of motivation and access to equipment that tend to create the time-rich and the time-poor, regardless of the incentives to learn about the new technology. Many of the teachers involved in the EDSI projects were frustrated by the lack of time they had to explore, given the other pressures of reporting, marking, planning and administration—the burdens of which they felt were increasing all the time. Expressions of envy were made of those who were perceived as having the time to engage in a more thorough utilisation of the new technology. This was also related to the boundary of the IT-rich and IT-poor. IT-rich could refer to those schools or departments who had a large number of machines connected to the Superhighway and to which teachers were given relatively easy access; or it could also refer to those who had access to the Internet at home through their own machines and who could therefore invest the necessary time at their own leisure and comfort. The IT-poor, on the other hand, were schools where the machines were either few in number, slow or difficult to access, and teachers who had little alternative access to the new technology. This division is also reflected in the pupils, where the material and cultural resources for ICT access are highly differentiated and impact upon attitudes towards ICT and home availability to different groups of pupils.

Conclusion

In what senses then, can the findings of the EDSI projects indicate a potential dissolving of traditional boundaries associated with schooling? The message is a somewhat mixed one. While the Leicester team lean towards the transformative effect of the new technologies, they are also mindful of the caveat put forward by Kenway (1996, p. 218)
that ‘despite its (the information superhighway’s) promise and promises we need to remain open-minded as well as sceptical and critical’. We were also aware that the use of stark dichotomies, such as modern and postmodern, could act to hide the complex reality of the impact of ICT on schooling. Nevertheless, we believe that the major blurring effect that we found was concerned with the dislocation of space and time, which is a feature of the cyberspacetime. While restrictions might be placed in the way of global access, both teachers and pupils have a habit of circumventing those restrictions in the search for useful sites. Moreover, as the utility of an open-ended database became more widely appreciated, the demand for open access was more insistent.

Our data also suggest that there is some mileage in the idea that the information superhighway breaks down the traditional roles of teachers and pupils, and that both are having to find new ways of working together. Whether this is a feature of a transitional stage or a more permanent change in role needs to be researched further, but we tend to accept the argument that the nature of the Internet is qualitatively different from previous introductions of technology into schools and is therefore likely to have a powerful effect. The precise nature and direction of this change remains to be determined.

However, we found less compelling evidence that the traditional secondary-school boundaries of department and subject were becoming blurred under the influence of the Superhighway. Here, the importance of the concept of utility was highlighted. We saw that training for using the Internet was most effective when there was a merger of technical and subject concerns. Moreover, as the utility of the Internet was recognised, there was increasing demand for connected access in the classroom and departments through dispersed networks, rather than in dedicated ICT rooms. This represents a hardening of the subject/department boundary rather than a blurring. It was the context of a bounded subject that provided the biggest incentive to learn how to access the Internet. We also saw that usage by both students and teachers was related to the requirements of a subject, and often, when appropriate, to the examination demands therein. Only in the relatively greater fluidity of the primary curriculum was there any real evidence of dissolving of traditional subject boundaries. It remains to be seen whether, as the Internet beds down, more integrated approaches to its use develop elsewhere.

Therefore, we believe that the use of the Internet does have a transformative capacity and the potential for blurring the traditional boundaries within schools, but that these developments are likely to be uneven and may occur in ways as yet unexpected. They may also be resisted by those teachers who challenge to usefulness of unrestricted access to the Internet, without appropriate information skills training for the students. However, as the National Grid for Learning comes on-line and as schools are guaranteed connectivity through the Labour Government’s strategy, the impact on the way that the process and structure of education in Great Britain is organised is potentially large. There is therefore an urgent need for a programme of research that can chart and measure, more precisely than the EDSI evaluations were able to, what these effects will be. We ourselves hope to contribute to this debate with a follow-up study of the more advanced schools in the EDSI project, which has just been completed.

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NOTES

[1] These are local government bodies in Great Britain, responsible for public education in a locality.
[2] This is the British government’s strategy for connecting schools to the Superhighway and providing teachers with access to appropriate curriculum materials.
[3] EDSI involved the independent evaluation of 23 different Superhighways projects, involving some 200 educational institutions and 150,000+ learners.

REFERENCES


