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Researching computers and education — glimpses of the wider picture

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Abstract

With information and communications technology (ICT) beginning to form the basis of extensive educational reform around the world, this paper considers how research into educational computing can move beyond its 'hobbyist' origins and keep abreast of the burgeoning role of technology in education policy and practice. By discussing the present limitations of educational computing research the paper goes onto suggest an agenda for advancing and improving inquiry in this area. In particular the discussion focuses on the need to embrace diverse methods of research and theoretical approaches to examining educational computing, as well as the need to ask 'wider' questions of the social, cultural, political and economic aspects of ICT in educational settings. © 2000 Elsevier Science Ltd. All rights reserved.

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1. Introduction

After three decades of uneven implementation and only partially fulfilled potential, educational technology — and in particular the use of information and communications technology (ICT) — is now beginning to have a significant impact on policy-making around the world. Over the last decade a host of countries have made considerable policy commitments to the development of educational technology infrastructures on a hitherto

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unprecedented scale. For instance, the Clinton/Gore administration's $2 billion 'Technology Literacy Challenge' and $2.25 billion 'E-Rate' initiative in the USA have been mirrored abroad by the £1 billion UK 'National Grid for Learning', the DM160 million 'Schulen ans Netz' in Germany and the S$2 billion Singaporean 'Educational Masterplan for ICT'. This government commitment aside, the level of institutional expenditure on educational ICT is also booming. For instance, the UK primary school sector (K-6) alone is now estimated to be spending £680 million per annum on information technology (Bannister, 1998).

This current rising profile stands in stark contrast to the previous 30 years, where educational computing largely remained the preserve of small groups of well-intentioned, enthusiastic yet under-funded and isolated 'hobbyists' — individuals whose driving motivation was often an intrinsic interest in technology, often from a purely personal perspective. However, the rapid policy expansion of educational technology now means that such a 'closed' capture of the field can no longer afford to continue. The 'hobbyist era' of education computing appears increasingly anachronistic as ICT enters the mainstream of educational policy and practice. Yet the current salience of computing in educational policy and practice terms has, as yet, been slow to permeate the field of educational technology *research* — which continues to remain rooted in rigid paradigms and a narrow perspective of what 'educational computing' entails. The purpose of this paper is, therefore, to examine the present limitations of educational computing research and, more importantly, to suggest an agenda for advancing and improving inquiry in this area.

2. Present weaknesses of educational computing research

Over the past three decades there have been many ground-breaking and exemplary pieces of work focusing on the role of computing in education. However, throughout the literature there are also a number of recurring limiting features. Primarily, some researchers have tended towards an optimism which, in its extreme form, has approached a utopian outlook on technology. Whilst an optimistic view of technology is not in itself a bad thing, such a reticence to consider negative or less successful aspects of educational computing has long been seen as fundamentally restricting the field (Kearsley, 1998; Maddux 1989). In many ways, this optimistic rationalism can be seen as a failure to take into account the 'wider picture' of education computing beyond the 'efficiency' of the technology in question. Moreover there has also been a conspicuous tendency to mistrust, or even avoid, theoretical approaches when formulating the direction of research — despite many attempts to introduce theoretical perspectives to an education technology audience (e.g. Bryson & de Castell, 1994; Carr, Jonassen, Litzinger & Marra, 1998; Seels, 1997; Wilson, 1997). All these characteristics have been translated into a body of research which, although substantial in size, remains narrowly focused and executed. Thus, much educational computing research continues to take the form of small/medium-scale surveys and case-studies, experimental descriptions and classroom-focused analysis. In short, as Kenway (1996, p. 217) has argued previously, much of educational computing research is "too micro-focused and unwilling to engage with wider concerns". How, then, can this situation be redressed and educational computing research

begin to reflect the increasing importance of information and communications technology both in education and society at large?

3. The need to embrace diverse methods of research

Perhaps the most obvious area for change is the way that education computing research goes about asking questions. Here, the opportunities to methodologically improve are two-fold. Despite a predominance of small and medium-scale survey approaches to research there has, as yet, been a lack of large-scale quantitative analyses that have so advanced other areas of educational inquiry. It can be strongly argued that education computing research is lacking the large-scale data-sets to illustrate how ICT is 'working out' in practice — across school districts, states and even countries — and not just in smaller samples of localised institutions which cannot necessarily be indicative of any wider context of technological implementation. To date, such an approach has tended to be limited to 'official' statistical reports, such as the US Presidential Committee on Educational Technology report (PCAST, 1997) and OECD (1998) global indicators, which provide useful national and international pictures of education computing use; albeit at a general level. Yet, as technology is rapidly introduced into educational settings there is a pressing need to replicate and expand on work such as the large-scale IEA comparative survey of ICT use in 21 countries carried out nearly a decade ago (Pelgrum & Plomp, 1991, 1993) as well as larger scale work carried out in UK schools over the last decade (Underwood, 1997; Underwood, Cavendish & Lawson, 1999; Watson, 1993).

By providing *large scale* pictures of education computing use it should be possible to highlight patterns and conditions of success and failure, good and bad practice and the strategies which lead to the effective implementation of technology.

Yet, there is also an equally pressing need for more qualitative approaches to educational computing research to be adopted. Unlike the vast majority of other areas of social science research, education technology has remained peculiarly impervious to qualitative methodology and analysis. Although an overt reliance on qualitative methods is as constricting as a purely quantitative approach, the addition of a qualitative dimension to education computing research allows a focus on what *does* happen (as opposed to what has apparently happened or what *could* happen) when computers are used in educational settings. Indeed, using the example of research concerning students' computer attitudes and achievement, Weinholtz, Kacer & Rocklin (1995, p.388) were anxious to show:

> ...just how ambiguous and misleading results from quantitative studies can be if not supplemented by qualitative data... Use of supplemental qualitative methods by quantitative researchers can serve as a prudent hedge against obtaining inconsequential or erroneous results.

In this way, qualitative findings can be used to 'illuminate' quantitative data (Parlette & Hamilton, 1972), reducing the need for speculation or subjective interpretations on the part of the quantitative researcher. Such use of 'triangulation', in terms of a combined methods approach in social science research, has been well established (Denzin, 1978; Williamson, Karp

& Dalphin, 1977). As Connidis (1983, p. 334) points out, "the usual assumption underlying this view is that any single method has its own inherent weaknesses; combining approaches helps fill the gaps left by each one". However, perhaps founded in traditional misconceptions of such methods as lacking 'rigour', educational computing research has largely shied away from a qualitative approach to data gathering and analysis; aside from a few notable exceptions (e.g. Schofield, 1995; Singh, 1993).

4. The need to ask 'wider' questions of educational computing

Allied to this need to broaden methodological horizons is the fundamental need to start asking wider questions of education computing. If we are to attempt a more objective, detached analysis of ICT in education then it would seem appropriate to move beyond the linear 'cause and effect' model of technological and social determinism and explore alternative perspectives on society and technology. There is clearly a pressing need to step beyond the limitations of previous analyses if we are to gain a deeper understanding of educational computing. Above all, researchers need to be aware of the social, cultural, political and economic aspects of educational computing; the 'soft' as well as the 'hard' concerns. By considering alternative theoretical perspectives we can begin to form a multi-dimensional view of what is a very complex area of education. Given the increasing salience of ICT, research cannot afford to spare educational computing the analyses that technology has been subjected to in other areas of the social sciences.

At this point it is worth reconsidering Qvortrup's (1984, p. 7) argument that computing "cannot be properly understood if we persist in treating technology and society as two independent entities". This perspective strongly suggests that we move beyond the view that educational computing as a technology is separate from society in either its cause or effect. Thus education computing research needs to make a conscious effort to move away from positions of either technological or social determinism towards a perspective that avoids drawing a technology/society distinction, and focus on the social, cultural, political and economic contexts where technologies are developed, and the ones where they are used (Bromley, 1997).

4.1. The social aspects of educational computing

There is, therefore, a need for educational researchers to pay more attention to opening up the 'black box' of technology (Grint & Woolgar, 1997). Educational innovation can be understood as a 'garden of forking paths' (Williams & Edge, 1996) where every stage in the development of a technology is reliant on social and technological factors, resulting in a direction, or 'trajectory', of development shaping both the content of the artefact and potential technological outcomes. Educational computing, then, is borne of a series of technical and social influences from its conception to implementation.

From this social shaping perspective, the idea that technology is inherently neutral is obviously a nonsense. Yet educational computing continues to be justified by many of its advocates in terms of social justice and equality of opportunity — as a great social leveller for

learners and teachers alike. But the popular portrayals by governments and policy-makers of, for example, African classrooms and remote Vietnamese villages enjoying on-line access to state-of-the-art Western education (e.g. Barber, 1999; Clinton, 1998) show little sign of being realised. Indeed, on a global level, social inequalities in terms of access to ICT appear to be widening rather than diminishing. For example, although 147 million people are currently estimated to be on the Internet almost half of them are to be found in the USA. Similarly, whereas one in four Australians are 'on-line', in Africa the ratio is nearer to 1 in 4000 (Vidal, 1999). In the same vein, research repeatedly tells us that disparities in ICT, for example between 'rich' and 'poor' schools or male and female students, persist even in technologically-rich countries such as the USA, Australia and UK (Durndell & Thomson, 1997; Hickling-Hudson, 1992; Shashaani, 1993). This is not to say that the social aspects of education technology should be seen merely in terms of 'information rich' and 'information poor'. After all, as Webster (1995, p. 97) reasons:

> ...to distinguish between the 'information rich' and 'information poor' both avoids precise delineation of who these are and fails to consider the range of different positions...In short the model lacks sufficient sociological sophistication.

Instead, educational computing research needs to develop more precise understandings of the patterns and implications of different levels of access to, and exclusion from, educational ICT. This is allied to the wider social effects that differential levels of use of technology may entail; for example, in terms of changing patterns of communication, interaction and social relationships between learners, teachers and institutions as well as the 'social construction' of educational computing.

4.2. The cultural aspects of educational computing

Any analysis of educational computing also needs to consider the cultural contexts in which technology is being used. Although a fiercely contested concept, conventional definitions state that cultures are systems of ordinary, taken-for-granted meanings, values and symbols, with both implicit and explicit content that are, deliberately and indeliberately, shared amongst members of a social group (i.e. Erickson, 1987). Thus, it has been strongly argued that cultures and sub-cultures have an important influence on educational processes in a way that is common across individual schools, school districts and even countries (Siskin, 1991).

At a global level, there are already indications that countries' approaches towards educational computing have been strongly mediated by 'national' cultures; from the 'village market' national cultures of the USA and UK reflected in their 'laissez-faire' market-driven policies, to the Singaporean 'family' national culture reflected in the centralised, government-directed IT2000 vision (Garfield and Watson, 1998). Thus cultural variations in individualism and collectivism, norms of power distribution and short-term/long-term orientation can both affect and be affected by the implementation of educational ICT. For example, the ambitious goals of recent education technology policies in countries such as Japan, Malaysia and Singapore can be traced (at least in part) to a strong cultural faith in technology (Latzer, 1995). Similarly, issues of national culture are also prevalent in Singapore's on-going attempts

at controlling, and in some cases censoring, individuals' access to the Internet (Birch, 1998), where other Western countries have tended to shy away from any notion of overtly controlling the Internet. The extent to which national cultures affect the eventual 'shape' and effectiveness of education computing policies remains to be seen, but it seems that caution should be taken when trying to directly compare the experiences of one country with another.

Similarly, at a more 'micro level' one must also be aware of the importance of schools as cultures on the implementation and eventual effectiveness of education computing. As Ball and Bowe (1992) contend, even the implementation of a relatively 'rigid' educational policy is shaped by the influence of educational sub-cultures. Indeed, there is little reason to assume that education computing is any different, with technology constantly fighting a battle against pre-existing educational cultures, occasionally succeeding but generally failing to be effectively adopted (Goodson and Mangan, 1995). This viewpoint echoes Eraut's (1991, p. 37) argument that, "the insertion of a computer rarely affects either the curriculum or normal classroom practice: its use is assimilated to existing pedagogic assumptions". Nevertheless, as they note (p. 613), aside from a few notable exceptions, educational research is lacking "a developed analysis of the challenge which computers in classrooms may present to the well established cultures and sub-cultures of schools".

4.3. The political and economic aspects of educational computing

Finally, there has been a general reluctance within the literature to recognise that educational technology is also shaped by political and economic concerns. Thus researchers have tended to ignore the dynamics of advanced industrial society in shaping the development and implementation of technology. As Webster and Robins (1986, p. 65) surmise, "technology ought to be perceived as a product of capitalist development, as constitutive of capitalist social relations, and as a means of perpetrating those relations". However, in adopting this perspective we should not just view technologies as simple direct translations of economic and political imperatives into tangible machines and practices but take a more sophisticated, less reductionist focus on the role of various groups and interests involved in the processes of technological innovation.

For example, much has been written about the military and economic shaping of computers. It is an often repeated argument that the genesis of computerised technology intrinsically embodies capitalist over public interest criteria, reflecting the commercial and military research and development that has initiated most of society's technology (Noble, 1991). Thus, information technologies such as the computer are developed and shaped primarily with corporate capitalism in mind. Although IT serves "nicely the world business system's requirements" (Schiller, 1981, p. 16) this 'construction' of IT is not necessarily based upon the fundamental requirements of educational systems.

This political economy view of educational computing has gained renewed importance with the rise of global telecommunications networks presently embodied in emerging information superhighways. With digital information seen as fast becoming the dominant form of capital (Castells, 1996) the political–economy perspective looks set to continue in its relevance to the macro shaping of educational computing. Similarly, at the classroom level, some commentators (e.g. Apple, 1987; Apple & Jungk, 1990; Bryson & de Castell, 1998) have begun to extend the

work of Braverman in identifying the long-term tendency of educational technology to de-professionalise, or de-skill, the work of the teacher. Similar concerns have also being raised over surveillance aspects of the Internet as a 'Super Panopticon' (Poster, 1995) and means of extending centralised control over educational processes rather than the notions of liberation popularly associated with telecommunications technology.

5. Conclusions

All these points are not made to dismiss or devalue the vast body of education computing literature that has accumulated over the past 30 years. Such work has, after all, laid invaluable foundations for where the field finds itself today. However, as computers and education move into a new era of heightened importance so must education computing research. If ICT is to become an integral part of day-to-day educational processes there is an urgent need to find out how education computing is currently working out in practice. To this end, research must recognise and explore the web of mediating factors that technology comes into contact with once it is placed in educational settings. The social, cultural, economic and political dimensions of educational computing must be addressed if research is to go any way to effectively analyse the success or failure of the many national initiatives described at the beginning of this paper.

Above all, research into educational computing needs to expand its outlook and draw from a broad range of approaches to examining technology. Thus work in educational settings can be strengthened by multi-disciplinary perspectives; from human–computer-interaction and cognitive psychology to sociological and cultural studies, political science and human geography. If education computing is to mature into an area of mainstream educational research and keep abreast of the burgeoning role of technology in education policy and practice, then such wider perspectives must be taken into account.

Indeed, there are already some encouraging pointers among current literature to guide such a progression. The Australian work of Bigum (1997, 1998), Green and Bigum (1993) and Parlo Singh (1993, 1997), alongside the US work of Bromley (1992, 1995), provide invaluable insights into the day-to-day negotiations between technology and other educational actors. The Canadian work of Goodson and Mangan (1995) and Bryson and de Castell (1998) offer similar insights into the socio–cultural aspects of computers and classrooms. Moreover, excellent discussions of the political and economic aspects of educational technology can be found in Apple (1987, 1997), Apple and Jungk (1990) and Robins and Webster (1989, 1999). Yet the challenge now facing educational researchers is to empirically build upon these foundations and make such work an integral, rather than marginal, part of education computing research. While a need for the traditional paradigms of experimental and small-scale survey work remains, at the very least such work needs to be reinforced and contextualised with the type of research questions and approaches that this paper has sought to profile.

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