

Thinking about new learning environments ®

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ABSTRACT

The move to embrace new information and communication technologies (ICTs) in all educational sectors invites scrutiny of the consequences of their use. However, the bulk of the literature in the area of ICTs tends to be limited to advocacy for, or description of, their application. As a response to Mark Windschitl's (1998) call for research which is more detailed and critical, this paper maps several sets of literature which might inform such research. These literatures address: post-modern views of culture, organizations and power; views of educational management, including the specification of curricula; social constructivist views of learning; and, ecological views of communities and resources. The purpose is to provide a conceptual basis for an examination of the intersection of the affordances of ICT-rich learning environments, pedagogy and learning, in ways which allow both critical scrutiny and informed speculation on emergent possibilities for effective practices.

The paper acknowledges that ICTs are being introduced into quite complex environments. These are outcomes of a multitude of prior investments, many of which militate against fundamental change in educational practices, as is well documented in the educational reform literature. Given such contexts, thinking about new learning environments needs to draw on multiple perspectives in order to engage effectively with these inherent complexities. Moreover, it needs to be informed by scholarship that is as contemporary as the new technologies if we are to move beyond applications of these technologies that merely extend the shelf life or the reach of old pedagogies.

The following is an extract from a colleague's reactions to involvement in the initial stages of development of a new campus of my university. It is a purpose-built IT-rich campus where all teaching involves the use of Web-based resources to support 'flexible learning'. The ratio of PCs to students is 1:6, and all PCs are networked. All teaching also involves elements of on-campus face-to face teaching, The reactions exemplify the sense of loss and uncertainty which so often accompanies significant change:

Q. How, if at all, has your involvement with the [new] Campus initiative changed your view of your role as a lecturer?

A. Given that the duties of developing materials for [the campus] has come at pretty short notice, and on top of our normal workload, there has been very little time to develop this sort of perspective.

I suppose the main change is that I have lost any illusions I might have had about being part of a community of scholars, and I now see myself - or I think the university sees me - simply as a production or office worker in a large hierarchical organization.

Q. What questions and/or concerns remain unanswered, or continue to challenge your thinking?

A. It would be useful to know exactly what the University thinks flexible learning is. The descriptions of [some] people ... make sense, but the university's presumptions seem quite different.

It would also be useful to know what the educational justification for this approach is. ie does flexible learning work? Nobody really seems to know.

Q. What major changes do you expect in your practices and/or role over the next two years?

A. No time to think this far ahead. *We are just coping.* [my italics]

This seems a far cry from the optimism that so often accompanies the advocacy of the potential of information and communication technologies to create effective new learning environments (NLEs), as exemplified in the later excerpts from the policy statements of Australian states. I hasten to add that this colleague is seen by colleagues and students as an exceptionally effective teacher. Just how far apart is the promise from the reality? What sort of research do we need to answer such questions?

The 'new' challenges

It is a truism to suggest that compulsory and post-compulsory education in most OECD countries is facing a number of challenges that are quantitatively and qualitatively different from those they have faced. There are many recently written versions of these 'new' challenges. I want to draw on a number of these to illustrate their nature and principal causes.

Steve Ehrmann (1996) suggests that education is facing a 'triple challenge'-to increase the accessibility of high quality education in cost-effective ways. He also points to the potential value of information and communication technologies (ICTs) as a basis for responding to this challenge. The influence of his work is seen in the reports of both the Dearing and West Committees where the nature and cause of this triple challenge are elaborated. The report of the Dearing Committee-*Higher Education in the Learning Society* (NCIHE 1997), suggests that 'external changes' have been, and will continue to be, a significant source of challenges.

External factors have affected the development of higher education since the Robbins report on higher education in the early 1960s. We judge that external changes will be even more influential over the next 20 years. (Introduction, para. 16)

The report of the West Committee acknowledges the likely impact of "increasing globalization of education services and advances in communications technology" in its opening paragraph (CRHEFP 1998, p. 1). Later the report identifies a number of specific challenges facing the Australian higher education sector (pp. 55-56), two of which are directly linked to the availability of ICTs:

- the information and communications revolutions will provide many opportunities for higher education administration, teaching and research to be undertaken in better ways;
- taken together, the information and communications revolutions and growing competitive pressures will generate pressures for change in the overall structure of the higher education sector.

Specific Australian policy statements affirm an intended relationship between the broader developments of ICTs and expectations of post-secondary education, training and lifelong learning. The relationship is seen as mutually reinforcing. For example, the document *Technology 2000: Improved learning, teaching and management through technology*, issued by the Education Department of Western Australia in November 1997, states:

IT has the potential to transform the nature of teaching and learning - to empower teachers to become mentors and facilitators and students to become independent, life-long learners. (p. 6)

The Victorian Department of Education acknowledges this relationship in terms of this potential and external demands:

The focus of the Department of Education's communication and multimedia strategy is to realise the potential of technology to enhance the quality of all aspects of education, especially student learning. To compete successfully in an information rich, technologically-enhanced and rapidly changing environment, students will need to be highly skilled and flexible in their ability to use technology in all its forms. (*Learning Technologies in Victorian Schools 1998-2001* 1998, 8)

The reference to 'independent, life-long learners' also highlights the intention to achieve self-regulated access to learning.

ICTs are seen as essential ingredients in the development of NLEs in all sectors. In universities we have 'smart' lecture theatres, while all primary and secondary schools are being connected to the Internet. However, many educators (including my colleague cited above) see this move as being driven by policies based on 'external factors' rather than arising from the educational efficacy of their use. This thesis is difficult to examine through analysis of the current research because, unfortunately, the overwhelming majority of literature in the area either advocates or describes the use of ICTs in ways that uncritically focus on the technology. This is in keeping with Windschitl's argument that new questions need to be researched, questions such as "How is the introduction of this technology changing pedagogical practices?" (1998, 28).

Meta-components of NLEs

As an initial response to such calls, this paper maps several vantage points from which to pursue more searching questions about NLEs and their educational efficacy. To do so, it moves to make sense of learning environments in terms of an expanded interpretation of the

concepts of *hardware*, *software*, and *wetware* as meta-components of those environments. *Hardware* is taken to represent the physical infrastructure of the learning environment. The elements of *hardware* include ICTs, on-campus facilities, home-based resources, and people. Following Conceição et al (1998, p. 187), *software* refers to "knowledge that is codified and stored outside the human brain, in, say, books, CD-ROMS, computer hard drives, papers, blueprints, and so on". Thus, *software* includes discipline-focused understandings, as well as educational understandings elaborated in theorizing about pedagogy, including: post-modern views of culture, organizations and power; views of educational management, including the specification of curricula; social constructivist views of learning; and ecological views of communities and resources. *Wetware*, on the other hand, refers to "the knowledge stored in the wet computer of the human brain, including belief, skills, talent, among others". The educational discussion of *wetware* focuses on students and teachers, but extends to many other groups, including those responsible for policy development, parents and the broader community. Conceição et al (1998, p. 189) suggest that "wetware and software are two faces of the same coin, two inseparable aspects of knowledge accumulation". This recognizes the central role of *wetware* in the interpretation and elaboration of *software*.

Of the three meta-components-*hardware*, *software* and *wetware*-elements of one or other are nearly always a casualty in discussions of educational practices. For example, advocates for the use of ICTs often seem to assume that delivery of information-as-software is all that is required to support learning-that teachers-as-wetware can be made redundant through very clever multimedia products (Garson 1999). On the other hand, those who contest this view often underestimate the very significant contributions to learning made by books-as-software, and to overestimate the contributions of teachers-as-wetware. The premise here is that accessible, high quality, cost-effective education can be provided in a number of different learning environments. Indeed, differences between those environments may be an essential pre-requisite to that outcome. The key imperative is to identify the conditions under which those contributions are positive or negative in order to help administrators and educators make better decisions about how to design new learning environments that are educationally effective and sustainable.

I want to turn here to consider NLEs from the vantage point of educational understandings elaborated in new educational theorizing about pedagogy. This brief consideration will draw on post-modern views of culture, organizations and power, views of educational management, including the specification of curricula, social constructivist views of learning, and ecological views of communities and resources. That consideration will focus on elements of the three meta-components elaborated above with the intention to illustrate how new thinking, drawing on the elements of *software* noted above, offer exciting and insightful lines of research into NLEs.

New thinking about NLEs

Debates rage as to the nature, and degree of uniformity, of the broad cultural conditions that we are currently experiencing. The terms 'modern' and 'postmodern' are used to signify a sense of discontinuity between a modernist culture underpinned by Enlightenment thought, and cultural values and emergent cultural practices which resist this unified version of cultural advancement. A concern with the postmodern can be understood as a recognition that 'things have changed, they aren't as we expected them to be' in quite challenging and discontinuous ways-that is, a concern with 'the postmodern condition'. This is accompanied by an ongoing condition of uncertainty, and (for some) anxiety. And it is the condition that allows postmodern scholars to speak of this as contributing to *the end of enclosure*.

The term *enclosure* is used to indicate attempts by institutions to create contexts in which the occupants define the particular rules and practices that govern internal operations (Deleuze 1992). This intention is often expressed in terms of a need for operational cohesion, stability and autonomy. Traditional practices can be seen as an attempt to 'enclose' education in secure boundaries. In the postmodern context, Deleuze and others characterize attempts to maintain 'sites of enclosure' as failing. In many instances this is addressed in terms of the failure of boundaries or borders. For schools this may be experienced in terms of increasing expectations that decision-making will be opened to external influences. In the United States the trend is evidenced in the rapid development of the 'charter school' movement (see Manno et al 1998). As schools become more accountable to their local communities teachers are experiencing increasing levels of surveillance and control in their professional decision-making. This rise in external surveillance and accountability is also evident in higher education (Taylor 1999a).

The *end of enclosure* challenges all organizational designs that rely on traditional and/or centralized *software* for planning, control and direction. One of the reasons for this rest with the lack of continuity between the assumptions underlying those policies and the underpinning practices within the unbounded context of implementation (Marion 1999). Another is reflected in the discontinuities within those policies (Bergquist 1995). This is a challenge for those who administer and lead educational systems and institutions, given its shake-up of many assumptions associated with traditional practices.

For example, traditional curriculum practices are challenged by the dissolution of boundaries around the process of education (Taylor 1999b). Where schools were once the site at which key educational understandings and capacities were first encountered and engaged with, those encounters and engagements are increasingly experienced in less-formal settings, particularly the home. Educational television provides alternatives to schooling-*Sesame Street* being an almost universal example. ICTs, particularly access to the Internet, provide a rapidly expanding range of options. This is a challenge for those whose authority rests with their expertise as knowers-particularly teachers-and for the information-focus of traditional educational *software*.

The policy-level consensus on the need to achieve lifelong learning includes reference to the development of capacities for self-regulation and self-discipline. It includes a focus on collaborative learning and creative thinking, and reflects a belief in the potential of ICTs to 'transform the nature of teaching and learning'. While the policy statements and research literature tends to rich in this rhetoric, there is little evidence that the very significant literature on self-regulation and metacognition associated with social constructivism, as represented in the work of White and Frederiksen (1998), is being used to inform the design of NLEs. White and Frederiksen provide strong evidence that metacognitive development of learners is essential to equitable learning outcomes, and can be addressed through digital *software*. Nor is there robust evidence that the extensive research on students' approaches to learning, as represented by the work of Prosser and Trigwell (1999), is influencing the research of NLEs.

Recent research into the development of ICT skills in Australian schools as reported by Meredyth *et al* (1999) identifies additional challenges for the design of accessible NLEs. This research provided survey responses from a representative sample of schools from all Australian States and Territories, and from all levels (primary and secondary) and sectors (state, Catholic and Independent). In all, 222 principals, 1258 teachers and 6213 students completed the questionnaires. This research indicates that most of the ICT skills development of Australian students (and teachers) is occurring outside of formal educational settings-largely in the home. Such findings pose a double challenge for education. The Internet is increasingly facilitating rapid and relatively unregulated access to vast amounts of

information, information that is often far more up-to-date than that available through conventional instructional practices and media. In addition, the skills necessary to access this information are also increasingly being developed in informal settings. These point to the end of enclosure for formal educational practices generally, and challenge the possibility of achieving equity of opportunities for learning through any curriculum design operating within a formal educational institution.

Of particular interest to this work is research on the demographics of access to, and use of, ICTs. In the USA, the rate of growth in access and connectivity is closely related to household income (Bikson and Panis 1997). Between 1989 and 1993, home-based access to computers increased from 35% to 55% for those in the top quartile of household income, while for the bottom quartile, the increase was from 6% to 7%. The authors conclude thus:

There are information society haves and have-nots; membership of these two classes is significantly predicted by income, education, and-to a lesser extent-race/ethnicity, location, and age. Except for gender gaps, these disparities have persisted over a period when the technologies of interest have decreased dramatically in price and increased markedly in user-friendliness. More worrisome still, gaps based in income and education have not merely persisted but have in fact increased significantly. There is nothing in the data, then, to suggest that, without policy intervention, these gaps will close. (Bikson and Panis 1997, 426)

In a context where most students learn most of their ICT skills at home this inequity should raise issues for those researching NLEs. The wide availability and use of ICTs offers many opportunities for research which focus on their contributions to equity of access.

One of these issues focuses on the assumption that teachers' *wetware* locates them as the *software* expert within the classroom. But that expertise has often focused on the *wetware*-knowledge that supported student engagement with and development of understandings of curriculum-specified *software*. Few teachers feel authoritative in terms of supporting the development of the capacities and dispositions for lifelong learning, particularly if this involves the use of ICTs (Meredyth *et al* 1999). And there are increasing concerns over the need to align what I am referring to as *wetware*, *software* and *hardware* in order to develop effective NLEs. In particular, several recent papers focus on the need to develop the spatial elements of *hardware* in ways that compliments the focus on *software* (Jamieson *et al* in press). These challenges suggest that teachers will need to develop new forms of expertise, and a sense of professional identity that is more consistent with what Andy Hargreaves (1997) refers to as postmodern professionalism. How might research support such developments?

Foci for research

The preceding discussion presents a number of reasons for informed skepticism about the possibility of NLEs, designed primarily as *software*. New thinking invites a search elsewhere, and in this spirit I want to suggest several promising directions for practice and research.

Before moving to these, I want to acknowledge that current research has generated a very impressive array of insights into 'what works'. For example, we know of the benefits that can accompany the introduction of charter schools (Manno *et al* 1998), and the use of sophisticated software to model expert metacognitive functioning (White & Frederiksen 1998), and a focus on students approaches to learning (Prosser & Trigwell 1999), and use of high technologies in low-income communities (Schön *et al* 1999). These and a myriad of other papers can serve to inform thinking about the development of NLEs. But what they

often fail to tell us is 'under what conditions is it likely to fail and/or work most successfully'. In turn this reflects a failure to look beyond a narrow *software* focus.

The directions in which I am looking tend to be consistent with an acknowledgement of the end of enclosure, and with Foucauldian notions of the operation of power as capillary and non-linear. These points of departure also help to identify what is not possible. Just as it would be naïve to invest in the hope that research alone will reverse the trends to growing inequities, I see little reason to expect that any single 'direction' will bring uniform benefits to all. Thus, there is need for research based on the possibility of a more fragmented and opportunistic approach to the design of NLEs. It would involve constant re-appraisal of the value of any strategy in terms of its actual and potential contribution, in combinations with other strategies, to the broader agendas of accessible, high quality and cost-effective education. No strategy pursued in isolation or in perpetuity is likely to lead to uniform or unproblematic progress. Thus, I am calling for research which is more tentative, more concerned with continuous change.

One direction lies with the use of ICTs themselves. Some see the use of ICTs as yet another addition to the curriculum-yet another topic to be taught in an already over-crowded curriculum. A more optimistic version of this view sees computers as useful tools to augment traditional teaching practices. This leads to the stationing of one or more computers at the back of the classroom, with opportunities to use them awarded to those students who need additional (tutorial) support in particular skills (often basic literacy skills), and those students who use them as a reward-often to play 'educational' games. But these uses do little to change either the *wetware* of student behaviour or the *hardware* of the learning environment, and they tend to reward those who arrive best equipped to learn in these environments-the already advantaged.

An alternative view sees the use of ICT as an integral aspect of the learning environment, rather than as an unwelcome intrusion or an optional add-on. Unfortunately there are few examples of ICT-rich learning environments. The exemplary sites are exceptions. In these cases ICTs have been used as a resource to achieve fundamental reform in everyday practices (see Garson 1999). Schön *et al* (1999) offer interesting examples of effective uses which lie within and beyond formal education institutions. These examples, like the charter school movement, tend to involve very close and sustained engagement with quite specific local conditions and opportunities. These are more ecologically-sensitive uses of ICTs, used to support the development of communities where the use of ICTs is in keeping with the user's discovered needs and interests rather than to any *a priori* judgements of software designers or educators. What Schön *et al's* work also illustrates is that these practices have been created through systematic and long-term efforts, the sorts of efforts that stand against the tide of tradition (or of a quick visit by a busy researcher).

A second direction lies in the problematising of the generalisations that underlie much thinking about NLEs. An excellent example is the work of Rena Upitis (1998), which provides a close reading of the diversity that underlies the generalizations made possible by studies like that of Meredyth *et al* (1999). Over a one-year period she studied the response of a class of Grade 7 and 8 Canadian students to the introduction into their classroom of four networked computers. Her findings invite a more fluid understanding of access to, and use of, ICTs:

It has been shown that both boys and girls feel included in some ways, but even those who are included are not necessarily included at all times and for all purposes. . . It is clear that one cannot simply ask the questions 'Who is excluded?' or 'Who is included?' for, in fact, all of the students are both excluded and included in some way, regardless of gender. (p. 313)

Thus, rather than focusing on advantage or disadvantage in some absolute sense, it may be more productive, and more valid, for research to focus on diversity and difference, and to treat these both as transient and as contextual outcomes.

A third direction lies with research which focuses on the role of communities of educational practice. It is a common-place to find papers which acknowledge the central role of people (*wetware*) and the ecological context in relation to the development of innovation. Less common are papers which engage with that context in systematic ways. The work of Uptis is unusual, but even here the focus is relatively narrow. It tells little of the wider ecological system of educational practice. Conceição *et al* (1998) assert the role of communities of practice as the primary means for diffusion and institutionalization of innovation, as well as for linking *software* and *wetware*. Alastair Bain's (1998) work invites close interrogation of deliberations within communities of practice, seeking to understand how those conversations serve to both resist and promote organizational learning. This resonates with Hargreave's (1997) call for a postmodern professionalism on the part of educators. Here the emergent forms of professionalism "is uniform neither in its practices nor its value orientation; it is a site of ideological struggle over differing versions of 'agreement'" (Nixon *et al* 1997, p. 6). Clearly, it is not sensible to think that these 'struggles' can be contained within the community of educators. A more realistic approach would invite contributions from adjoining communities of interest. My point is that research which is inclusive of a focus on the community of practice seems essential to an understanding of the conditions under which some practices are deemed successful while others wither.

In a collective sense these 'directions' suggest that effective designs for NLEs cannot be sourced as 'software packages' - 'on demand' and 'off-the-shelf'. That is, effective designs may lie outside of the very logic of many of the so-called 'visions' that are guiding educational reform. They require teachers to teach in ways that they were not taught, to "relate differently to communities beyond their school" (Hargreaves 1997, p. 101), and to form new relationships with students and other members of the wider community, including parents. In turn they invite research that seeks to understand the contextual factors which, individually and collectively, make certain outcomes possible.

Conclusion

In concluding I want to point to two meta-challenges facing research into NLEs. In part these challenges reflect the broader socio-political context in which we find ourselves. While research must address the issue of trustworthiness of its findings, the issue of trust in the context of innovation should become the object of research. Taylor (1999a) argues that change is always from something, not just to some new state. His argument is that change necessarily involves loss, especially if the new state is not seen as desirable. There is clear evidence that the introduction of computers into education is threatening for many teachers. Thus there is every reason to assume that some will experience a sense of loss as a result of the development of new learning environments. Further, trust is likely to be a victim of change-induced loss. How can loss be minimized and most usefully acknowledged? How can trust be maintained?

The institutional contexts of most educational researchers are the subject of considerable competitive pressures. That competition is focused on access to funding, and on the 'ownership' of the benefits of research. Open collaboration between researchers focused on NLEs in higher education, for example, is unlikely to gain strong institutional support for collaborative research focused on high-risk institutional strategies. Research that recognizes its context-specific limitations is most likely to involve multiple sites. Collaboration seems essential to this, yet competition militates against it. This is likely to remain an on-going challenge.

Researchers must engage with significant elements of all of the meta-components of any learning environment, and seek to understand how these elements interact. Knowing *that* is different to knowing *why*, and to knowing *how*, and all *software* must remain open to change, ie, learning. My colleague asked 'does it work'. I have argued for research that would inform the *software* by which one might respond-'the most useful strategies which your team might consider for teaching your subject to your students on this campus are'. That *software* is not yet available, yet it is precisely the software so many educators need if they are to make professional decisions about the design of their new learning environments.

Postscript: the end of improvement

It is some months since I wrote this paper. In the intervening time I have had the opportunity to reflect on the thinking that informed it. I now want to revisit several aspects of that thinking in order to highlight issues that tended to be more implicit in the discussion.

I recently had the privilege of reading the final draft of the professional doctorate thesis of a colleague with whom I have been collaborating over the last four years (Draper 1999). This thesis describes very impressive efforts to respond to a vast array of challenges associated with his work in higher education. In the text he made several references to the 'improvement' of his practices. However, that term did not seem to fit his discussion. It suggests that he also focused on coping.

The term *improvement* suggests that we are directing change. It is a term embedded in the Enlightenment project and its fundamental call to progress. Are we really trying to improve education? The answer has to be "YES" - we are committed to that goal, aren't we? But when we look for evidence of improvement it is VERY difficult to find (Cuban 1990). Benchmarks only make sense in a relatively stable environment. For example, it is very difficult to measure improvements in literacy when we are not too sure what literacy might now mean. Does it, for example, mean that kids are now better (than who?) at reading left to right? Or does it are we talking about visual literacy? And if we are, are we focusing on print or iconic symbols? And so on.

We are working in contexts where 'just coping' represents a very significant achievement. And coping is a necessary prerequisite to any nobler achievement.

Our professional work is increasingly interconnected with 'communities beyond the school' (Hargreaves 1997). Agendas for change are being negotiated across those boundaries. We are not just trying to improve our work - we are trying to figure out what our work is (Taylor 1999a). Thus, rather than 'to improve', it seems more useful to adapt - to do the best we can in changing circumstances. As with enclosures (Deleuze 1992), we seem to be working at *the end of improvement*.

This is an adaptive and open process. We influence pressures as well as respond to them (Marion 1999). And expectations/pressures change as we respond. This means that improvement is one possible outcome - as we become more competent and confident, more is expected of us. But should it be our central aim?

In a radical sense, this perspective invites us to focus our change efforts on what is being asked of us - to be more client centred. On the other hand, it invites us to focus on meeting or modifying those expectations, rather than adopting either a servant role, or a follower role - setting out to implement some noble vision. As we embrace the end of improvement we rightly focus on issues of sustainability, even survival. It seems especially prudent to focus

attention on the identification of aspects of current practices that might endanger our survival.

Contextualised in this way, the issue of researching new learning environments has to be read very differently. Windschitl's question - "How is the introduction of this technology changing pedagogical practices?" - no longer invites improvement-focused thinking. Rather than a search for the Holy Grail of generic improvement (or empowerment, or transformation, or any other splendid intention), we might focus on the more local issues discussed earlier. We might also pay more attention to identifying emergent expectations, and give greater attention to communicating our achievements to external communities. And we might seek to learn more effectively from our failures/failings. Self-defined notions of improvement give way to a more contingent and coping-focused engagement with the very complex task of education in these times.

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