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ABSTRACT

This paper looks at challenges that face the epistemological model on which formal education is based as a result of the rapid growth in use of new communications and information technologies (CITs). The argument has three parts. The first describes some phenomena associated with the development during recent decades of these new CITs and their large scale incorporation into diverse social practices. While much of the detail is based in the growth of new technologies in the First World, the nature and directions of this growth impact powerfully on trends in countries like Mexico. The second part of the argument briefly describes what the author sees as an epistemological model underlying formal education. The third part considers some of the ways the phenomena described in the first part challenge this epistemological model, and to that extent, educational practices based upon it. The conclusion to the argument is that in the current context there is an urgent need for educational philosophers, along with other educational scholars and researchers, to consider the implications for epistemology of the new technologies and social practices of the digital age. (Contains 24 references.) (AEF)

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Information, Knowledge, and Learning: Rethinking Epistemology for Education in a Digital Age.

by Colin Lankshear

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Information, knowledge and learning: Rethinking epistemology for education in a digital age

Colin Lankshear

Invited Keynote Address Vth National Congress of Educational Research,

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Introduction

This paper will look at some challenges that face the epistemological model on which formal education is based as a result of the rapid growth in use of new communications and information technologies (or CITs). The argument has three parts.

The first - which is by far the longest part - will describe some phenomena associated with the development during recent decades of these new CITs and their large scale incorporation into diverse social practices. While much of the detail will be based in the growth of new technologies in the First World, it is obvious that the nature and directions of this growth impact powerfully on trends in countries like México.

The second part of the argument will briefly describe what I see as the epistemological model underlying formal education. This is an epistemological model which is very old and deeply entrenched.

The third part of the argument considers some of the ways the phenomena described in the main part of the paper challenge this epistemological model and, to that extent, educational practices based upon it.

The conclusion to the argument is that in the current context there is an urgent need for philosophers of education, along with other educational scholars and researchers, to consider the implications for epistemology of the new technologies and social practices of the 'digital age'. Of course, if we accept the line of argument I offer but do not like the implications that come from it, we may have to address in a deep and serious way the issue of the aims and purposes of education, and the relationship between formal education and the various agendas we see unfolding in the digital age.

Part 1: Some phenomena associated with the rise of new CITs

(i) Knowledge in the postmodern condition

In The Postmodern Condition Jean-François Lyotard (1984) advances what has proved to be a highly prescient and compelling account of scientific (as distinct from narrative) knowledge in so-called 'advanced' societies. His working hypothesis states that

the status of knowledge is altered as societies enter what is known as the postindustrial age and cultures enter what is known as the postmodern age (1984: 3).

Lyotard's analysis of the postmodern condition is a report on the status of knowledge under the impact of technological transformation within the context of the crisis of narratives - especially Enlightenment metanarratives concerning meaning, truth, and emancipation which have been used to legitimate both the rules of knowledge in the sciences and the foundations of modern institutions. His concept of the

postmodern condition describes the state of knowledge and the problem of its legitimation in the most 'highly developed' countries, in the wake of 'transformations which, since the end of the nineteenth century, have altered the game rules for science, literature and the arts' (1984: 3; Peters 1995).

By 'transformations' Lyotard means particularly the effects of new technologies since the 1940s and their combined impact on the two main functions of knowledge: namely, research and the transmission of acquired learning. He argues that the leading sciences and technologies are all grounded in language-based developments - in theories of linguistics, cybernetics, informatics, computer languages, telematics, theories of algebra - and on principles of miniaturization and commercialization. This is a content in which

> knowledge is and will be produced in order to be sold, and it is and will be consumed in order to be valorized in a new production: in both cases, the goal is exchange (1983: 4).

Knowledge, in other words, 'ceases to become an end in itself'; it loses its use value and becomes, to all intents and purposes, an exchange value alone. The changed status of knowledge comprises at least the following additional aspects.

- Availability of knowledge as an international commodity becomes the basis for national and commercial advantage within the emerging global economy

- Computerized uses of knowledge become the basis for enhanced state security and international monitoring

- Anything in the constituted body of knowledge that is not translatable into quantities of information will be abandoned

- Knowledge is exteriorized with respect to the knower, and the status of the learner and the teacher is transformed into a commodity relationship of 'supplier' and 'user'.

Lyotard's critique frames the central question of

legitimation of scientific knowledge in terms of its functions of research and transmission of learning within computerized societies where metanarratives face 'incredulity' (1984: xxiv). In his critique of capitalism Lyotard argues that the state and company/corporation have found their only credible goal in power. Science (research) and education (transmission of acquired learning) as institutionalized activities of state and corporation are/become legitimated, in de facto terms, through the principle of performativity: of optimizing the overall performance of social institutions according to the criterion of efficiency or, as Lyotard puts it, "the endless optimilization of the cost/benefit (input/output) ratio" (Lyotard 1993, 25). They are legitimated by their contribution to maximizing the system's performance, a logic which becomes self legitimating - that is, enhanced measurable and demonstrable performance as its own end.

> Performativity in education at all levels calls for our schools and universities to make "the optimal contribution . . . to the best performativity of the social system" (Lyotard 1984, 48).

This involves creating the sorts of skills among learners that are indispensable to maximum efficiency of the social system which, for societies like our own, is a system of increasing diversity and players in the marketplace of global capitalism. Accordingly, two kinds of skills predominate:

1. Skills "specifically designed to tackle world [economic] competition," which will vary "according to which 'specialities' the nation-states or educational institutions can sell on the world market"

2. Skills which fulfill the society's "own needs." These have to do with maintaining the society's "internal cohesion." Under postmodern conditions, says Lyotard, these cohesion skills displace the old educational concern for ideals. Education is now about supplying "the system with players capable of acceptably filling their roles at the pragmatic posts required by its institutions" (48).

As Marshall (1998) notes

> educational institutions . . . will be used to change people away from the former liberal humanist ideals (of knowledge as good in itself, of emancipation, of social progress) to people who through an organized stock of professional knowledge will pursue performativity through increasingly technological devices and scientific managerial theories (12).

There are several implications for knowledge and learning in the context of formal education.

- According to Lyotard, 'to the extent that learning is translatable into computer language and the traditional teacher is replaceable by memory banks, didactics can be entrusted to machines linking traditional memory banks (libraries, etc.) and computer data banks to intelligent terminals placed at the students' disposal' (1984: 50).

- At higher levels of education, instruction by teachers would be directed to teaching students 'how to use the terminals' rather than transmitting content. Lyotard identifies two aspects here: (a) teaching new languages (e.g., informatics, telematics), and (b) developing refined abilities to handle 'the language game of interrogation' - particularly, to what information source should the question be addressed, and how should the question be framed in order to get the required information most efficiently?

- The primary concern of professionally-oriented students, the state, and education institutions will be with whether the learning or information is of any use - typically in the sense of 'Is it saleable?' or 'Is it efficient?' - not with whether it is true.

- Competence according to criteria like true/false, just/unjust have been displaced by the criterion of high performativity.

- Under conditions of less than perfect information the learner/student/graduate/expert who has knowledge (can use

the terminals effectively in terms of computing language competence and interrogation) and can access information has an advantage. The nearer conditions are to perfect information (where data is in principle accessible to any expert), advantage comes from the ability to arrange data 'in a new way' - to make a new 'move' in the knowledge game, or to 'change the rules of the game' - by using imagination to connect together 'series of data that were previously held to be independent' (1984: 52). Imagination, in the final analysis, becomes the basis of extra performativity.

(ii) Dealing with superabundant information

With the advent of the new CITs we have entered what Mark Poster (1995) calls the second media age, or the second age of mass communications in the twentieth century. The first age, comprising film, radio and television, was based on a logic of broadcast. Here 'a small number of producers sent information to a large number of consumers,' transcending earlier constraints of time and space by initially electrifying analogue information and, later, by digitizing it. The integration of satellite technology with telephone, television and computer media has brought the emergence of a many-to-many logic of communication, which is Poster's second media age. Boundaries between producers, distributors and consumers of information break down, and social relations of communication are radically reconfigured under conditions of infinitely greater scope for interactive communication than in the broadcast model (Poster 1995: 3).

There are some interesting and important contingencies associated with this second media age, and with the Internet in particular.

First, there is the now-notorious issue of the sheer volume of available information. While the phenomenon known as info-glut (Postman 1990: Gilster 1997: 6) or data smog (Shenk 1998) is by no means confined to the Internet and other information technologies, it certainly reaches an apex here.

Second, the Net is a radically 'democratic' inclusive medium where information is to a large extent unfiltered. Paul

Gilster (1997: 38-39) notes that even with the introduction of cable television, conventional mass media are nonetheless exclusive. Certain categories of content are excluded through the filtering decisions and actions of programming executives and the like. While many information sources on the Internet (especially on the WWW) filter and otherwise moderate content in accordance with their perceived interests and purposes, this is in no way the norm.

Third, a great deal of information on the Internet is presented. Gilster (1997: 2-3) notes that with the tools of electronic publication being dispersed practically on a global scale, 'the Net is a study in the myriad uses of rhetoric.' The importance of presentation and the incentives to present information in maximally compelling ways should not be underestimated in the context of what Goldhaber (1998) calls 'the attention economy' (see below).

Gilster (1997: Chapter 7) describes a practice he calls 'knowledge assembly' which he sees as a necessary new literacy in and for the information age. He asks how one builds knowledge out of online searching and caching, and how specific items of information are to be evaluated. He seeks open, non-prejudiced inquiry, which strives for balance, goes where the evidence leads, and aims to get at the heart of the themes or issues in question.

For Gilster, knowledge assembly is 'all about building perspective'. It proceeds by way of 'the accretion of unexpected insights' (Gilster 1997: 195, 219). When it is used properly, says Gilster,

> Networked information possesses unique advantages. It is searchable, so that a given issue can be dissected with a scalpel's precision, laid open to reveal its inner workings. It can be customized to reflect our particular needs. Moreover, its hypertextual nature connects with other information sources, allowing us to listen to opposing points of view, and make informed decisions about their validity (ibid: 196).

Knowledge assembly is about targeting issues and stories

using customized new feeds and evaluating the outcomes. It is the

> ability to collect and evaluate both fact and opinion, ideally without bias. Knowledge assembly draws evidence from multiple sources, not just the World Wide Web; it mixes and distinguishes between hard journalism, editorial opinion, and personal viewpoints. [It] accepts the assumption that the Internet will become one of the major players in news delivery … but it also recognizes the continuing power of the traditional media (ibid: 199)

Gilster describes the tools and procedures of knowledge assembly using the Internet in terms of a five step process.

The first step involves developing a customized personalized electronic news service - a personal newsfeed. This is done by subscribing to an online news service and entering keywords that define the topics or issues you want to receive breaking stories about. The service - often fee charging, depending on the range of information sources it culls - then sends you by email or via a web page which can be tailored for personal use stories on topics of interest as they break. (For more detailed descriptions of the kinds of services available, see Gilster 1997: 201-208).

The second step augments the first, (which draws on formal 'published' information, or 'hard news'). In the second step one subscribes to online newsgroups and mailing lists that deal with the subject(s) of interest. These offer the personal viewpoints and opinions of participants on the issues in question, providing access to what (other) netizens make of the topic. Some newsgroups make their own newsfeeds available, which helps with focused searching by subtopics and the like among the myriad postings that occur across a range of lists on daily and, even, hourly bases.

In the third step identified by Gilster one searches the Internet for background information - e.g., by going to the archives of online newspapers to get a history of the build up of the story or issue thus far. Gilster also mentions

using search engines to find Internet links to sites covering key players in the story or issue. These may provide related stories or other information which helps contextualize the issue or topic, providing additional breadth, variables and angles.

The fourth step involves drawing together other helpful Internet news sources, such as radio archives accessed by software like RealAudio, interactive chat sessions, video archives and so on. Although the facility should not be abused, direct email links might also be used to verify or disconfirm information.

The final step in the assembly process takes us beyond Internet sources of information and involves relating the information obtained from networked sources to non networked sources: such as television, conventional newspapers, library resources, and so on. This is indispensable to seeking balance and perspective, since it puts the issue or story being worked on into a wider context of news and information - including prioritized contexts (e.g., where newspapers consistently run the story on page 1, or on page 12)

These steps toward 'filling the information cache' entail diverse understandings, skills and procedures - many of which are only acquired through regular use and 'practice'. For example, learning to find one's ways around the innumerable mailing lists and news groups/discussion lists; identifying the 'predilections' of different search engines, and which one to use (and with which other ones) for particular areas or topics; how to narrow searches down by refining keyword checks; how to use Boolean logic, and which search engines employ which Boolean commands and protocols, and so on. Gilster also mentions specific 'tools' of content evaluation that one uses along the way to filling one's information cache, item by item: for instance, the credentials of the sources, the probable audience a source pitches at, the likely reliability of the source, distinctions such as those between 'filtered, edited news' … personal opinion … and propaganda (ibid: 217).

(iii) The logic of online information searching and its

constitutive effects

Michael Heim (1993) explores some constraining influences on how we interrogate the world of information - and, indeed, the world itself - that can be seen as associated with normalized practices of a digital regime. He focuses on Boolean search logic, since nowadays to a large and growing extent we 'interrogate the world through the computer interface' and 'most computer searches use Boolean logic' (1993: 14-15).

Heim's underlying point is that to live within the digital regime means that in no time using Boolean search logic and similar computing strategies becomes 'second nature' - something we take for granted (1993: 14). He is interested in how this will 'affect our thought processes and mental life and, to that extent, how we will be constituted as searchers, thinkers, and knowers. He builds on two key ideas:

- The types of questions we ask shape the possible answers we get

- The ways we search limit what we find in our searching.

Heim's account of the relationships between question types and answers, and between search modes and what our searches turn up, focuses on the operating mode of the search engine. On the surface it may appear that search engines have already moved beyond using Boole's tools: the use of AND, NOT, OR, NEAR, etc., in conjunction with 'key words, buzz words and thought bits to scan the vast store of knowledge' (1993: 22). Some search engines now invite us simply to ask them a question or enter a few words. (The 'initiated', of course, still prefer to work with key words and Boole.) But beneath the surface of our natural language questions or phrases the software is still operating pretty much according to Boole. The point is that all such searching makes use of logics that presume pre-set, channeled, tunneled searching: pointed rather than open searching. Invitations from the machine to refine our search (as when too many data sources are identified) are invitations to further sharpen/focus 'an already determined will to find something definite'; to

'construct a narrower and more efficient thought tunnel; to create still finer funnels to sift and channel 'the onrush of data' (1993: 22-23).

Heim contrasts this kind of information scan with what he calls 'meditative perusal' - noting along the way that for some champions of online searching 'meditating' is reduced to reflective efforts to find sharper and more discriminating key words. Information scanning is pre-conceived, focused, highly goal-directed, and treats texts as data. The key values of information scanning are speed, functionality, efficiency and control. The answers we get from scanning are bounded and defined: data falling inside the kinds of spaces escribed overlapping circles in Venn diagrams. We can then use what we get in accordance with our knowledge purposes.

In contrast to this, Heim describes 'meditative perusal' as the kind of 'contemplative, meditative meander along a line of thinking' that we might engage in by slowly reading a book and keeping 'the peripheral vision of the mind's eye' open. Here the reader is open to unexpected connections, meaning and interpretation, options that were taken and others that were not, authorial hunches, tensions and contradictions, and so on. This is an approach to knowledge/getting to know (about) something which privileges intuition, the unexpected, and openness to 'discoveries that overturn the questions we originally came to ask' and to 'turning up something more important than the discovery we had originally hoped to make' (1993: 25-26). Insofar as spaces on the Internet can, like books, be browsed in this mode, doing do will require us to resist the wider web of values and purposes to which search logics are recruited or, at the very least, to be and remain aware of wider options that exist.

(iv) Economies of information and attention

The superabundance of information has been linked to the hypothesis of an emerging attention economy in ways that have important epistemological implications. The fact that information is in over-saturated supply is seen as fatal to the coherence of the idea of an information economy - since 'economics are governed by what is scarce' (Goldhaber 1997).

Yet, if people in postindustrial societies will increasingly live their lives in the spaces of the Internet, these lives will fall more and more under economic laws organic to this new space. Numerous writers (e.g., Goldhaber 1989, 1992, 1996; Lanham 1994; Thorngate 1988, 1990) have argued that the basis of the coming new economy will be attention and not information. Attention, unlike information, is inherently scarce. But like information it moves through the Net.

The idea of an attention economy is premised on the fact that the human capacity to produce material things outstrips the net capacity to consume the things that are produced - such are the irrational contingencies of distribution. In this context, 'material needs at the level of creature comfort are fairly well satisfied for those in a position to demand them' (Goldhaber 1997) - the great minority, it should noted, of people at present. Nonetheless, for this powerful minority, the need for attention becomes increasingly important, and increasingly the focus of their productive activity. Hence, the attention economy:

> [T]he energies set free by the successes of … the money-industrial economy go more and more in the direction of obtaining attention. And that leads to growing competition for what is increasingly scarce, which is of course attention. It sets up an unending scramble, a scramble that also increases the demands on each of us to pay what scarce attention we can (Goldhaber 1997).

Within an attention economy, individuals seek stages - performing spaces - from which they can perform for the widest/largest possible audiences. Goldhaber observes that the various spaces of the Internet lend themselves perfectly to this model. He makes two points of particular relevance to our concerns here.

First, gaining attention is indexical to originality. It is difficult, says Goldhaber, to get new attention 'by repeating exactly what you or someone else has done before.' Consequently, the attention economy is based on 'endless originality, or at least attempts at originality.'

Second, Goldhaber argues that in a full-fledged attention economy the goal is simply to get enough attention or to get as much as possible. (In part this argument is predicated on the idea that having someone's full attention is a means for having them meet one's material needs and desires.) This becomes the primary motivation for and criterion of successful performance in cyberspace. Generating information will principally be concerned either with gaining attention directly, or with paying what Goldhaber calls 'illusory attention' to others in order to maintain the degree of interest in the exchange on their part necessary for gaining their attention.

(v) Multimodal truth

Since the invention of the printing press the printed word has been the main carrier of (what is presented as) truth. Mass schooling has evolved under the regime of print, and print has more generally 'facilitated the literate foundation of culture' (Heim 1999). Of course various kinds of images or graphics have been used in printed texts to help carry truth (e.g., tables, charts, graphs, photographic plates, illustrations). However, Web technology merges pictures and print (not to mention sound) much more intricately and easily than has ever been possible before. As Heim puts it

> The word now shares Web space with the image, and text appears inextricably tied to pictures. The pictures are dynamic, animated, and continually updated. The unprecedented speed and ease of digital production mounts photographs, movies, and video on the Web. Cyberspace becomes visualized data, and meaning arrives in spatial as well as in verbal expressions.

This situation now confronts the primary focus within classroom-based education on the linguistic-verbal-textual resources of reading, writing and talk. Teaching and learning have been seen throughout the history of mass education as principally linguistic accomplishments (Gunther Kress, personal communication). Recently, however, teachers and

educationists have become increasingly interested in the role of visual representations in relation to teaching and learning. 'The importance of images as an educational medium is beginning to be realised, as text books, CD ROM, and other educational resources become increasingly reliant on visual communication as a medium for dealing with large amounts of complex information' (Kress, personal communication).

Part 2: The epistemological model of formal education

I will identify in a broad sweep some of the key elements of the epistemological model that has underpinned education throughout the modern-industrial era. We can then go on to consider how far these elements may be under question in a digital age where more and more of our time, purposes, and energies are invested in activities involving new communications and information technologies.

Throughout the modern-industrial era of print learning has been based on curriculum subjects organized as bodies of content which are in turn based on work done in the disciplines (history, mathematics, natural science, etc.). The primary object of learning was the content of subjects. This was based on the premise that what we need to know about the world in order to function effectively in it, and that is to be taught in formal education, is discovered through (natural and social) scientific inquiry. Even the very 'practical' or 'manual' subjects (cooking, woodwork, etc.) contained a considerable 'theory' component.

Although it often did not happen in actual practice, school learning has also been based on the assumption that, by participating in curriculum subjects derived from the disciplines, learners would not only acquire the content of acquired learning but also come to see how this content gets discovered and justified by experts. In other words, ideally the learner would not only learn a body of truths - e.g., historical truths - but would also learn something how

historians (physicists, mathematicians, etc.) arrive at these truths methodologically and how they are proved and justified. To use a once-common formulation from Anglo-American educational philosophy, knowledge has both its literatures (content) and its languages (disciplined procedures), and successful learning initiates learners into both (cf. Hirst 1974).

The epistemology underlying this model of learning is basically the standard view of knowledge which has dominated Western thought since the time of Plato. This is widely known as the 'justified true belief' model. According to this epistemology, for A (a person, knower) to know that p (a proposition)

- A must believe that P
- P must be true
- A must be justified in believing that P

(see, for example, Scheffler 1965)

This general model allowed for many variations, for instance in theories of truth (correspondence, coherence, pragmatist), in theories of reality (realism, idealism) and so on. But beneath all such variations, justified true believe has been the epistemological standard for two millennia, and has been applied (in a more or less particular way) to school curricular learning.

Part 3: Some challenges facing this epistemology

The ideas presented in Part 1 pose some serious challenges for this epistemology and for established educational practices based on it. I will identify very briefly five challenges.

1. The standard epistemology constructs knowledge as something that is carried linguistically and expressed in

sentences/propositions and theories. This is hardly surprising considering that for two millennia the modes for producing and expressing knowledge have been oral language and static print. To the extent that images and graphics of various kinds have been employed in texts their role has been, literally, to illustrate, summarize, or convey propositional content.

The multimedia realm of digital CITs makes possible - indeed, makes normal - the radical convergence of text, image, and sound in ways that break down the primacy of propositional linguistic forms of 'truth bearing.' While many images and sounds that are transmitted and received digitally so still stand in for propositional information (cf. Kress' notion of images carrying complex information mentioned above), many do not. They can behave in epistemologically very different ways from talk and text - for example, evoking, attacking us sensually, shifting and evolving constantly, and so on. Meaning and truth arrive in spatial as well as textual expressions (Heim 1999), and the rhetorical and normative modes challenge the scientific-propositional on a major scale.

Michael Heim (1999) offers an interesting perspective on this in his account of what he calls 'the new mode of truth' that will be realized in the 21st century. He claims that as a new digital media displaces older forms of typed and printed word, questions about how truth is 'made present' through processes that are closer to rituals and iconographies than propositions and text re-emerge in similar forms to those discussed by theologians since medieval times. Heim argues that incarnate truth as the sacred Word is transmitted through a complex of rituals and images integrated with text-words. In the case of the Catholic church, for instance:

> communal art is deemed essential to the transmission of the Word as conceived primarily through spoken and written scriptures. The word on the page is passed along in a vessel of images, fragrances, songs, and kinesthetic pressed flesh. Elements like water, salt, and wine contribute to the communication. Truth is transmitted not only through spoken and written words

> but also through a participatory community that re-enacts its truths through ritual (Heim, 1999).

The issue of how truth is made present in and through the rituals of the community of believers-practitioners has been an abiding concern of theologians for centuries. Is the presence of incarnate truth granted to the community through ritualized enactment of the sacred word real, or should it be seen as symbolic or, perhaps, as a kind of virtual presence? (ibid.). Heim suggests that this and similar questions take on new significance with the full-flowering of digital media. If truth 'becomes finite and accessible to humans primarily through the word,' he asks, 'what implications do the new media hold for the living word as it shifts into spatial imagery?' (ibid.).

Heim casts his larger discussion of these issues in the context of Avatar worlds being constructed by online users of virtual reality (VR) software to express their visions of virtual reality as a form of truth. These visions are realized and transmitted through what Heim calls the 'new mode of truth.'

2. In the traditional view knowing is an act we carry out on something that already exists, and truth pertains to what already is. In various ways, however, the kind of knowing involved in social practices within the diverse spaces of new CITs is very different from this. More than propositional knowledge of what already exists, much of the knowing that is involved in the new spaces might better be understood in terms of a performance epistemology - knowing as an ability to perform - in the kind of sense captured by Wittgenstein as: 'I now know how to go on.' This is knowledge of how to make 'moves' in 'language games.' It is the kind of knowledge involved in becoming able to speak a literal language, but also the kind of move-making knowledge that is involved in Wittgenstein's notion of language as in 'language games' (Wittgenstein, 1953).

At one level this may be understood in terms of procedures like making and following links when creating and reading Web documents. At another level it is reflected in Lyotard's idea

that the kind of knowledge most needed by knowledge workers in computerized societies is the procedural knowledge of languages like telematics and informatics - recalling here that the new CITs and the leading edge sciences are grounded in language-based developments - as well as of how to interrogate. Of particular importance to 'higher order work' and other forms of performance under current and foreseeable conditions - including performances that gain attention - is knowledge of how to make new moves in a game and how to change the very rules of the game. This directly confronts traditional epistemology that, as concretized in normal science, presupposes stability in the rules of the game as the norm and paradigm shifts as the exception. While the sorts of shifts involved in changing game rules cannot all be on the scale of paradigm shifts, they nonetheless subvert stability as the norm.

3. Standard epistemology is individualistic. Knowing, thinking/cognition, believing, being justified, and so on are seen as located within the individual person (knowing subject). This view is seriously disrupted in postmodernity. Theories of distributed cognition, for example, have grown in conjunction with the emergence of 'fast capitalism' (Gee, Hull and Lankshear 1997) and networked technologies. This is a complex association, the details of which are beyond us here (see also Castells 1996, 1997, 1998). It is worth noting, however, that where knowledge is (seen as) the major factor in adding value and creating wealth, and where knowledge workers are increasingly mobile, it is better for the corporation to ensure that knowledge is distributed rather than concentrated. This protects the corporation against unwanted loss when individuals leave. It is also, of course, symmetrical with the contemporary logic of widely dispersed and flexible production that can make rapid adjustments to changes in markets and trends.

A further aspect of this issue is evident in Lyotard's recognition of the role and significance of multidisciplinary teams in 'imaging new moves or new games' in the quest for extra performance. The model of multidisciplinary teams supersedes that of the expert individual (Lyotard's professor) as the efficient means to making new moves.

In addition, we have seen that in the information-superabundant world of the Internet and other searchable data sources it is often impossible for individuals to manage their own information needs, maintain an eye to the credibility of information items and so on. Practices of information gathering and organizing are often highly customized and dispersed, with 'the individual' depending on roles being played by various services and technologies. Hence, a particular 'assemblage' of knowledge that is brought together - however momentarily - in the product of an individual may more properly be understood as a collective assemblage involving many minds (and machines).

4. To a large extent we may be talking about some kind of post-knowledge epistemology operating in the postmodern condition. In the first place, none of the three logical conditions of justified true belief is necessary for information. All that is required for information is that data be sent from sender to receivers, or that data be received by receivers who are not even necessarily targeted by senders. Information is used and acted on. Belief may follow from using information, although it may not, and belief certainly need not precede the use of information or acting on it.

There is more here. The 'new status' knowledge of Lyotard's postmodern condition - knowledge that is produced to be sold or valorized in a new production - does not necessarily require that the conditions of justified true belief be met. This follows from the shift in the status of knowledge from being a use value to becoming an exchange value. For example, in the new game of 'hired gun' research where deadlines are often 'the day before yesterday' and the 'answer' to the problem may already be presupposed in the larger policies and performativity needs of the funders, the efficacy of the knowledge produced may begin and end with cashing the check (in the case of the producer) and in being able to file a report on time (in the case of the consumer). Belief, justification and truth need not come within a mile of the entire operation.

Even Gilster's account of assembling knowledge from news feeds stops short of truth, for all his emphasis on critical thinking, seeking to avoid bias, distinguishing hard and soft journalism, and so on. The objectives are perspective and balance, and the knowledge assembly process as described by Gilster is much more obviously a matter of a production performance than some unveiling of what already exists. We assemble a point of view, a perspective, an angle on an issue or story. This takes the form of a further production, not a capturing or mirroring of some original state of affairs.

5. So far as performances and productions within the spaces of the Internet are concerned, it is questionable how far 'knowledge' and 'information' are the right metaphors for characterizing much of what we find there. In many spaces where users are seeking some kind of epistemic assent to what they produce, it seems likely that constructs and metaphors from traditional rhetoric or literary theory - e.g., composition - may serve well than traditional approaches to knowledge and information.

Conclusion

The digital age has thrown many of our educational practices and the assumptions that underlie them into doubt. To understand what will be involved in making informed and principled responses to the conditions of postmodern life in computerized societies will depend greatly on our willingness to problematic and rethink long-standing epistemological assumptions and investments. If this paper does no more than encourage us to explore this claim further it will have done its job.

At the same time, the fact that our established epistemological ideals and values are disturbed by trends, directions, patterns, practices, and other phenomena associated with the digital age and its new CITs might encourage us to ask questions about the digital age itself, and about the role and purposes of education and the relationship between education and global directions being

pushed from 'familiar centers of hegemonic power,' and not simply to ask questions about what 'digital epistemology' might look like.

For example, Lyotard's argument about knowledge in the postmodern condition applies to scientific knowledge. It leaves untouched the domain of narrative knowledge which has never been accountable to the epistemology of justified true belief. Moreover, it has been largely excluded from practices of formal education. To redefine the role and purposes of education away from the values of scientific knowledge, and away from logics of exchange, performativity, and the like, might be to emphasize the role and significance of narrative knowledge for education (cf. Esteva and Prakash 1998; Prakash and Esteva 1998).

Alternatively, to retain strong commitment to the traditional epistemology associated with formal education throughout modernity might require us to emphasize within formal education the kinds of practices using new technologies that accommodate their uses to pursuit of justified true belief (e.g., Thagard 1997).

Then again, we may decide that for formal education to prepare learners appropriately for the world they will enter, it is necessary to acknowledge multiple, hybrid, or eclectic epistemologies epistemologies - reflecting combinations of the sorts of ideas and trends discussed here: for example, aspects of a propositional epistemology operating in conjunction with aspects of a performance or 'compositional' or 'rhetorical' epistemology, together with multiple language games of 'truth' and the like.

There is much to think about and many options to negotiate. The only option, perhaps, that is not reasonably open to us is to stand still.

Note

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