Digital tools and challenges to institutional traditions of learning: technologies, social memory and the performative nature of learning

R. Säljö
Department of Education, University of Gothenburg, Gothenburgh, Sweden; and Centre for Learning Research, University of Turku, Finland

Abstract
The purpose of this article is to offer some reflections on the relationships between digital technologies and learning. It is argued that activities of learning, as they have been practised within institutionalized schooling, are coming under increasing pressure from the developments of digital technologies and the capacities to store, access and manipulate information that such resources offer. Thus, the technologies do not merely support learning; they transform how we learn and how we come to interpret learning. The metaphors of learning currently emerging as relevant in the new media ecology emphasize the transformational and performative nature of such activities, and of knowing in general. These developments make the hybrid nature of human knowing and learning obvious; what we know and master is, to an increasing extent, a function of the mediating tools we are familiar with. At a theoretical and practical level, this implies that the interdependences between human agency, minds, bodies and technologies have to serve as foundations when attempting to understand and improve learning. Attempts to account for what people know without integrating their mastery of increasingly sophisticated technologies into the picture will lack ecological validity.

Keywords
Computer assisted learning, digital literacy, learning, learning and computers, learning and technology, literacy and technology, technology and remembering.

Background
On the occasion of the anniversary of this distinguished journal, it is timely to reflect on the field of computer assisted learning and the development of the use of digital technology in education more generally. During the past few decades we have witnessed many significant advances in digital technology. Personal computers (PCs) have become increasingly powerful with fast processors, remarkable storage capacities and sophisticated software. They have become cheaper and mobile, and nowadays, schools in many countries profile themselves by providing students with a portable PC as a basic piece of educational equipment. The integration of technologies and mobility is also a remarkable element of this development: the portable PC and the mobile phone serve as our external memories, information sources and links to the world wherever we are. Without them, many of us would find it difficult to organize our activities. In these developments, there are
many small breakthroughs that are worth remembering. One such sequence of steps concerns the ability to store information and to transfer between computers: the floppy disks (in their two formats, 5¼ and 3½ in., respectively), the CD-ROM, the DVD (still alive), and finally, today we have the omnipresent USB stick, which simplifies our lives as we prepare classes and back up information. Another such development, which has had a noticeable effect on teaching inside and outside academia, is the PowerPoint presentation. This facility represents not just a move from the overhead slide; it has also become a currency, which is negotiated between teachers and students. To give lectures without PowerPoint presentations has become an exception, and lecturers may hear students ask: ‘Will you put that presentation on the course website?’ The response to this question is not just a piece of information: it will affect how students engage in what you say, the notes they take and the manner in which they read the literature. This is a clear illustration that technologies are never neutral; rather, they have implications for social activities, some of which may be foreseen and others which materialize as the technology becomes integrated into specific activities (Perriault 1989).

But, from the point of view of education, perhaps even more significant among these transformations are the networking capacities that follow from the emergence and growth of the Internet during the past 25 years. The Internet stands as the symbol of globalization and the information society that occupies so much attention in public debate (Castells 1996). The world has become a global village in which relationships and identities are formed in new ways and in which information is exchanged between people independently of where they live (Turkle 1995; Castells 1997). Social interaction in the context of virtual communities has exploded, with sites for such activities continuing to multiply. What is now referred to as social websites – such as Facebook, Twitter, Flickr and so on – attract millions of users, as do online games, where some of the most successful ones have more than 10 million subscribers. Finally, a very significant dimension of this general development in recent times is the rather dramatic changes in access to information; we can now connect to websites, databases, libraries and other resources in our own homes and in the classroom. We respond to many challenges by searching the Internet wherever we are.

Digital technology, schooling and research on learning

It would be strange if this dynamic would not have had, and will continue to have, significant consequences for education on several levels. As we all know, this has been the case. It creates dilemmas about how to teach and what to teach, and it has material consequences by cutting into the budgets of schools and universities. In terms of the availability of technology, we find that the computers entering classrooms, schools and universities have broadband access to the Internet with all the resources that this offers, distance education has grown substantially as has online teaching in general, new learning management systems are continually launched, and so on. In recent years, we have seen governments and schools spending money on a new digital tool, the interactive whiteboard (Gillen et al. 2007; Jewitt et al. 2007). Indeed, the introduction of this device may be seen as a symbolic step in which one of the established artefacts of traditional, teacher-centred pedagogy, the blackboard, is on its way out of the classroom. Although in terms of software development dedicated for use in schools, progress is not equally obvious. Digital curriculum materials and multimedia resources have not been able to assert themselves as part of regular educational practices to the extent that some predicted they would.

Digital technology, as a potential for transforming education, has been a major theme of research and development work for a long time. As early as in the late 1950s and early 1960s, there were intense debates as well as some early developmental activities. By the late 1970s and early 1980s, the Apple and the IBM PC (and clones of the latter) began to spread to schools and universities. Even though such tools were initially used mostly for administrative purposes (documentation, scheduling, etc.), their potentials for education were visible and were intensively discussed. In response to this development of digital technology, a lively debate between techno-utopians, sceptics and those standing in between these positions emerged. So there were visionaries who predicted that there ‘won’t be any schools in the future’ and that the ‘computer will blow up the school’ (Papert, cited in Cuban 1986, p. 72; cf. Papert 1980), while others, for different reasons, remained much more sceptical about the revolutionary impact on schools of digital technology (Weizenbaum 1976;
Cuban 1986). Many people, including teachers, have been, and still are, asking themselves how to respond and accommodate to the changes taking place.

In terms of research and developmental work of relevance to learning and schooling, several research traditions and areas of inquiry emerged. The first to appear was computer aided instruction (CAI), a perspective on how computers could transform teaching and learning, which was launched already during the latter half of the 1950s. The CAI concept was largely modeled on behaviourist principles of learning, attempting to use the medium for organizing self-instructional learning materials. The computer software was to serve as an instructor leading the student through those learning materials. This would result in a more stimulating learning environment, adapted to the needs of the individual. The possibilities of individualizing instruction stood out as especially promising because the problems of adapting teaching and learning to the needs and abilities of different groups were, and still are, considerable. The potentials of the new tools were so vividly painted that teachers in the USA eventually started to fear for their jobs as the computers were portrayed as capable of taking over central instructional duties.

After CAI, we have seen acronyms such as CAL (computer assisted learning), CBL (computer based learning), HCI (human–computer interaction), CSCL (computer supported collaborative learning), CMD (computer mediated discourse), CSCW (computer supported cooperative work), TEL (technology enhanced learning) and several others. These traditions, as well as design research more generally, developed more open research agendas in which the interplay between people and technologies in terms of the potentials for collaborative activities, information seeking and community building are at the centre of attention (cf., for instance, Koschmann 1996; Koschmann et al. 2002; Wasson et al. 2003). What has also appeared on the stage are quite elaborate digital learning ‘environments’ that are intended to scaffold student learning, collaboration and inquiry, such as the well-known computer supported intentional learning environments (CSILEs) (Scardamalia et al. 1994). This quite remarkable proliferation of research and research approaches, and the availability of funding to support it, indicates that there is a very strong interest from many and diverse stakeholders in issues of how to use digital technologies in educational settings.

In spite of the rapid technological developments – the extensive research on educational uses of technology, and the continued commitment by politicians and school administrators to reform schooling through the introduction of digital tools – many of the problems of what is referred to as the implementation of information and communication technologies seem to remain. There are still obstacles to fit Information and Communication Technology (ICT) resources into the established practices of teaching and learning in many areas. Moreover, when introduced, the outcome is far from straightforward and not always a success, neither generally (Cuban 2001; Lehtinen et al. 2001; UNESCO 2005), nor in specific subjects or contexts (Sinko & Lehtinen 1999; Hui et al. 2008; Krange & Ludvigsen 2008, 2009; Lantz-Andersson et al. 2008). Solid evidence that the introduction of computers produces significant improvements in academic performance seems to be hard to find. Rather, it appears as if ‘their impact depends on a positive confluence of several variables such as student engagement, group participation, frequent interaction and feedback from mentors, and connections to real-world contexts’ (Sternberg & Preiss 2005, p. xiv). In other words, computers and digital technologies in their own right do not necessarily improve educational practices, and if they do, this will not be in a uniform manner. The problems of what constitutes productive pedagogies seem to be with us for the future as well. But, in spite of this, what is obvious is that the much of the discussion about how to organize learning, how to reform schooling and how to produce competent citizens now takes place under the premises that the recent technologies have introduced.

These complex relationships between technologies that in quite dramatic ways transform our daily practices, and the institutional traditions of organizing teaching and learning are interesting to analyse from a more general perspective: one in which the problem is not reduced to a matter of schools and universities being slow to integrate the technology (Crook & Light 1999). This rhetoric of seeing technology as developing and as providing solutions, and the educational sector as slow to make use of them, is far too simplistic. Schools and universities have been around for a long time and, as institutions, they have developed traditions of organizing teaching and learning that provide reasonable, perhaps even respectable, platforms for considering the gains and losses of innovations.
In the following, I will address two general features of this problem of the implications of digital technology in the production and reproduction of knowledge and skills. I will argue that rather than considering computers and digital technologies primarily as instructional aids, one of the main consequences of why these technologies are so significant is that they affect the manners in which society builds up and provides access to social memory, that is, the pool of insights and experiences that people are expected to know about and to make use of. Then, my second point is that the technology does not facilitate or improve learning in a linear sense, rather it is currently changing our interpretations of what learning is and changing our expectations about what it means to know something.

Technology and learning: a socio-genetic perspective

Discussions of schooling and the digital technologies are complex and, at times, even confusing. First, the new technology is no longer new; it is a taken-for-granted way of interacting with the world of large proportions of the generation(s) that Prensky (2001) refers to as ‘digital natives’. Activities such as writing, calculating, gaming, establishing and maintaining social relationships, and many others are coordinated by such means for a substantial proportion of the young, and not-so-young, generations. The skills for engaging in many of these practices people still develop largely outside the educational system. Second, human learning has always been a matter of inventing, and interacting with, technology and artefacts. To be a competent participant in many traditional activities has involved the mastery of a range of tools and instruments such as knives, bow and arrow, utensils for cooking and, in more recent times, books, paper and pencil, calculators, Personal Digital Assistants (PDAs), and so on. This hybrid nature of human learning and knowing, oscillating between reasoning, social interaction and manipulation of the world through the use of artefacts, has often been difficult to maintain as a position in research (for attempts to do this, see Donald 1991; Cole 1996; Latour 1998; Cole and Derry 2005).

Technology and interpretations of learning

One significant reason why some of the features of digital technologies are difficult to implement in educational practices is that they challenge the traditions of teaching and learning on which institutionalized learning has been based. Digital technology is not primarily a teaching and learning device functioning, to use experimental language, as an ‘independent variable’ that can be introduced to boost learning and performance levels in the system as it exists – even though it may have appeared so at the early days of computer assisted instruction. In fact, considering that most accountability systems of student performance (such as the international comparative studies PISA, TIMSS and so on) use paper-and-pencil tests in which digital resources are not allowed, it is questionable if investments in digital tools will result in higher achievement. An informed guess would be that students who are socialized into a world of keyboards, computer software, the Internet and the affordances of such resources will not perform better on most such tests than students educated in more traditional environments.

Instead, it is through its impact on our culture and our communicative/cognitive activities that technology becomes significant to a rather radical restructuring of how we develop skills and exercise intelligent action. By changing the communicative ecology of our daily practices, and the way in which we interact with the collective resources of our social memory, technology contributes to transforming our conceptions of what learning is: our expectations of what people should master, and how human skills should be cultivated. Certain significant elements of these changes exerting pressure on formal education are important to consider: they are (1) the role of the technology as a tool for storing information and building up a social memory; (2) the consequences of the recent developments in our abilities to have access to social memory; and (3) the increasing capacity of technologies to perform analytical, cognitive-like operations that were previously made by people.

Thus, the modes of relating to knowing, knowledge and social memory that are mediated by digital technology are at odds with some of the established notions of what it means to learn and know within the educational system. The gap is, in my opinion, wide, perhaps even widening. In order to understand this tension between institutional definitions of learning and the affordances of the new technology, it is necessary to go back briefly in history.
Schooling and the reproductive metaphor or learning and knowing

Schooling as an institutional activity emerged in response to social and technological developments. In our tradition, this happened about 5000 years ago in Mesopotamia or present-day Iraq. In the famous city states of the Fertile Crescent, cuneiform writing appeared as a new intellectual (and motor) skill. Writing was integrated into expanding social activities that had to do with trade, legal affairs, registration and taxation (Kramer 1981). As such documentary practices gained importance for regulating social life, the demand for scribes increased, and skills of reading and writing had to be taught more systematically (Visicato 2000). The solution to this bottleneck of lacking skilled people was the invention of the school and the classroom. These were contexts where the objective of the activities engaged in was not to produce food and goods but rather to cultivate people equipped with specific skills. In the first schools, the edduba (i.e. the tablet house), the distinctive roles of teachers and students emerged, and the entitlements and obligations of these positions were defined in a way that would be consequential for the millennia to come. Teachers lectured and students followed whatever was said, they responded to questions and practised the skills of reading and writing. This was a high-tech context of its time, with advanced writing utensils and clay tablets serving as ‘hard disks’.

In the centuries and millennia to follow, texts became significant for building up a social memory; they became the prime external symbolic storages (Donald 1991) or artificial memory systems (d’Errico 1998). Texts were integrated into social institutions as means for remembering and organizing activities. In ancient Greece, philosophy, mathematics, drama and other genres of textual practices were established and gained prominence as valued elements of society and its social memory. The invention and later development of writing, and of technologies associated with writing, did not represent just a new mode of documenting activities in a narrow sense. What we see is a new way of building up a social memory, a store of information, insights and documented human experiences that was to be consequential for learning on many levels and in many senses (Olson 1994).

Expressed differently, humans have always been able to learn and to advance knowledge and technologies that serve to enhance our capacities for performing various activities. What is specific about writing and texts is that they became elements of a cultural development that radically transformed the ability to externalize and objectify human experiences (Donald 1991). Texts became – at least to some extent – publicly available as a social memory. They became constitutive elements of many practices, making it possible to share information and insights between people in new ways. They became partners in thinking and remembering across a range of activities and, borrowing from Nickerson (2005), they were to serve as potent cognitive amplifiers of considerable cultural significance for collective as well as individual action.

As we now struggle to understand the consequences of digital technology as a resource for building up and organizing the social memory, it is worth noticing that this externalization of human experiences into texts did not go unchallenged. Socrates complained, in several ways, about the consequences of relying on such artefacts. In particular, he was concerned about the dangers that writing would destroy memory, as he observed how people began to rely on ‘external written characters and not remember of themselves’. Thus, texts and alphabets ‘will create forgetfulness in the learner’s souls, because they will not use their memories’ (Plato 360 BC; cf. Wolf 2008, p. 74). Similar concerns are often voiced in popular debates today: with ubiquitous computing powers, do we no longer have to learn and remember? Of course, we do have to. But perhaps in this new ecology, what we need to learn and remember, and how we do it, will be different from what we are used to.

The institutional interpretation of learning that was established already at the early age of the edduba heavily emphasized the copying of letters and the memorization of information (Falkenstein 1948; Burns 1989; Visicato 2000). In the fragments of information that are available, it is obvious that exact imitation of the letters written by the teacher scribe – the dubsar – and the exact reproduction of information presented were the expected ‘learning outcomes’ (to use modern Bologna-speak). Improvisation, creativity and reflective commentary on the part of pupils were not expected nor appreciated. ‘The method of instruction was very elementary, and called for no initiative in the pupil: it depended for its effectiveness on his docility’ (Marrou 1977, p. xvi). Thus, even though the introduction of a new institution for learning with a systematic
intellectual training is an important change in the manners in which competences are reproduced in society, the particular interpretation of learning adopted leaned heavily towards memorizing and copying. The metaphor of knowledge and skills embedded in these practices was reproductive; mastery implied imitating and giving back what was presented; the closer to the original the reproduction was, the better the outcome. The meaning-making expected on the part of the student implied preserving content and form of what was presented in the pedagogical setting.

In the continued development of schooling, this reproductive view of learning has exerted a strong influence as an underlying, barely visible, metaphor. Memorizing and reciting texts have been central elements of institutionalized educational practices. To know something in this niche of society has been, and sometimes still is, a matter of being able to give back what has been presented: terms, definitions, grammatical rules, text passages. Furthermore, in the traditional ‘conceptions of knowledge’ (Resnick et al. 2005, p. 79) embedded in many school systems, the material to be learned has been limited to the textbook and its particular selection of information (sometimes even regulated by state authorities) and its mode of presenting the world. Indeed, for a long time, there were few other sources of information available, and when other media, such as newspapers, radio, motion pictures and television, began to appear in society, their role in the classroom and as learning objects was never particularly strong (even though many argued at the time that they would revolutionize schooling; cf. Cuban 1986). The most important learning material has been the textbook.

A revealing example of the consequences of such an institutional assumption about the nature of learning is given by the literacy scholar Vincent (2000, p. 48) in his analysis of how children learned to read in public schools in 18th century France. What Vincent found is that children sometimes went directly from learning the letters in their own language to reading Latin texts. This reading therefore implied that children spelled their way through the Latin words letter by letter but obviously without understanding much of what they read. Such reading implied identifying letters, sounding them out as loudly and as precisely as possible and, at best, combining the sounds into words in a language, which one did not understand. It is unclear if the children even remembered the previous word as they spelled their way through the next one. This is a very particular mode of meaning-making, and the rationale for such an activity cannot be understood unless one considers the institutional traditions of schooling and their reliance on printed texts as objects of learning and practice.

Many educational philosophers and reformists (John Dewey is perhaps the one that comes first to mind) have struggled with the problem of the dominance of this reproductive interpretation. ‘Learning here’, Dewey argues, ‘means acquisition of what already is incorporated in books and in the heads of the elders’ (1963, p. 19). In addition, he argues, there is a tendency in instructional practices to confuse the product of learning with the activities which produce insight and understanding. Thus, ‘statements, the propositions, in which knowledge, the issue of active concern with problems, is deposited, are taken to be themselves knowledge’ (Dewey 1966, p. 187). This conception also seems to be one of the foundations that all reforms of classroom work eventually encounter; the established and taken-for-granted modes of transmitting and testing knowledge, where the outcome is measured in terms of how much information students are able to reproduce.

This interpretation of what it means to learn has not been exclusive to schooling though. It represents a cultural stereotype, which is visible elsewhere. In academic psychology, for instance, research on learning and memory has often relied on verbatim reproduction of nonsense syllables or lists of words as criteria of performance. In fact, modern research was founded on this very idea (Ebbinghaus 1885). No doubt, this tendency to see the exact reproduction of words and terms as evidence of knowledge in itself may be seen as a consequence of the ‘technologizing of the word’ (Ong 1982) that written language brings with it. An exact verbal copy of a term, a definition or a formula indicates that one knows.

In the general perspective outlined above, it is easy to see the transformations that digital technologies and the new media imply for communicative ecologies. Schools no longer have control over information and the information sources that people encounter and find relevant. When a student learns about nature and society in school, he or she will already have had access to alternative sources about many curricular topics such as the animals of the savannah, the Big Bang or political conflicts in the world. But this is not just a consequence of
remarkable quantitative expansion of information that
the new media ecology brings. The dramaturgy of these
media presentations requires that such information
about the world is packaged in different formats as com-
pared with the taxonomic narratives that textbooks in
schools make use of. The authority of the text book will
also often be challenged as alternative versions of
events are available, and in many areas textbook authors
have problems with keeping their texts up to date. Tran-
sformations of this kind, which are linked to the
globalized media ecology, illustrate that the school –
and the teacher and the student – are operating in a new
environment. This is one where the classical, reproduc-
tive approach to learning is increasingly difficult to
maintain even at a basic level: giving back what is
already known is not as relevant as it once was, and, at
any rate, it cannot be seen as the final outcome of learn-
ing. Through technologies, most of the interesting infor-
mation is within reach anyway and without such
cumbersome efforts.

Technological affordances, meaning-making and
changing institutional metaphors of learning

In societies where texts play a central role for documen-
tary practices, literacy skills function as the response
to this particular technology for building up a social
memory. By learning how to read and write, individuals
and groups develop meaning-making skills, which
allow them to interact with selected parts of the social
memory mediated through text (including not just linear
text but also a range of other resources such as images,
graphs, models and symbols). It is therefore not surpris-
ing that the promotion of literacy has been, and still is, a
central feature of what schools are expected to focus on.
High literacy standards are vital for the community as
well as for the individual because this is one of the
pillars of our social memory.

Put differently, and in more general terms, meaning-
making practices, and the cultivation of such skills, are
contingent on technical, social and semiotic features of
how the social memory is organized, and what the
expectations of competent performance are. From a
historical perspective, Resnick and Resnick (1977; Res-
nick 1990) have explored the meaning-making prac-
tices associated with literacy and literacy teaching
in Western schools from the Protestant Reformation up
until after the Second World War. In brief, their conclu-
sion is that the nature of the skills that we refer to as lit-
eracy has changed during this period. The Protestant
literacy that was promoted in the wake of the Reforma-
tion implied that people could read a limited number of
texts, almost exclusively within a religious genre. Luth-
er’s Catechism served as textbook, and what was to be
mastered were the Ten Commandments, Luther’s expla-
nations of the Commandments, The Lord’s Prayer,
some psalms and similar texts. The aim of the teaching
was to inculcate the virtues of the protestant faith and
obedience to the church, the King and other representa-
tives of authority. The concrete nature of the meaning-
making skills required represented a mix: deciphering
letters on the page on the one hand and remembering on
the other. What was to be read were texts that had been
heard in church on many occasions. When reading,
people could thereby rely on memory to quite a large
extent.

During the 19th century, the literacy of the Volkss-
chule gradually replaced that of the Protestant literacy
movement. These new literacy expectations implied,
among other things, the ability to read more varied types
of texts, including the broader repertoire of textbooks
that were used in the expanding school systems with
curricula that began to concern themselves with matters
outside religious and nationalist indoctrination (such as
mathematics, geography and biology). The reading of
an unfamiliar text now became the expected skill, a
target which represents a much more advanced goal for
popular literacy, and which requires extensive training.
But learning was still very much a matter of being able
to give back what was in the textbook and/or presented
by the teacher. The textbook defined the subject which,
in turn, defined what was relevant to attend to.

When we reach the period after the Second World
War, we see the literacy ideals and expectations of
meaning-making skills that immediately precede the
digital revolution. These types of skills Resnick and
Resnick (1977) describe as technical–scientific literacy.
Skills that comprise this type of literacy imply an ability
to read a broad range of text types (newspapers, novels,
public information, technical instructions, etc.). In ad-
dition, there is an expectation that the reader will be able
to understand and grasp the meaning of what he or she
reads. Thus, these are skills that imply being able to see
the point of a line of argumentation, to digest, condense
and synthesize information, and to express it in ones
own words. The latter type of personalization of what
was read was seen as critical and as a symptom of understanding; one should be able to move from text to life and perhaps also from life to text. The use of handbooks may serve as one example of this kind of skill: you read an instruction, seek to understand it and then perform the actions recommended. Curricular documents and teacher normative assumptions of the mid-20th century are full of illustrations of this metaphor (Bergqvist 1990). Pupils are expected to incorporate what they read with their own ideas and assumptions, and as a further step, they should be able to apply the insights they have acquired to what they do in other settings.

What we see in the digital era is how these practices change as a function of the new media situation and the availability of new types of texts in which information is organized differently. The new media situation entails that we now have access to information from a multitude of sources, and that we live in a much more polyphonic world. We have to be selective and learn to disregard much of what we hear and see. We have to pre-select on the basis of interest and relevance, we often read a few lines and then move on to something else. But the critical differences are not just about the amount of information we encounter, the information is also organized differently in a number of ways.

Kress (2003), for example, has analysed these developments from the point of view of the consequences for our meaning-making practices of the increasingly multimodal nature of texts, where written language and images interact in new ways. His point is that we are now experiencing a shift, which can be seen as an extension of the analysis provided by Resnick and Resnick (1977). What Kress argues is that we are moving away from a definition of ‘reading as interpretation’ (2003, p. 50, italics in original), which is a meaning-making strategy and an attitude to texts which comes close to what Resnick and Resnick (1977) characterize as that of the technical–scientific literacy of the post-war period. In the linear text, ‘each word asks to be filled with meaning’ (Kress 2003, p. 59), and the ‘task of reading lay in interpretation and transformation of that which was clearly there and clearly organised’ (p. 162). In the affordances of a multimodal environment, especially on the screen, the meaning-making practices shift from ‘telling the world’ to ‘showing the world’ (p. 140, italics in original). Images and texts now interact in more complex ways, and on the screen or the multimodal page there is not the same strict adherence to reading from left to right as with linear texts. Reading in the latter context becomes more a matter of imposing order and relevance on what is presented, or, in the words of the author, what we see emerging is the practice of ‘reading as design’ (p. 50, italics in original); you select and attend to what is presented in a manner that is steered by your own perspectives and interests.

Reading as design can be seen as an element in a cognitive and communicative response to media with new affordances and new principles for codifying information. Images and texts interact in new ways. In the multimodal context, this will be consequential for how we understand texts and images. The ‘reading as design’ metaphor emphasizes the creative element in the interpretive activities of readers/learners; reading and interpretation go beyond giving back what is already there. What is expected is cognitive work aimed at producing a version of what is seen that is significant for some purpose.

This emphasis on transforming messages seems to be operating at other levels as well; it is not only a consequence of multimodality. Through the documentary capacities of digitized external symbolic storage systems, the social memory has expanded dramatically, and the recent developments of networking systems give us more or less constant access to these vast sources of potentially relevant information. The implications of this development is that, as learners, we are now held accountable not just for what is in one particular text or even in large numbers of sources; the summarizing of what is known is not enough. Rather, it is our ability to make insightful and productive use of the collective resources in locally relevant ways that is of interest (Mäkitalo et al. 2009). In other words, the objectives of learning and knowing become more geared towards producing competences that have to do with abilities of transforming information so that it becomes relevant for specific purposes. Information is stable and can be stored, knowledge is situated and a response to a question or an issue (Liedman 2001). Thus, learning in these cultural and technological environments has more to do with performative action (Wulf & Zirfas 2007) and with the ability to produce insights that are consequential for further action.

For those of us who are interested in the history of learning research and the philosophy of education, this transition to a performative metaphor of learning echoes...
some of the arguments made, and epistemological positions held, by pragmatists such as William James and John Dewey. James, for instance, argued that as a pragmatist one should always ask, what is it that one can do differently if one knows something? ‘Grant an idea or a belief to be true’, he says, ‘what concrete difference will its being true make in anyone’s actual life? How will the truth be realized?’ What is it that you get in exchange for knowing something; what is in other words ‘truth’s cash-value’? (James 1907, p. 120). Dewey in his later writings explored what he referred to as a transactional view of knowing, in which the criteria of insight and knowing are to be found in their consequences for the person learning as well as for the world in which this knowing operates (Dewey & Bentley 1949). This performative nature of learning and knowing thus implies a focus on what is new, relevant and productive, rather than merely on what is true in an absolute sense.

Technologies as partners in learning and knowing

But there is another element of this development that we are currently experiencing that is also worth mentioning and which contributes to this performative turn in the interpretation of learning. In print cultures, the externalization of human knowledge largely, although not exclusively, had the character of information. With the digital technologies we see an increasing capacity to externalize human cognitive functions, and this development will have implications for learning and for the institutional definitions of learning. The classical example of this development is the minicalculator, which appeared at the beginning of the 1970s. In this highly portable artefact, the externalization includes not just digits but also increasingly advanced modes of performing calculations and representing the results in numbers and graphically. What is stored in the artefact are algorithms and rules for performing calculations and modeling mathematical arguments and functions (Shaffer & Kaput 1999). In a similar manner, modern statistical computer software now performs a range of operations at very little cognitive cost for the user. With the data organized in a database, the software can perform operations such as calculating means, standard deviations, rank ordering the data and performing various kinds of statistical tests. The output can be presented in a range of formats numerically, as well as in graphic form. The conceptual knowledge about how to organize the data, what questions to ask and how to handle the software are still with the user, but the algorithmic elements of the problem solving are carried out by the software (Säljö et al. 2006). Similar types of externalized cognition are now found in spell and grammar checks, search engines, Global Positioning System (GPS) navigators, bookkeeping software, face recognition devices and a range of similar resources used in various sectors of society. Within a few seconds, the accountant can produce the sales figures or financial status of a large company, and all kinds of analyses involving a vast number of figures and categories can be performed. The contribution of the human agent concerns formulating the questions, instructing the software to perform the desired operations and evaluating the outcomes, while the algorithmic parts of the exercise are taken care of by the technical partner in this collaborative enterprise.

An interesting development that will be consequential for learning, thus, concerns the rapidly increasing possibilities for interacting with external symbolic storages that perform analytical functions. Information in the social memory is not just easy to access, it is also searchable and analysable in ways that we have not seen before. Statistics software produces a range of descriptive, multimodal information as well as inferences about the significance of the values observed that the informed user can respond to and consider in terms of their importance. At a more general level, this potential of technologies may be seen as an emerging ‘cascade of “mindware upgrades” ’ (Clark 2003, p. 4), and to an increasing extent, we have to accept that such mindwares are integral parts of our meaning-making capacities. An interesting feature of such tools is that they black-box many of the steps to solving problems or reasoning that we are used to engage in. The separate steps that go into performing calculations, organizing and analysing information are no longer visible for the person. The basic principles of double Italian bookkeeping, and the analytical powers that go into analysing the data organized in the software as it operates, are not visible for the user. We may of course be able to reconstruct the separate steps, but we would often not be able to remember all the details of the complex operations that go into our analytical practices. Those are black-boxed through the powerful, user-friendly mindwares that we rely on.

Important elements of the transformations that digitization and technological development imply are
captured under the idea of the hybridity of human cognition and learning as outlined by Donald (1991). Thus, our future intellectual capacities are neither restricted to our innate abilities nor bounded by the skin of our bodies; our minds and mindful practices rely on productive ‘mergers and coalitions’ (Clark 2003, p. 7), italics in original) with powerful and increasingly sophisticated external tools that the socio-cultural evolution produces. We cannot look for human competences solely in our minds or bodies. Instead, our knowledge is expressed in our abilities to merge and collaborate with external tools and to integrate them into the flow of our doings, whether these are intellectual, physical or mixed. To explore the consequences of this development for our interpretation of learning is a challenge that we are currently facing.

Conclusion

The basic argument of my discussion has been that the developments that follow in the wake of digital technology are exerting a pressure on education and the particular metaphors of learning on which instruction has been based. The giving back of what is already known, and the interpretation of a given text per se and as it stands, as metaphors and indicators of learning, are challenged by a performative and transformative view of learning and knowing: to learn something is to be able convert information stored in the expanding external symbolic storages of our social memory into something that is new, interesting and consequential for a practice or an issue. The implications of such a metaphorical construction of learning will have to be worked out within the educational system and its instructional practices. It does not follow from a mere introduction of new technologies. But this development is a challenge for research on learning as well: we need to explore the collaborative, almost incestuous, relationships between our minds, bodies and the increasingly sophisticated mindwares that are integrated into our activities. Mindwares do not think by themselves, even a complex mindware is still a mindware. But when such resources are integrated into most of what we do, and when they reach a level of complexity in which they process and analyse information relevant for social action, then our mastery of such tools is a critical element of what we know.

References


