Learning to learn

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Introduction

> "One of the core functions of 21st century education is learning to learn in preparation for a lifetime of change".

This vision of the future of education, which David Miliband articulated in his speech to the North of England Conference in 2003, suggests the importance of learning to learn in the politics of education. Overall his speech indicates it is an important dimension of lifelong learning and a vital strategy for the workforce to ensure the county's economic competitiveness. One of the purposes of education is to ensure that people are equipped for the future, both as individuals and in terms of the needs of wider society (Carr, 1991). The quotation also implies that teaching in schools needs to include learning to learn as part of the curriculum that is taught. However, this conception of learning to learn also poses some challenges. Part of the role of education is preparation for the future, but this should not be its only function (Dewey, 1916). The balance of short and long term aims of education is a distinctive challenge (Peters, 1967) and the balance of individual and collective needs are all part of the complexities involved in 'learning to learn'.

The aim of this chapter is to provide a summary of evidence from current research in the UK and internationally about learning to learn. This is in order to identify and analyse the emerging trends in society, technology and education which might act as significant drivers of change for knowledge production, creativity and communication in education to 2025 and beyond. The chapter considers a range of ideas, strategies and interventions which the education sector might use in response to these challenges to shape the development of learning to learn in education. The chapter begins with an analysis of the concept of 'learning to learn' and some of the implications for knowledge and creativity in education, with examples from learning to learn projects in the UK and internationally. Further analysis draws on 'architecture' as a metaphor and includes two main dimensions. First the *physical architecture* of learning and learning spaces, particularly schools, and second the design of teaching and learning as a structured or purposeful form of human interaction: the *pedagogical architecture*. It therefore looks at

the design of schools as learning spaces with an historical overview of the nature of space of the school. It also considers some current ideas and trends in the *Building Schools for the Future* programme for redesigning schools as active spaces with a particular focus on learning and learning to learn within and beyond the classroom. This analysis includes an overview of the impact of the physical environment on learning, a review of the history of school building programmes and their effects (or rather their lack of effects), and the impact of learning spaces on pedagogy and learning. The second section looks at the structure of classroom interaction and the advantages and disadvantages for learning, with the role of dialogue central to this. The analysis focuses explicitly on the challenges, risks, demands and opportunities which learning to learn as an educational idea offers for knowledge production, creativity and communication in education in terms of both policy and practice.

Keywords: knowledge, creativity, communication, economics, education, curriculum

Education and change

There appears to be a global consensus that argues for radical change in education, expressed as a belief that education is no longer fit for purpose. One strand of this draws on developments in neuroscience and the implications for learning and pedagogy. The chief argument here seems to be based on the thesis that the current design of schooling and the teaching and learning approaches which operate within formal settings are inappropriate or inefficient for children and young people's learning. Certainly this has popular and intuitive appeal. 'Brain-based' and 'brain-friendly' approaches seem persuasive to the profession looking to enthuse and motivate their charges with the latest techniques inspired by scientific research (Goswami, 2006). After all who would argue for *un*scientific teaching or learning which was *un*friendly to the brain? (For a more philosophical analysis of the relationship between neuroscience and learning see Davis, 2004.)

Another caucus in this consensus considers changes in technology and the rapid pace of development in society, arguing that the new 'information age' requires different skills for the workforce. The ability to adapt and retrain is central to the economic competitiveness of the nation as different skills are required in response to market forces. At the most radical its vision of the future is "de-schooled" (Illich, 1973) where learners acquire knowledge and skills in more informal settings and spaces over the course of their lives as required. The technophiles see ICT as contributing to this by enabling flexible "anytime, anywhere" learning with e-learning, ubiquitous internet access and "just in time" cyber-learning (Borgman et al, 2008). This has created a coalition of what might be called the new progressives, or Cuban's (1993) 'neoprogressives' who are scientifically and technologically literate, making a persuasive case for radical change in education.

The nature of the learning environment is also central to these arguments, with a view that contemporary learning spaces are not appropriate or effective for learning. However the consensus does not hold as far as the solution to these problems. Some argue for change within schooling and formal learning environments to make them more learner- (or brain-) friendly, with others arguing that formal learning will become redundant and replaced by the flexibility and availability of information through technology.

Sections of the educational research community are also part of this broad consensus, though predictably less unified, but similarly arguing for change in education from differing perspectives from theory and research. Drawing on ideas such as radical pedagogy, constructivism, meta-cognition, situated learning and formative assessment they advocate change in schooling according to their particular personal penchant, like

Aesop's fable of the three tradesmen, who each argued that their own particular craft was essential to the defence of their city – from the bricklayer to the cobbler!

From Gutenberg to Google: *plus ça change?*

There have always been calls for education to change however. Each technological advance seems to have heralded the demise of the teacher and current forms of educational organisation, from the arrival of the printing press to motion pictures, with one of the wittiest analyses of this crafted by Harold Benjamin in 1939, using the sobriquet J. Abner Peddiwell:

> "The wise old men were indignant. Their kindly smiles faded. "If you had any education yourself," they said severely, "you would know that the essence of true education is timelessness. It is something that endures through changing conditions like a solid rock standing squarely and firmly in the middle of a raging torrent. You must know that there are some eternal verities, and the saber-tooth curriculum is one of them!""
> Benjamin, 1939

Through his satire he argued for the idea of learning to learn (or at least flexible and transferable Neolithic skills) as an important dimension of any curriculum. There are other historical instances of calls to reform education. John Dewey and the so-called progressive movement of the early 20th century can be seen as a reaction to social and cultural changes in North America and the challenge of urbanisation and industrialisation (Ryan, 1997). Contemporaries of Dewey also saw technology (and multimedia) as the future of education:

> On the average we get about two percent efficiency out of schoolbooks as they are written today. The education of the future, as I see it, will be conducted through the medium of the motion picture … where it should be possible to obtain one hundred percent efficiency.
> (Thomas Edison, speaking in 1922, cited in Cuban, 1986)

What we need to decide for the present time is whether the current pace and scale of change is, on this occasion, of a sufficiently different degree or scale, or whether is this is another occasion when technology meets pedagogy, and, to paraphrase Larry Cuban (1992), pedagogy wins again. Certainly the way we interact with *information* is different in terms of quality and especially the *quantity* of information which is now easily accessible. Information on its own is not the same as knowledge, however, as the latter has a personal quality involving interpretation and meaning (Hendricks, 2005) which, in turn, pre-supposes a purpose in acquiring and using the information. The range and types of information are clearly changing with the advent of digital literacies, but these are not replacing other literacies. Rather they are overlaying them and increasing the complexity of what can and needs to be learned with the demands of multi-layered meanings and more complex semiotic systems (Kress, 2003).

So what is learning to learn?

In one sense learning to learn is a trivial idea, in that we all learn to learn. Humans have evolved to learn effectively by imitation and to be good at learning and acquiring new skills and knowledge. Just consider the rapid development in skills and knowledge from infancy through childhood. As social creatures the desire to learn to learn through participating is part of our early development (Berk, 2008). The concept of learning to learn has been extended in recent years, however, and encompasses the notion that we

will need to become more effective, more efficient and more resilient learners due to the increasing pace of technological and cultural change; a response to Toffler's (1970) *Future Shock*, perhaps. This will mean that we will need to learn for most of our lifespan in order to survive in a changing workplace and wider world. A range of more formal definitions of learning to learn exists, drawing on ideas of metacognition, thinking skills, self-regulation, self-efficacy and self-esteem (see, for example, Claxton, 2002). It is a well-used phrase in contemporary educational debates around the world, but the idea lacks conceptual clarity. In the UK, it is sometimes equated with lifelong learning or at least the foundational elements in lifelong learning skills (Cornford, 2002). It is widely acknowledged to require the development of meta-cognitive skills and techniques (Sternberg, 1998) as well as the development of self-regulation (Hautamaki et al, 2002) and independence more broadly (Rademacher, 2004). In policy terms, learning to learn is firmly part of the skills agenda supporting employability and increased economic competitiveness (Rawson, 2000), as we saw in the political appropriation of the term above. The complexity of what is involved can perhaps best be captured in the working definition used by Hargreaves (2005): "learning to learn is not a single entity or skill, but a family of learning practices that enhance one's capacity to learn." With this emphasis on learning practices, rather than a more individual or psychological description on skills or even a focus on personal dispositions (eg Perkins et al, 1993; Claxton and Carr, 2005) the academic focus has shifted towards learning activities and communities of practice (eg Wenger, 1998) as outlined in some of the publications from the Teaching and Learning Research Programme (TLRP): see, for example James et al (2007). The implications are therefore that learning to learn can best be seen as a multi-dimensional concept involving an understanding of the learning identities which develop over time and through and in response to different situations and contexts (Sfard, 2005) and which involves the development of specific skills and knowledge as well as broader attitudes and dispositions to learning.

Claxton's four generations of 'teaching learning' (Claxton, 2004) provide a helpful way of distinguishing some of the practices that can often be clustered under the general banner of learning to learn in practice.

Phase	**Focus**	**Characteristics**
First generation	Raising attainment	Good teaching is effective delivery of content knowledge
Second generation	Developing study skills	Hints, tips and techniques Study skills techniques
Third generation	Developing teaching through broadening the curricular and cognitive focus	Emotional and social factors (emotional intelligence, collaborative learning) Characteristic ways of learning (learning styles and brain-based learning) Concerned with the *how* of teaching
Fourth generation	Developing learning by engaging students and teachers	Involvement of students in the process (self-regulation) Concerned with how students can be helped to help themselves Teachers themselves involved in becoming better learners Developmental and cumulative

Table 1: Adapted from Claxton's (2004) four generations of teaching learning

In the UK, the Campaign for Learning, a national charitable organisation, has been supporting a Learning to Learn in Schools research programme since 2000 (Higgins et al, 2007) over four phases of research. Phases 1 and 2 mainly investigated Claxton's third generation of learning to learn, with teachers in primary and secondary schools

researching ideas such as emotional intelligence, brain-based learning and learning styles. Phases 3 and 4 have tried to integrate teacher and learner enquiry as part of an active process of learning as central to the process of education (Baumfield and Higgins, in press). The concept of learning to learn is based on a dispositions framework (readiness, resourcefulness, resilience, reflectiveness, responsibility) with an overarching definition of learning to learn as:

> … a process of discovery about learning. It involves a set of principles and skills which, if understood and used, help learners learn more effectively and so become learners for life. At its heart is the belief that learning is learnable.
> (Higgins et al, 2007 p8)

A similar development with remarkable parallels to this project which developed independently on the other side of the globe can be found in South Australia (DECS, 2005). This also started from the view that there is scientific evidence which can inform learning, but evolved a broadly similar model of professional inquiry and research to develop teaching and learning in schools. The outcomes valued as part of this project include learners:

- exercising choice responsibly
- using meta-cognitive skills
- taking responsibility for learning
- accepting alternative viewpoints
- working with greater persistence
- expressing greater hope for a future with expanded opportunities
- experiencing improved progression in site-based programs
- able to articulate their learning
- self-assessing their learning.

These principles draw on a well-established set of ideas which see educational systems as ‘loosely coupled’ (Goldspink, 2007) and recent advances in the application of complex systems concepts to organizational management (DECS, 2005). These concepts, and the UK and South Australian examples, suggest some possible benefits from using self-organizational properties to improve institutional learning. Unlike more rationalist management and market approaches, this alternative model brings to the fore the need for a focus on people and relationships as key aspects of learning rather than structures or centrally determined standards for conformity (Goldspink, 2003). Both approaches emphasise the role of teachers and professional inquiry as part of learning to learn in schools in order to ensure that the difficult balance between complex and sometimes competing educational aims is achieved.

A team based at Bristol University (Deakin-Crick et al, 2004) has developed a research-based approach to learning to learn based on a concept of learning power. The aim was to identify the characteristics and qualities of effective lifelong learners and to develop tools and strategies for tracking, evaluating and recording people's growth as effective real-life learners. Learning power was defined as: “A complex mix of dispositions, lived experiences, social relations, values, attitudes and beliefs that coalesce to shape the nature of an individual's engagement with any particular learning opportunity (Deakin-Crick et al, 2004 p247).

The assessment of these is through the “Effective Lifelong Learning Inventory” (ELLI) with inter-related aspects of learning beliefs and attitudes about learning. Those whose profile is low on these dimensions appear to be fragile and dependent as learners. Strategic awareness appears to be a learned dimension or something which can be developed and taught over time, and in some ways seems to work as the individual's monitoring of the other dimensions. These ELLI learning dimensions appear to be a reflection of the formal curriculum in that they are affected by all subjects and disciplines

in the classroom and beyond (Deakin-Crick *et al.* 2007). What is clear from the data gathered from learners of different ages is that over time, and throughout the course of formal schooling, students tend to become less confident on all of the learning dimensions, especially in terms of creativity. At the same time they tend to become more dependent and fragile as learners. This suggests that in the current system, and at the present time, learning to learn and the development of an increased confidence in one's own learning capabilities is hard to achieve.

Similar to the Campaign for Learning and South Australian projects, a school-based development and research approach involved teachers working with these learning dimensions to understand how they might be helpful to promote learners' self-awareness and confidence in the classroom. They also used this information to decide on new approaches to develop students' learning power. These interventions made a difference to students' learning power profiles after two terms. They became more resilient and more strategically aware of their own learning and less dependent and fragile. There were also some indications that students achieved more in terms of traditional learning outcomes (Deakin-Crick et al, 2007).

The key themes underpinning all of these interventions into learning to learn were the development of teachers' professional vision and values, supporting positive interpersonal relationships in both classrooms and staffrooms involving trust, affirmation and challenge (Hall et al, 2006). Other common features included the quality of dialogue and discussion and the use and development of terminology and language to talk specifically about learning. A further similarity is in the focus on dispositions (rather than learning objectives) as a way to ensure some of the longer term goals and aims of education are not drowned by short term targets and assessments.

Some similar aspects of assessment and engagement for students and the situational nature of learning also form a central feature of the UK's Teaching and Learning Research Programme's *Learning How to Learn* project. This research focused on the *how* (rather than the *what*) and took a narrower view of learning within the curriculum and the development of students' understanding of their academic learning through a focus on formative assessment and feedback in classrooms (Sadler, 1998; Black and Wiliam, 2006). Again key issues such as metacognition and self-regulation by students and the importance of engaging teachers in the process are central to the research (James et al, 2007).

In the European Union learning to learn is one of the key generic or 'transversal' competences agreed as part of the Lisbon framework in 2000 for international progress towards shared goals, and which developed into the European Reference framework of key competences (Fredricksson and Hoskins, 2007; Hoskins and Fredricksson, 2008). Competences have emerged as a significant educational outcome as a result of the demand from policymakers to identify what individual learning outcomes are needed for a citizen to contribute to a modern globalised society, both economically and democratically. The idea of learning outcomes as competences is a blend of the usually separate components of knowledge, skills, attitudes and values. Competences are usually assessed in relation to real-life tasks in terms of being able to do things effectively rather than reproduce knowledge passed from one generation to the next (Hoskins and Deakin Crick, 2008) emphasising the importance of an active and first-person perspective. Again the rationale is based on a conviction that this conception of knowledge will be the most useful for a rapidly changing technological and globalised world, where it is not possible to predict what knowledge will be needed in the next five or ten years, let alone for a lifetime.

> "… it takes a holistic notion of the individual combining the values, attitudes of the individual such as the desire to learn from others in interaction and the valuing of different knowledge with the cognitive processes of building on

> prior learning and the capacity to develop strategies and solve problems to learn something new."
> (Hoskins and Fredriksson, 2008, p11)

At the heart of the European conception of learning to learn is the changing nature of knowledge as a result of technological innovation, and the importance of economic competitiveness with an essential component of a student's education seen as the ability to learn to learn effectively. (For an analysis of developments across Europe see, for example, Moreno and Martin (2007), or for a broader overview see Fredricksson and Hoskins, 2007) There is a further dimension to the European learning to learn agenda, however, in the development of indicators or assessments to track progress towards these objectives. Whilst this is understandable from a political perspective, from an educational viewpoint it raises the possibility of high-stakes assessments (Nichols et al, 2006) and a scenario of learning to learn tests and performance monitoring. The assessment of such competences at national and international level is likely to influence the development of learning to learn in practice, and the greater the stakes the more profound the impact, though the wider impact is likely to be complex (Au, 2007).

At a more profound level the concept of learning to learn is an epistemological one and some of the tensions in the application of the term relate to different understandings of the nature of knowledge and learning. Learning to learn emphasises the process of learning or of coming to know and implies a difference in the quality of knowledge achieved through purposeful activity on the part of the learner. As such it aligns closely with the philosophies of writers such as Dewey, Merleau-Ponty and Freire in terms of the relationship between the learner and what is learned. It emphasises the relationship between the knower and the known not so much as separable, but integrated in the same way that dancing creates both the dancers and the dance itself (Gill, 1993): knowing is an interaction or transaction between the knower and the known (Dewey and Bentley, 1949). Much of what is discussed as learning equates rather to the retention of information assessed through the application of specific academic skills with a logical separation of knowing and known. Conceptually this is difficult, as such acquired information can only really be described as knowledge once it is applied actively. An important facet of this relational quality of knowing is dialogue and interaction, or the application of these ideas creatively by the learner in expressing their understanding through discussion. Of course, Dewey would argue that this is still a limited conception of knowledge, as such activity could still be somewhat artificial and it is only valid once such information is applied in some purposeful inquiry.

> If one is not able to estimate wisely what is relevant to the interpretation of a given perplexing or doubtful issue, it avails little that arduous learning has built up a large stock of concepts. For learning is not wisdom; information does not guarantee good judgement.
> (Dewey, 1910, p106)

A version for the 21st century might replace "*arduous learning*" with "*diligent searching*" and "*concepts*" with "*internet weblinks*", but the underlying point remains the same. Learning is about developing the quality of one's judgement and the facility to use the skills, knowledge or understanding in order to resolve a challenge or problematic situation, but above all this is through action. Such judgements are refined through experience and can be supported with the guidance of a teacher or mentor but are dependent upon transactional inquiry. The nature and availability of information changes the skills and judgements required, but does not alter the challenge of translating information into active knowledge, except perhaps that the increasing scope and scale of available information may increase the complexity of the challenge.

This intrinsically evolutionary and pragmatic stance towards knowledge conceives it as neither ideal or pre-given but discovered in purposeful action. 'Knowing', from this

viewpoint, is always a creative act. Creativity in this sense includes how a child learns to crawl as well as how a musician composes a song. For Dewey, effective learning through expressive or purposeful action was not a gradual approximation to some ideal concept or form or any abstract proposition. It is knowledge because, like good science, it opens up creative possibilities for new ways of perceiving the world and for taking action within and upon it. This conception of knowing and learning seems more appropriate for a rapidly changing technological world where information is widely available, but it is learning, and in learning to learn what information to apply and how to apply it purposefully, that becomes the crucial issue.

The physical architecture and learning to learn

The second theme in this chapter is the nature of physical settings and locations for learning. In the development of learning to learn in schools there has often been a focus on the learning environment and the influence that this has on learners. This has been evident in teachers' focus on creating appropriate conditions, with aspects such as ambient music and access to water. This has its most dramatic expression in the UK's ambitious Building Schools for the Future Programme (BSF) which will see a £45 billion investment which aims to rebuild or renew 3,500 state secondary schools over the next 15 years. A key aim is to create "21st-century environments that will inspire new ways of learning" (CABE, 2007). This section therefore turns to considering the importance of learning spaces and environments, and the question of how designing spaces for learning might differ from spaces for learning to learn. Although the physical aspects of learning environments have effects on both teachers and learners, these are not as profound or direct as most people believe (Woolner et al, 2007). The most important aspects are poor temperature control, bad lighting, poor air quality and acoustics, all of which have negative effects on concentration, mood, wellbeing, attendance and, ultimately, attainment. It is therefore important to ensure that these aspects meet a basic level of adequacy. For the most part this can be achieved simply by conforming to the appropriate standards and regulations, which at least recently were not being achieved by a quarter of secondary schools (Ofsted, 2001). However, the overall relationship between aspects of the physical environment on learning is hard to identify. In a review of the environmental effects in education, Weinstein (1979) was quite cautious about any impact on learning. She concluded that although the 'weight of the evidence suggests that design features can have a significant influence on students' general behaviour … and on their attitudes' (1979, p584), it is difficult to find reliable evidence of a definite effect on achievement. (1979, p599). More recent reviews have tended to be more optimistic about positive evidence for direct as well as indirect effects of the environment (see, for example, Moore and Lackney, 1993), yet many of these effects relate poor performance in schools with poor environments: an accurate and a significant correlation perhaps (eg Schneider, 2002; Young et al, 2003), but not necessarily a causal connection. Implications for designing spaces and planning for learning are much more speculative. Beyond the advisability of meeting basic standards, there is not enough evidence to give clear guidance to policy makers, planners or teachers on how to design for learning or to evaluate the relative value for money of different design initiatives. There are a small number of physical improvements to the environment which are related to improvements in attainment, but once the environment reaches a reasonable standard, a complex interaction of effects comes into play (Woolner et al, 2007) and it is hard to make specific recommendations without deciding on the particular learning purposes for which a space will be used.

Learning environments can also be thought of as composed of different dimensions: the physical, social and the cultural (Horne-Martin, 2004). Although the major concern of those planning and building schools or other learning spaces tends to be the physical elements, any hopes for the effect of changes in the physical environment on learning must be based on an understanding of this complexity of learning spaces. Schools are

systems in which the physical architecture and environment is one of many interacting factors, including the pedagogical, socio-cultural, curricular, motivational and socio-economic. Getzels (1975) suggested that the changes in the typical United States classroom, from rows of desks in a rectangular room through a circle of tables to open classrooms, reflect changes in the cultural conception of learning. This relates to the idea of the symbolic meaning of a particular environment (Proshansky and Wolfe, 1975; Rivlin and Wolfe, 1985; Maxwell, 2000) and such conceptions are clearly behind attempts to improve or revive through physical regeneration. For example, the headteacher at a recently opened school commented:

> 'This is more than just another school in Hackney: it is a symbolic school, an emblem, saying these places should be where children from all backgrounds in inner city areas should come and be successful' (Ward, 2004).

The relationship between people and their environment is a complex one and any impact from changes to a setting are likely to be produced through a complex causal chain. It is an understanding of these mediating chains that is paramount and must take account of issues relating to ownership, relevance, purpose and permanence, especially in understanding the difference between learning and learning to learn. If positive changes are chosen and made by the teachers and learners who used them, this might then produce further positive changes, whereas negative aspects might cause a cycle of decline. Externally imposed changes, regardless of how beneficial their potential, are likely to have less of an effect than changes brought about through genuine consultation and an inclusive design process. Large-scale investment, particularly that which is heralded as 'future-proofed', will necessarily be less organic and rooted in the needs of specific communities than smaller-scale projects.

One of the schools in the Campaign for Learning's Learning to Learn in Schools project (Higgins et al, 2007) investigated how to create a 'learning to learn' classroom by removing all the furniture and equipment and then re-introducing what was needed to support learning and learning to learn. They created learning zones in the classroom to support self-initiated learning in their mixed age Reception and Year 1 classes. However they also reported that there were significant challenges in terms of the curriculum and timetabling. Overall the school was also positive about the impact on children's creativity and self-esteem but recognised the limits of what they could achieve within current expectations (Furnish and Tonkin, 2004).

It is certainly the case that the built school environment can be altered and is open to change and improvement so that, even if such changes are likely only to have a small and uncertain direct impact on learning these changes can be defended, particularly in schools where the students are disadvantaged in other less immediately alterable ways (eg Moore and Lackney, 1993; Young et al, 2003). 'Change, for its own sake, can be a stimulating experience' (Gump (1987, p703) and is potentially catalytic in terms of its effects on learning. The idea that reviewing and trying to change the nature of the learning environment is in itself empowering is discussed by a number of writers (David, 1975; Horne, 1999; Horne-Martin, 2002). This of course needs to be a genuine or authentic process (Dudek, 2000; Clark, 2002). A contemporary text at the time of experimentation with open plan education (IDEA, 1970), argued that all staff need to be involved to realise the potential of the space, while 'there must be extensive involvement of the parents in the planning as well as in the implementation of the programs; otherwise, the new school is doomed before it is even opened' (p20).

The ecology of schools is complex, however, and the forces restraining the use of new and flexible spaces in the other direction are also strong. The indications from previous large scale attempts to change schooling are clear and there are obvious lessons from the past (Woolner et al, 2005). The phrase "part of the furniture' does not mean 'comfortable' and taken for granted for nothing. As Rivlin and Wolfe commented 'It is

rare for a person to move a chair once it has been placed—even in one's own living room' (1985, p7). It is crucial, therefore, for the growing trend of user involvement in design of learning environments to become embedded in normal practice. Learning to learn may need to involve learning to design or at least configure your learning space.

The key message from this synopsis is that considered and targeted environmental improvement is worthwhile but that the solutions are likely to vary widely across the country and should involve both teachers and learners in developing their understanding of learning spaces. The history of ambitious school building programmes (Woolner et al, 2005) warns us that interactive whiteboards and the spacious glass atria of today could be the typing suites and flat roofs of the middle decades of the 20th century. Overall, the evidence is consistent about the importance of involving those who use the learning spaces in defining and solving design problems in schools. A necessary consequence of this is that design solutions for learning (and learning to learn) should be individualised, organic and local. Indeed, the most successful are likely to be those which are seen as temporary or interim solutions and which have within them elements of flexibility and adaptability for new cohorts of learners and teachers, as new curriculum demands and new challenges enable more effective learning and learning to learn in schools.

The pedagogical architecture for learning to learn

One of the regular features of schooling is the arrangement of one teacher to large groups of learners, usually 20 – 30 in most types of schools. This places constraints on the kinds of interactions which are likely to occur. It typically makes the default pattern of exchange in the classroom very focussed on the teacher. The dominant pattern is where the teacher asks a question, a pupil responds and the teacher gives some kind of evaluative feedback. These exchanges are quite brief, lasting only a few seconds (Sinclair and Coulthard, 1992; Smith et al, 2006) and punctuated with only slightly longer explanations and instructions from the teacher. It has been described as Initiate – Respond – Evaluate/Feedback (I-R-E/F) and has clear advantages in terms of control (Mehan, 1979) as each of the episodes of interaction is started and finished by the teacher. It is therefore an effective way of managing didactic interaction with large numbers of students. The aspirations of those who advocate dialogue about learning (eg Alexander, 2004; Wegerif, 2008) may simply not be realistic unless the ratio of teachers to learners changes significantly. It is possible that the structure of this default pattern of exchange can be re-designed to enable more authentic exchanges using particular teaching strategies and techniques (Leat and Higgins, 2002; Smith and Higgins, 2006). Certainly some changes can be achieved by altering the groupings that students work in, such as through co-operative and collaborative group work (Baines et al, 2007) and by approaches such as peer tutoring (Robinson et al, 2005). Even in these situations however the focus of the interaction is still usually determined or at least managed by the teacher. With learning to learn, learners need the opportunity to initiate and determine the direction of their learning, at least for some of the time, so that their sense of themselves as learners can include a sense of control and self-determination.

One of the characteristics of learning to learn projects in classrooms is the change in focus to include explicit discussion of the process of learning (Deakin-Crick et al, 2007; Higgins et al, 2007; James et al, 2007). Many of the structural features remain similar but teachers create space for learners to talk to each other about learning, rather than simply the learning content. Devices such as role play, storyboarding or cartoon structures (Jones and McMahon, 1994; Wall et al, 2006) may also encourage reflection on learning, as can commentaries on learners' portfolios, though again the challenge is to ensure the use of these approaches remains authentic rather than part of the ritual exchanges of schooling. An anecdote from a recent visit to a learning to learn classroom may illustrate this. A Year 6 pupil in one of the Campaign for Learning schools was explaining his digital learning portfolio (created using Microsoft's *Powerpoint*) to the

researchers. He commented incidentally that he was always getting into trouble from the teacher because he was so slow at getting started with adding a new entry, especially as the school year drew to a close, but explained "I like to look through what is in there first so I can see what I did before and what I've learned before I add anything new". The balance between time spent on reflection on one's progress and completion of learning tasks or even the learner's recording of that progress may therefore need redressing if learning to learn is to become embedded in the culture of schools. Certainly one of the challenges that teachers acknowledge in developing learning to learn in schools is in finding the time to address it effectively with the competing demands of curriculum coverage and assessment (Higgins et al, 2007).

There is evidence that collaborative use of technology can be beneficial in enabling more authentic dialogue in formal learning situations (Mercer et al, 2004) and in establishing more effective learning interactions between learners. This is both by structuring the interactions (such as through the interface or software design for turn taking or by pacing a sequence of exchanges) and by scaffolding those interactions, such as by choices, prompts and feedback (Wegerif et al, 2003). From this perspective the technology is integrated into the pedagogy as both a physical artefact and a participant in the discourse: both a psychological and a physical tool (Säljö, 1999).

Challenges for the future

A number of further structural aspects of education strongly militate against the changes envisaged by the visionaries of informal, anytime, anywhere learning. Some learning may need to be in formal settings for social and economic reasons. Basic skills of literacy and numeracy will still need to be mastered. Classes of 30 equally inexperienced children may not be the most efficient or effective approach when looked at from the point of view of an individual child, but it may be effective and efficient when viewed from a cultural and societal perspective.

Technological change may have been slow to have an impact on schools and classrooms (Cuban, 1986), but in the UK at least digital technologies are having an more visible impact on classrooms. Becta's Harnessing Technology report (Becta, 2008) indicates that there is now an average of 18 interactive whiteboards in each primary school and 38 in each secondary schools (compared with none a decade ago). The pupil-computer ratio in primary schools is 14 pupils to each desktop computer and an average of 32 pupils for every laptop. In secondary schools, there were an average of about four pupils for every desktop computer, with an average of over sixty pupils for every laptop. Digital technologies are now very much part of the equipment of schooling.

Technology is, however, very much still in the foreground. It tends to dominate rooms in which it is present and it still requires the space around it to be configured to incorporate it. Three-fifths of teacher respondents agreed that pupils enjoy lessons more if they use ICT than if they do not. The salient point here is that lessons with technology are still a pleasant change from lessons without, even if the actual technology is perhaps a little disappointing from the learners' perspective (Robinson et al, 2008). In the future it seems likely that technology will be more integrated into the background or the fabric of the learning environment as part of the furniture of schooling. Smaller devices with distributed computing, clouds and wireless networking are likely to be more integral to learning environments in the future, with seamless connections between learners' personal devices and school technology. Intelligent agents or virtual teaching assistants (Johnson and Rickel, 2000; Ashoori et al, 2007) may be programmed with the likely mistakes and misunderstandings that students can encounter (and perhaps programmed with an adaptive learning algorithm themselves so that they can improve over time).

Whether children will actually sit at home and learn virtually through their avatar in an online virtual learning environment seems at this juncture unlikely, unless this scenario offers significant advantages for particular learners, such as those who cannot attend in person or who have specific personal needs which can be better met in a virtual environment. This is especially true for younger learners who need supervision for physical safety. One of the sociological functions of schooling is to enable their parents and carers to be economically productive. A number of universities already run virtual courses in Second Life, but these courses are aimed at those looking for distance or part-time learning (Berge, 2008). Most learners prefer a face-to-face experience as we are innately social creatures who thrive on social interaction. Virtual social interaction may offer an alternative to no interaction but it is different and not without its challenges (Twining et al, 2007).

What of learning to learn and technology? If learning to learn is about learning to make choices about what to learn as well as how to learn (and furthermore to be aware of how well you have succeeded) in order to develop a confident learning identity over time then technology's role is clear. It should support the learner in taking responsibility for these choices and in developing his or her own judgement about such learning. Sophisticated learning environments may add to the efficiency or effectiveness of this process, but at the heart of learning to learn is the idea of self-determination, so, in my view, the choices about the future of education and learning to learning to learn remain fundamentally ethical and educational, rather than technological.

Will the seamless integration of technology into learning environments really change schooling itself? It is over forty years since John Holt argued that the kind of knowledge schools taught was inappropriate:

> Since we cannot know what knowledge will be needed in the future it is senseless to try to teach it in advance. Instead our job must be to try to turn out young people who love learning so much, and who learn so well, that they will be able to learn whatever needs to be learnt (Holt, 1964).

Holt's argument may be persuasive and has been interpreted as meaning that formal curricula and formal schooling will be redundant in the brave new digital world. However, although the specifics of the curriculum may indeed be relatively unimportant and even irrelevant to the knowledge we need for later life, in order to learn to learn you have to learn *something* to base this understanding of learning upon. To be the effective and enthusiastic learners that Holt envisaged means that learners need to have become effective learners by learning something (and preferably lots of things). Something needs to be taught (or at least learned) to create these avid learn-to-learners. Expertise is therefore the development of complex learning skills and capabilities. Technology will be a part of learning to learn, in the same way that it will be a part of the world that learners study. Whether technology itself will determine the nature of learning to learning seems more doubtful.

There are some significant challenges posed by any increase in informal learning which replaces schooling. Technology may offer the possibility of anytime, anywhere learning, but it still has to take place *some*time and *some*where. This poses a series of questions which the advocates of informal learning need to answer. Will all learners have equal access to the technologies they need for anytime, anywhere learning? Where will they be? Will the environment be conducive to learning? Who will be responsible for the learners? One of the advantages of the current system is that the state undertakes a duty of care for learners from 5 -16 and this enables their parents and carers to be economically productive. Who will support and scaffold the choices that learners make if the learning of young children becomes more informal, or will it be survival-of-the-fittest at learning to learn? This seems likely to perpetuate or exacerbate existing inequalities. These ethical questions dominate the debate about the future of technology and learning

to learn. Although schooling, like democracy, may be inefficient and at times ineffective, it may be preferable to the alternatives on the grounds of equity.

Conclusions

Learning to learn is a diffuse and complex concept, with different aspects emphasised in different contexts. It is a global phenomenon with similar ideas about learning to learn articulated around the globe. The common features associated with the idea are those of lifelong learning to ensure economic competitiveness, as well as expressing some dissatisfaction with aspects of the current education system in terms of its appropriateness for contemporary society and culture. The key advantages for the development of knowledge production, creativity and communication in education is in the repositioning of the learner in relation to what is learned in terms of responsibility, choice and interest. This repositioning is most apparent in re-balancing the goals and longer term aims of education, in thinking about how the process of education influences the development of learning dispositions in the longer term. The learner becomes central in regulating their learning and in determining the development of their own learning history and identity. The educational research which has attempted to understand the beginnings of these evolutionary changes has also shared some common features. One key characteristic has been to see the teacher as a learner and to base the development of learning to learn on active professional inquiry, to balance short term targets and curricular goals with broader aims of education in developing dispositions for lifelong learning. There are, however, significant challenges. There is no consensus about what learning to learn entails or involves in formal or informal settings. Exactly how it relates to the assessment of dispositions towards learning is a key question which will determine its evolution. It threatens to be derailed by formal comparative assessments or by the persuasions of science and technology in determining what can be done because it is technologically possible rather than pedagogically desirable. Learning to learn reminds us, however, that education is a moral and political enterprise, as well as a scientific and technical one.

A future based on learning to learn does imply a qualitative difference in education. It suggests a change of emphasis from an absolute to a relative measure of performance or from simple to compound measures. Today's learners are measured by the distance that they have travelled or by their their speed through the curriculum. Perhaps tomorrow's learners will be assessed by the *acceleration* they show or the increase in their progress through a curriculum of skills, knowledge and active learning experiences, coupled with the development of their beliefs and confidence about themselves as learners. Additionally, rather than thinking of progress as a linear measure through the curriculum, the distance travelled, perhaps the breadth of development will also be important, the area of learning as a measure. This would represent a step change in understanding what it is important to assess in education, from progress as speed to the idea of acceleration or from distance to area of learning mastered, and a focus on the learners' potential as well as their progress. The role of technology is hard to predict in the short-term, without beginning to consider the future beyond the current horizons. Technology will undoubtedly be a part of the world that future learners inhabit and therefore a part too of the pedagogical architecture through which they learn. Such developments should be driven by what is pedagogically desirable, rather than what is technologically possible. It is, however, essential that learning to learn does become a key feature of the future of education, to ensure that at the heart of education is learning to be human and to take responsibility for one's place in a society which encourages and enables participation by all its citizens, to enable them to fulfil their own potential and shape the future for subsequent generations.

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