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Stepping over the edge: the implications of new technologies for education

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Abstract

This chapter considers the impact of web 2.0 technologies on education and in particular how these new technologies are changing learning and teaching practices. It will consider their fundamental characteristics and look at the implications for learners, teachers and institutions. It argues that the impact on practice can be both positive and negative and that as a consequence educational institutions need to develop new policies and strategies. It concludes with two approaches to making sense of and harness these new technologies. The first is an example of applying web 2.0 approaches to facilitating greater dialogue and sharing of learning and teaching ideas, through a social networking site for design. The second argues for greater use of metaphors and other forms of meaning making as a mechanism for understanding web 2.0 technologies in an educational context.

Introduction

There is now a growing body of empirical evidence on the impact of web 2.0 technologies on education; see for example a recent review of Learning 2.0 (Redecker, 2008), the use of web 2.0 in schools (Crook and Harrison, 2008), the NSF task force on Cyberlearning (NSF, 2008), the most recent Horizon report on future technological trends (NMC, 2008) and the OECD report on ‘new millennial learners’ (OECD, 2007). The central message across these reports and reviews is encapsulated in the following quote from a report by Jenkins (2007):¹

According to a recent study from the Pew Internet & American Life project (Lenhardt & Madden, 2005), more than one-half of all teens have created media content, and roughly one third of teens who use the Internet have shared content they produced. In many cases, these teens are actively involved in what we are calling *participatory cultures*.

A growing body of scholarship suggests potential benefits of these forms of participatory culture, including opportunities for peer-to-peer learning, a changed attitude toward intellectual property, the diversification of cultural expression, the development of skills valued in the modern workplace, and a more empowered conception of citizenship.

The new skills for this according to Jenkins include: play, performance, simulation, appropriation, multitasking, distributed cognition, collective intelligence, judgment, trans-media navigation, networking, and negotiation. The list seems to encapsulate a lot of the potential of what web 2.0 technologies can offer in an educational context. However, fostering these new skills suggests a need for radical transformation of the educational curriculum.

¹ Referenced in a keynote by Roy Pea (2008)

The chapter reflects on how web 2.0 technologies are being used in education. The central focus is a critique of the impact of new technologies on education – in terms of the: new digital literacy skills needed, changing roles - what does it mean to be a teacher or learner in this new environment? and implications for organisational structures and processes – what new learning spaces should we be developing to harness the potential of new technologies? The title ‘stepping over the edge’ is used to indicate that we are poised on the threshold of major change in education. A taxonomy of tools is used as a basis for critiquing the characteristics of web 2.0 technologies and the associated positive and negative impacts on practice. The chapter then looks at the implications for learners (how they learn and how they are supported in their learning), teachers (how they design and assess learning) and educational institutions (in terms of the learning spaces – real and virtual they provide for learners). The chapter concludes with two examples of approaches to harnessing web 2.0 technologies – a social networking site for learning and teaching and appropriate of new methods of meaning making and metaphors to better understand and represent the digital environment and how it is being used. The chapter concludes by considering the impact of web 2.0 technologies on education and the potential implications for the future.

The evolution of technologies

With a historic lens it is evident that there are key step changes in terms of technological development that have acted as catalytic triggers in education. Cook et al. (2007) use Bush’s seminal paper ‘As we may think’ from 1945 as a starting point. In the paper Bush described the first system with hypertext capability that was in essence the forerunner of the internet developed decades later. Following the timeline forward there are other obvious triggers - the rise of the PC (and individual computer ownership), the internet (providing access to increasing quantities of digital information and new forms of electronic communication), the uptake of institutional Learner Management Systems/Virtual Learning Environments (LMS/VLEs), mobile technologies and in recent years the introduction of social networking and web 2.0 tools (Downes, 2006; Alexander, 2007; Anderson, 2007).

Pea considers technological developments and their impact on practice in five stages (Pea, 2008, NSF, 2008:11); focusing in particular on how progressive waves of technology have changed the ‘ether’ of mediation. The first phase is ‘cultural mediation’ (i.e. standard human communication in face-to-face settings, primarily through speech), the second phase is ‘symbol mediation’ (i.e. through more abstract symbolic representations such as letters (alphabets and written text) and numbers (and associated mathematic language)), the third phase is ‘communication mediation’ (i.e. first wave communication technologies such as the phone, radio and television), the fourth phase is ‘network mediation’ (the emergence of networks and the internet) and the fifth, current phase which Pea describes as ‘cyber infrastructure mediation’ (i.e. cloud computing, ubiquitous access and constant contact, smart technologies and sensors networks). These phases emphasises the development of technologies, as well as the co-evolution of tools and users. Pea argued that as a result of these changes, people’s learning have evolved substantially as well, echoing similar arguments emerging from empirical studies of the

netgeneration (see section ‘implications for learners’). With respect to thinking about this in terms of designing for learning, Laurillard (XXX) quotes Wolpert (2003)

It is only with causal beliefs that technologies become possible and it was technology – the ability to physically interact with the environment – that made life easier... The adaptive evolutionary advantage in making tools was enormous.

We may argue about the subtleties of which technologies to foreground, nonetheless for each new technological development there are an associated set of ripples of change in terms of their impact on individual practices and roles, and the structure of organisations. For example word processors signalled the demise of the traditional secretarial role and email changed the way in which we communicate within organisations (Conole et al., 2007). These changes in practice work both at an individual level and at the level of organisational culture. The rise of new integrated learning environments to support students required institutions to take stock of their IT structures and the nature of the associated support provision required for these new systems. Just when institutions were beginning to get ‘comfortable’ with learner management systems in place, web 2.0 technologies emerged raising fundamental issues about the balance of institutionally supported systems versus loosely, coupled systems. Web 2.0 technologies challenges not only the type of technical support that institutions might provide, but also the way in which learning might be designed, delivered and supported.

Web 2.0 technologies – functionality and impact on practice

A taxonomy developed in 2005 (Conole, 2005) classified tools according to how they were being used. The focus was not on the most technologically advanced, but rather on the tools that had the most radical impact on learning and teaching. Not surprisingly word, email and the internet emerged as the tools that had made the most significant differences; changing the way people create and distribute information, altering organisational structures and associated roles with some roles disappearing and new professions emerging, and arguably even altering the very nature and worth of knowledge itself.

Table one lists these functional characteristics and contrasts the original pre-2005 tools described in the chapter, with current web 2.0 tools. This time divide is somewhat arbitrary, but is meant mainly as an indicative marker to signal the emergence of web 2.0 tools. Some of the tools listed in the final column were around pre-2005 however, their impact on practice only started to occur to any significant extent post-2005. The intention is not to be comprehensive here, but rather to provide illustrative tools for each functional characteristic, and to consider what, if any, are the fundamental shifts and differences with new technologies.

Table 1: Changing tools sets against functionality

Function	Tools pre-2005	Web 2.0 tools and beyond
Text and data manipulation	Word, spreadsheets, databases	Google docs
Presentation and dissemination	Powerpoint, Pdfs, the html-based Web	Slideshare, Flickr, Youtube, Ajex technologies, flash animations

Data analysis	Quantitative tools (e.g. SPSS), qualitative tools (e.g. NIVO)	Tools to manipulate multi-media, enable annotation of data, and collaborative data analysis
Information seeking and handling	Search engines and portals	Google + wikipedia, RSS feeds
Storing and managing information	Bibliographic tools (e.g. Endnote), e-journals, repositories	Social bookmarking, blogs, wikis
Personal management	Online diary tools, to do lists	Online shared calendar services and to do lists (remember the milk)
Project management	Project manager	Collaborative working environments specifically designed to support project work (e.g. Sharepoint)
Communication	Email, discussion forums, chat	Audio and video conferencing (e.g. Skype and Elluminate), blogging, podcasts, microblogging (e.g. twitter)
Visualisation and brainstorming	Image manipulation tools (e.g. Photoshop), mindmapping tools	Gliffy, sense making tools (e.g. Compendium, Cohere)
Guidance and support	Wizards, toolkits	Pedagogical planners, specialised networks and online communities, social networking sites (Facebook, Linked in), immersive 3D-worlds (e.g. Secondlife)
Evaluation and assessment	e-Assessment tools, LMS/VLEs	Shift towards Personal Learning Environments, use of aggregators like iGoogle, pageflakes and netvibes

What is most noticeable in trying to map current tools to this taxonomy is that the functional classifications that were adequate to describe tools up to 2005 are inadequate to describe web 2.0 tools. In particular they do not reflect the core characteristics of web 2.0 approaches (such as user-generated content, networked communities, interactivity, participation, sharing and remixing) – practices captured in phrases such as ‘the wisdom of the crowds’ (Sueowiecki, 2004) and ‘the architecture of participation’ (O’Reilly, 2004)). Also it is significant that many of the post 2005 tools are available as free, online services. Classification against individual functionality breaks down with web 2.0 technologies, because they are multifaceted in nature, i.e. they can be used for a range of functions not just one specific purpose. Another feature of web 2.0 technologies is that information can be easily transmitted between tools and services; functionality created in one tool can be embedded or made available in another. For example the ‘embed’ function enables slideshare² presentations or Youtube³ videos to be incorporated into

² <http://www.slideshare.net/>

³ <http://www.youtube.com/>

blogs and run in situ in that environment. This enables users to create their own personal environment and to consume information at a location and in a format they choose/control. The emphasis on the social and collaborative characteristics of these new tools is very prominent, as is the shift from desktop tools to web services - emphasising the assumption that there is near ubiquitous access to the internet.

What we can see with this snapshot is further evidence of the co-evolution of tools and users depicted in Pea's five stages of development. Some tools remain as core, but aspects of their functionality change. For example word processing is a fundamental activity as a means of manipulating existing text or creating new text. But the introduction of online tools such as Google docs now combines some of the best features of word processors with the collaborative power of wikis; providing new ways in which people can construct knowledge. Sharing powerpoint slides on slideshare means that a greater audience has access to presentations, adding audio or video to these enhances the value and potentially the uptake of the presentation by others. Blogging and wikis change the way in which we create knowledge. Blogs can be used as a reflective tool, but also as a personal repository; they function simultaneously as personal tools and dissemination channels. Wikis enable group collaboration and co-construction of ideas. Kerawalla et al. (2008; 2009) undertook a detailed study of students' use of blogs and identified a range of uses, tailored to individual needs. Similar patterns of appropriation and personalisation occur with other tools, so each individual will have their own set of tools, adapted to their own particular needs and interests. Other tools hint at new practices and ways of doing things - such as immersive 3-D worlds like second life or new tools for visualising and representing knowledge and creating connections and meaning, such as Compendium (Okada and Shum, 2008) and Cohere (<http://cohere.open.ac.uk>). The boundaries of individuals and communities blur through the interconnected nature of social networks and the blogosphere, with information being simultaneously transmitted through multiple channels to different communities and audiences.

Web 2.0 technologies in education

Having given a general outline of new technologies and how they can be used, this section provides an overview of their use in an educational context. The aim is not to be comprehensive; more detailed case studies and examples are provided elsewhere in this book, as well as the references provided at the beginning of this chapter. Instead the aim is to give a snapshot of how these technologies are being used before moving on to consider the implications of this for learners, teachers and educational institutions.

In a comprehensive review, the IPTS Learning 2.0 report (IPTS, 2008) identified over 200 illustrative case studies of the use of web 2.0 technologies in learning and teaching. The report developed a conceptual framework, iLANDS (innovative lands for learning) - which helped conceptualise and structure the findings of the review, illustrating the ways that social computing tools are being used in education. The case studies spanned the educational spectrum from K-12, through tertiary education and into informal contexts as well as different discipline contexts. From these 16 cases were chosen for more in-depth analysis, focusing in particular on cases that demonstrated innovative use of technologies

and those that exemplified accessibility and inclusion issues. Table 3 lists some illustrative examples.

Table 2: Examples of the use of web 2.0 technologies in education

Project	Link
The MELT project	http://info.meltproject.eu/ww/en/pub/melt_project/how/social_tagging.htm
WISE – SecondReiff	www.w-i-s-e.net
Living labs network	http://www.openlivinglabs.eu/
LeMill – a web community for finding, authoring and sharing learning resources	http://lemill.net/
Notschool	http://www.thecademy.net/inclusiontrust.org/NS-overview-notschoolhome.html
Schome	http://www.schome.ac.uk/
Welker’s wikinomics,	http://welkerswikinomics.wetpaint.com/?t=anon
Protovoulia	http://www.protovoulia.org/en/odigos2.htm
MOSEP	http://www.mosep.org/

What these examples show is the variety of ways in which these tools are being used to foster new forms of dialogue and collaboration, co-construction of knowledge and reflection. They demonstrate how these tools are being used to address different discipline needs, foster specific types of learning approaches and address various educational challenges such as diversity, accessibility and cultural issues.

The characteristics of new technologies and impact on practice

Reviewing the use of web 2.0 tools in different educational contexts, such as the examples given in the last section, provides a perspective on some of the inherent differences between these and earlier tools. Table 3 synthesises some of the characteristics that define these new technologies and lists their impact on practice (both positive and negative).

Free resources: The internet has enabled access to a vast amount of information and with the growth of the Open Educational Resource movement (Seely Brown and Adler, 2008), access to free resources. However finding *appropriate* resources and knowing how to use them is a specialised skill; many learners, despite being competent technology users, lack the appropriate academic literacy skills to appropriate these free resources for their learning (Lankshear and Knobel, 2007). McAndrew et al. (2008) considered web 2.0 characteristics and compared them against the way in which Open Educational Resources (OERs) are developed and used, drawing on evaluation data on the use of the Openlearn

site.⁴ For example, they argue that such sites align well with the long-tail phenomenon by providing access to specialist subjects. Similarly, the social tools associated with the site enables users to contribute ideas and adapt content providing an example of the web 2.0 user-generated content and the broader notion of users adding value within a web 2.0 context.

Ubiquitous access. Web 2.0 practices rely on scale – user-generated content, the wisdom of the crowds, etc. Such scale requires easy of access and with this respect we are approaching a state of near ubiquitous access, with wifi almost universally available, the percentage of those online is approaching 100% in most developing countries, however the digital divide is still evident – narrower but deeper (Warschauer, 2003).

Multiple communication and distribution channels. The variety of communicative channels and multiple distribution mechanisms for retrieving and aggregating information means that there are a multitude of opportunities for finding resources and communicating with peers or experts. However, this has also led to a ‘fragmentation of voice’ – there is no longer one definitive source of knowledge, no one ‘expert’. Learners need to develop strategies for finding and validating appropriate resources. Learners and teachers have a variety of communicating channels (email, chat, blogs, skype, social networking sites, twitter etc), there is no single communicative channel. This multiplicity can be confusing and disorientating for both learners and teachers.

Free tools and services. The availability of free tools means that students can appropriate and personalise these for their individual learning needs. However there is a tension between these tools and those under institutional control. If students are able to use free email tools, wikis, blogs, etc – what is the function of an institutional LMS? What, if any, tools and services should institutions be providing? (Dalsgaard, 2006).

Media-rich representation. The richness of the new media means it is possible for new forms of representation, providing new opportunities in terms of sense making (Okada, Buckingham Shum, and Sherborne, 2008) but raises issues in terms of whether teachers and students have the appropriate digital literacy skills to utilise these representations (Seely Brown, 2006).

User-generated content and social profiling. The user participation and social practices of web 2.0 technologies clearly provide immense opportunities in terms of fostering collaboration, for co-construction and sharing of knowledge, but raises a number of issues about quality, copyright and privacy.

Table 3: Characteristics of new technologies and associated impact on practice

Change	+ve impact	-ve impact
Free resources	Specialised niche use	Inappropriate academic literacy skills
Ubiquitous access	Technology as a core tool for learning	Narrower, but deeper digital divide

⁴ <http://openlearn.open.ac.uk>

Multiple communication and distribution channels	Increased opportunity for peer and tutor dialogue. Information repurposed to meet different needs	Fragmentation of voice. No centralised repository of knowledge
Free tools and services	Personalisation	Lack of institutional control
Media rich representations	New forms of sense-making	Lack of new forms of digital literacy
User-generated content and social profiling	Variety and acknowledging individual contributions. Knowledge sharing and community build	Quality assurance issues. Inappropriate descriptions and use of personal information for other purposes

Implications

This section looks at some of the implications of these new technologies and the shifting patterns of use – for learners, teachers and educational institutions. It focuses on the impact on different stakeholders within the educational system (students, teachers and support staff, and argues that the boundaries between these roles is blurring as users adopt multiple and complex identities in the digital environment.

Implications for learners

Students are changing: in terms of how they interact with technologies and use them to support their learning. This is the overarching finding from a growing body of empirical research, which is looking at how students' are using technologies (Conole et al., 2008; Conole, 2008; ECAR, 2007; Kennedy et al. 2006; Baird and Mercedes, 2006). This includes the research outputs of a learner experience programme funded by the JISC in the UK,⁵ surveys of the use of technologies carried out in the States, Australia, and Hong Kong, as well as a wider body of research exploring the notion of the 'net generation'. A note of caution needs to be struck however, as this evidence is primarily from a western perspective and the experiences of those in developing countries are likely to be fundamentally different.⁶ However with this caveat the evidence does point to significant changes in how students are appropriate technologies for learning, which are likely to be mirrored more broadly in time.

The evidence of the empirical data is compelling. Students see technologies as core tools for learning, PC and laptop ownership is high, broadband connectivity in the home the norm. They complement PC/laptop ownership with a range of mobile devices – phones and mp3 players being the most common. They use a variety of tools and resources to support their learning, appropriating these tools to their own personal preferred styles of

⁵ www.jisc.ac.uk/whatwedo/programmes/elearning_pedagogy/elp_learnerexperience.aspx

⁶ Indeed there is evidence to indicate that rather than following the trajectory of technological developments adopted by western countries, some developing countries leap frog the use of technologies – skipping a technology generation. A good example of this is the way in which mobile technologies are being used in Africa. An international comparison of e-learning policy and developments provides a valuable snapshot of the issues faced by different countries (Carr-Chellman, 2005) and a more recent handbook of e-learning research provides case studies of research and development activities from around the globe (Andrews and Haythornthwaite, 2007).

communication and ways of learning. The internet is their primary information resource; particularly through Google and Wikipedia, but also through suggestions from peer networks. Uptake of social networking tools is rising rapidly, from participation in social networks like Facebook, to user-generation of content via blogs, wikis and publishing sites such as YouTube. Just as some technologies are on the rise, others are in decline – TV and email are being replaced by online, on-demand video and social networking tools such as Skype and Twitter.

Kennedy et al. (2008) provide a good summary of the current perspectives in this area and Michael Wesch encapsulates many aspects of today's students through his engaging YouTube videos (the machine is Us/ing us⁷ and a vision of students today⁸) and through his own use of technologies in his classroom to teach digital ethnography.⁹ Some researchers argue that the way in which these students learn is different – that they are used to small, bite size chunks of information, multi-modal and multi-faceted representation, that they learn through experiential interaction, rather than through guided step by step instruction. However others argue that despite the fact that they have grown up immersed in these technologies, that they lack the skills necessary to harness these for academic purposes – they may know how to navigate the internet to find information but don't have the skills to critically evaluate resources and assess their academic value.

Implications for teachers and others

In contrast to students, the change in teachers is less radical (Ertmer, 2005). Yes an increasing number of teachers are using technologies to support both their teaching and research. But use of new technologies is far from ubiquitous and in many instances is still in the realms of the innovators and early adopters. Some are engaging in the blogosphere and participating in communities of interest through social networking tools Facebook or Ning.com, however overall these spaces are still dominated by those with an interest in the technologies themselves, rather than mainstream academics. This is despite fairly significant investment in promoting innovations in the use of technologies in a number of countries.

Nonetheless, staff roles are changing as a consequence of the increasing impact of technologies – teachers have to juggle a complex range of duties associated with teaching, research and administration. The boundaries in terms of roles are no longer clear. Professional development in understanding and using technologies is more important than ever, but many institutions struggle to provide adequate and targeted support; this is further exacerbated by the fact that teachers lack the time and incentive to explore new technologies and have competing calls on their time – most notably a general drive to focus on research.

The teacher-student nexus is also under threat; in an information-rich, web 2.0 world where the focus is on user-generated content, peer dialogue and co-construction of knowledge, the notion of teacher as 'expert' and student as 'receiver' makes little sense.

⁷ <http://youtube.com/watch?v=6gmP4nk0EOE>

⁸ <http://youtube.com/watch?v=dGCJ46vyR9o>

⁹ See for example http://umanitoba.ca/ist/production/streaming/podcast_wesch.html

Therefore there is a disjuncture between student use of the technologies and academic use; with students increasingly developing their own sophisticated personal learning environment of tools and resources to support their learning; whilst teachers struggle to keep up with the latest technological fad. To label it simply as a generational effect is too simplistic. More fundamental is the cultural context within which teachers work. Research is still privileged over teaching and so for many investing the time to experiment with new technologies and apply them to their practice is a low priority. In addition use of social tools by their nature has a peer dimension – i.e. the value of use is multiplied if other peers with similar interests are using them as well; students are in peer networks. The same is not true for academics; currently the majority of teachers are not connected in this way and hence the potential benefits of such networks are not apparent to them. Participation in the blogosphere or via microblogging services such as twitter or immersion in 3D-worlds such as second life, only have true value if others are contributing and if what they are saying is of interest to you as an individual, i.e. if it adds value to your practice. Academics currently struggle to see the practical benefits of these tools, being overwhelmed by the sheer quantity and potential possibilities and intimidated by the fact that incorporation of these new approaches will require a fundamental change in their role as ‘teacher’ and associated loss of authority.

Similarly those with a support role in institutions – educational developers, technical staff, librarians and those in strategy/policy positions – are not engaging with these new technologies to the same extent as students. The minority who are face a frustrating battle trying to convince their colleagues of the importance and impact of these new technologies, finding themselves arguing against outdated arguments and concepts about technologies which relate to the way things use to be and have little or nothing to do with the reality of today’s digital environment. Providing the right kind of professional development to enable staff to understand and use new technologies is a major issue. What kind of support is needed? Who should do it? Who will provide ongoing support and advice? Educational developers, librarians and learning technologists all provide aspects of this – but it is unclear what the right balance should be and different institutions adopt different approaches. More importantly the constant changing support structures within institutions and reassignment of responsibility for professional development to different stakeholders in the system, suggest that neither policy makers nor users are happy with the services they received – workshops only skim the surface of the possibilities of how new tools can be used, advice and guidance and examples tend to be fairly generic and never specific enough to meet an individual’s needs at the time they need them. How can teachers and support staff keep up with the latest in research and development in a field that is moving very fast and where technologies are continuing to develop? Furthermore a key characteristic of these new technologies is ‘learning by doing’ - users need to be immersed in and ‘play with’ the affordances that these new digital environments offer and hence over time get a sense of how they can change practice.

Implications for institutions

The rise of web 2.0 technologies has served to illustrate that most educational institutions are working with inappropriate legacy systems and environments, which are fundamentally at odds with these new approaches and any attempt to incorporate new tools into the existing mix of technologies is like opening a hornet's nest of associated problems and issues (Sheehan, 2008).

There is a tension between institutionally provided systems – such as email and LMS/VLEs and freely available web services. This is problematic from a number of perspectives (Sclater, 2008). Firstly, many institutional tools are made available to the students only for the duration of their studies. This is a particular issue for tools such as blogs and e-portfolio which are designed to act as long-term repositories of information; students may be reluctant to commit to inputting information into an institutional system if they cannot then access it after their course has finished. Secondly, institutions tend to set very low limits on the amount of space associated with email accounts, in contrast, free services such as Google mail offer unlimited space. Thirdly, many students are already using existing tools and may not want to switch to institutional ones. Fourthly, institutional tools are often inferior in terms of functionality.

However, Sclater goes on to argue that not providing *any* institutional services is not necessarily the solution. Institutions have on the whole developed robust support packages for the technologies they provide - including back-up facilities, quick responses to malfunctions and a range of support and help. Student-facing tools, such as LMS/VLEs are also integrated with other systems such as student records, the library and finance systems. There is usually a consistency in terms of the interface and corporate brand and compliance with accessibility guidelines. In addition, LMS/VLEs have valuable tracking facilities, which enable teachers to monitor student activities and identify emergent patterns of use.

Just as roles are under threat, so too are organisational structures and potentially the longer-term viability of educational institutions. The traditional structure of institutions – into academic departments and a range of support services (finance, human resources, student services, information and support services, etc) was designed before the web. As technologies have become increasingly mission critical in the last 15 years institutions have had to engage in a continual cycle of reorganisation to accommodate the impact technologies have had on organisational processes. However on the whole these reorganisations tends to be piecemeal, for example a local review of information services or an educational development unit, rather than involving a more holistic review of all the inter-connected components of the system. Arguably the potential impact of technologies now is so profound that a more radical, systemic change is needed. If we were designing a new university from scratch, harnessing the affordances of new technologies what would it look like? (Walton, Weller and Conole, 2008) The information flow through the system is radically different in a digital world, and hence there is a need for re-conceptualisation of the best processes to support this. New ways of communicating and working together, distributing experience between real and virtual spaces require a different way of using the physical environment – tiered lecture theatres designed for one-to-many broadcasting are out of sync with these new patterns of working. The

suggestion that we need radical change also infers that piece meal, bottom-up interventions are inadequate, instead it is likely that top-level strategy and policy is needed to ensure that the change is indeed systemic. However such strategic change will require vision and an in-depth understanding of the new media, and it is debateable whether senior managers have the appropriate skills to do this.

Beyond education, as businesses have migrated online, new business models have emerged, therefore it seems self evident that the same will need to occur in education. In a world where content and services are free – what are students actually paying for? Are there existing models that could be adapted – e-bay or amazon for education? Or do we need new models tailored to the specific needs of the education system?

Making sense of the complexity

So far the chapter has provided an overview of the characteristics of new technologies and considered their impact on learners, teachers and educational institutions. The central message is that web 2.0 technologies are beginning to have an increasingly important influence in education and that this trend is likely to continue. However the chapter has also demonstrated that there are associated issues with this increased use and unintended consequences (see for example Table 2). Many learners and teachers lack the necessary new digital literacy skills to maximise their potential (for students in terms of utilising new technologies to support their learning, for teachers in terms of designing educational activities using new technologies) and there is little evidence at the moment of leadership at institutional level in terms of web 2.0-informed strategies and policies to provide appropriate learning spaces and digital environments to facilitate learning and teaching.

This section will introduce two approaches that might be helpful in terms of harnessing new technologies for learners, teachers and institutions. The first is an example of a social networking site for finding, sharing and discussing learning and teaching ideas. Primarily designed for teachers and support staff, this resource could equally well be used by students as a space to aggregate their learning resources and share and discuss with other students. The second addresses the complexity that new technologies bring – and suggests how notions of metaphors (and other methods of meaning making) might be used to provide different lenses on the digital landscape and to help users navigate through this space.

These examples address specific issues in an educational context. Firstly, how can we design for this new environment, to create pedagogically effective learning activities for our students that are relevant for their needs and context and which harness the affordances of the new technologies? Secondly how can we navigate the complex digital landscape and make sense of the space, how can we represent it and use different metaphors to describe different aspects of the activities occurring?

Example one: new design, new pedagogy

A fundamental feature of new technologies is that it is no longer possible for any one individual to be an expert; teachers cannot be expected to be up to date with all the latest tools and how they can be used. However the very nature of web 2.0 is about collective

wisdom; can we harness this to provide teachers with the relevant, just-in-time support they need?

The Open University Learning Design Initiative¹⁰ is developing a suite of tools, approaches, methods and schema to help teacher harness new technologies (Conole et al, 2008). We are adopting an iterative methodology focusing on two areas of activity in parallel: a) capturing and representing practice - through user consultation and case studies and b) supporting learning design – by gathering relevant resources and ideas about design, through the development of online tools for visualising and guiding design (such as CompendiumLD)¹¹ and through a series of associated workshops offering participants the opportunity to explore the resources and tools we have developed.

A social networking site for learning design, cloudworks¹² (Conole, Culver, et al., 2008) has been produced as part of this larger programme of activities. It adopts a web 2.0-based philosophy and is intended to be an evolving, dynamic community of tools, resources and users associated with learning design. The site is based on the notion of social objects, which Engestrom (2005) defines as follows:

The term 'social networking' makes little sense if we leave out the objects that mediate the ties between people. Think about the object as the reason why people affiliate with each specific other and not just anyone... The fallacy is to think that social networks are just made up of people. They're not; social networks consist of people who are connected by a shared object.

Cloudworks is built on the premise that there is a network of social objects associated with learning design – tools, resources, approaches to design and people. The site is designed to facilitate connections between these objects.

¹⁰ <http://ouldi.open.ac.uk>

¹¹ <http://compendiumld.open.ac.uk>

¹² <http://cloudworks.ac.uk>

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

Figure 1: The cloudworks homepage, showing new ‘clouds’

Figure 1 shows the home page for the site. Cloudworks aims to: i) apply the best of web 2.0 in an appropriate way to an educational context and ii) build on existing practice, whilst providing an environment which enables teachers to adopt more of a social networking approach to their practice. The core social object in cloudworks is a ‘cloud’. This can be anything to do with learning and teaching, this could include:

- A short description of some aspect of a teachers practice
- A more detailed design plan (a lesson plan, a case study or some form of visual representation of the design)
- A resource for use in a particular teaching context – such as a learning object or open educational resources
- A design template or a pedagogical schema (i.e. a specific structured approach to thinking about design)
- A link to a site providing information on a specific tool and how it can be used
- A description of a design or pedagogical tool
- A request for advice on a particular teaching problem
- A link to a paper or research project describing a particular pedagogical intervention or approach.

Each cloud is ‘social’ in that others can comment on it and an evolving dialogue associated with the cloud can be generated. Anyone can browse the site but to add clouds

or comment on existing clouds users have to register with the site. Each user has an associated profile and any social objects they put in are automatically assigned to them adding value to their profile.

Clouds can be aggregated into 'cloudscapes'. A cloudscape can be created around a particular shared interest, event or activity. So for example cloudscapes can be associated with conferences or workshops, with research projects or institutions. Cloudscapes can also be set up to aggregate and discuss clouds associated with a particular pedagogical approach or as a space to discuss the use of a particular tool. Individuals can choose to 'follow' cloudscapes and/or people; all of the social objects they are following are automatically added to their dynamic 'cloudstream'. So in a sense cloudworks is a combination of a web 2.0 repository, blog and microblog.

The site includes simple user generated tagging, around four categories – pedagogy, tools, discipline and other. Plans for the site include offering RSS feeds as different levels of the site, making connections to similar networks and including a range of embedding features.

Example two: Navigating the digital space, new metaphors for meaning-making

A key theme of this chapter has been the complexity of the digital space. There is a need for new approaches to help navigate through the digital environment and also to help make sense of it and the impact it is having on our lives. Simplistic descriptions of the digital environment replicating physical spaces are no longer appropriate, it is necessary to take a more holistic view and describe technologies and users together emphasising the connections between them. Example two focuses on how metaphors and other mechanisms for meaning making might be applied to describe technologies and how they are being used.

Metaphors are powerful ways of meaning making, how we use metaphors influences the way we think about the world around us. In their book, 'Metaphors we live by' Lakoff and Johnson (1980) suggest that metaphors not only make our thoughts more vivid and interesting, but also structure our perceptions and understanding.

We have found on the contrary, that metaphor is pervasive in everyday life, not just in language but in thought and action. Our ordinary conceptual system, in terms of which we both think and act, is fundamentally metaphorical in nature.

This section will begin by considering some of the limitations of the ways in which technologies have been described to date, before suggesting some alternative approaches, which emphasise the holistic, interconnected relationship between tools and users.

One of the most common means of describing technologies is via functional specifications. With the advent of the web and the introduction of the concept of hyperlinks and connections between web pages, the notion of the digital space quickly took hold. In an educational context 'virtual universities' were created, replicating real campus spaces with virtual cafés, libraries and lecture halls. Interestingly virtual 3D-worlds use similar ideas with the creation of islands and the replication of the physical

world through virtual objects. The windows operating system also uses a spatial metaphor, ‘the desktop’, as a means of describing the tools and functions of the system. Windows replicates ideas of files and folders, and objects on a desk. However the way in which we now use computers is radically different, information no longer needs to be ‘filed’ in one place it can have multiple locations, multiple connections; searching makes hierarchical filing redundant (Weinberger, 2007). Therefore as the patterns of use of the internet have developed and as tools have emerged with new functionalities resulting in changes of use and practice, simple spatial descriptions have become inadequate as a means of describing what is happening.

So in addition to a spatial description, it is also necessary to consider the temporal, functional and connected properties of the digital environment. It has become evident that just as in the real world, virtual space also has a temporal dimension – things happen over different timeframes and for some activities within the virtual space it is important to be able to represent this temporal dimension. Functionality is another important facet we need to take account of. What are the different things tools can do? What are the inputs and outputs associated with different tools in use? What is the information flow through digital space? Finally, the web 2.0 philosophy emphasises the social dimensions of the web, hence means of representing connectivity are also needed. These four aspects of digital space are described in Table 4.

Table 4: Descriptions of digital space

Focus	Aspects of the digital space this emphasises
Spatial	Made up of objects which are connected in a typology of hyperlinks
Temporal	Evolving over time, with events happening over different timeframes
Functional	Represented as the different functions of the tools; tools acting on ‘data’ in the system leading to transformation in some way
Connected	A connected network of different types of objects (tools, resources, people) interacting

Derntl et al. (2008) in describing design representations argue that:

A universal language or documentation system that will suit all these needs is likely impossible, just as no language can be taken as *the* medium of humankind, be it English or Esperanto, for capturing all forms of cultural expression that exist. (Derntl et al.: 357)

With this as a given, is it possible to better articulate what different representations of the digital space are for and are there new metaphors and meaning-making we should be applying to articulate new properties and patterns of use which arise as tools and users co-evolve?

Morgan’s work on organisational metaphors provide a useful illustration of how notions of metaphors might be adapted and applied to understand the use of technologies. Conole et al. (2007) provide a discussion of Morgan’s metaphors in an e-learning context, focusing on five metaphors: organisation as machine (emphasising the structural aspects of organisations), brain (organisation as information processing systems), organism (a living ecosystem), culture (organisation as being made up of mini-cultures

with different customs and values) and political (highlighting the relationship between different interests, conflicts and power dynamics).

Comparing these with the foci outlined in Table 4, the spatial, temporal and functional dimensions are evident if we view the digital environment as a machine or brain. However, what is potentially very powerful is application of Morgan's notions of organism, culture and political system have much to offer in terms of better describing the connected nature of the internet. In fact the organisms metaphor is already being applied to some extent with reference to technology – researchers talk of 'ecosystems' and 'learning ecologies' as a means of describing the interaction of users and technologies.¹³ Engeström (2007) also uses a biological metaphor through considering the notion of mycorrhizae as one means of understanding complex modern working practices - nodal, interconnected, mainly unseen and distributed. Siemens has applied the notion of 'connectivism' in an educational context (Siemens, 2006), arguing that this better describes the modern learning environment than more traditional learning theories.

These metaphors are beginning to give us new insights into the digital environment and ways of describing what is happening, we need to continue to explore different metaphorical approaches. The application of the cultural metaphor could be helpful in terms of understanding different communities and their practices and values. Similarly the political metaphor could help us to articulate power dynamics within a system and conflicts; the example of the tensions between institutional systems and loosely coupled free tools described earlier is one example. But also the behind the scenes power dynamics which are evolving, what are the implications for practice for example in the financial relationship which has been fostered between Google and Wikipedia,¹⁴ altering the way information is rendered to the user, similarly what the implications of restrictions in access to the internet as a result of clamp downs in fundamentalist regimes?

In addition to metaphors, new ideas for meaning-making and visualisation have emerged in recent years, which can be used to make sense of the connections between the social objects in digital space and to help users navigate through the digital environment (see for example Shum and Okada, 2008 for a description of knowledge cartography for open sensemaking communities). Mindmaps and visual argumentation tools are increasingly used within education – both by students and teachers. In the OULDI work, an argumentation tool, Compendium, has been adapted to create a tool for helping teachers to visualise designs (Conole, Brasher et al., 2008); Figure 2 shows some of the different visual representations that can be created in CompendiumLD. The LAMS¹⁵ tool also provides a visual representation – focusing on the sequences of tasks with a learning activity sequence. LAMS can be used not only as a design tool, but also as a runtime environment for the students. Cohere¹⁶ is a web-based tool, where ideas can be networked together in terms of their relationships and meaning.

¹³ See for example John Seely Brown http://serendip.brynmawr.edu/sci_edu/seelybrown/ and George Siemens http://www.elearnspace.org/Articles/learning_communities.htm

¹⁴ See for example <http://blogs.zdnet.com/Google/?p=124>

¹⁵ <http://lamsinternational.org>

¹⁶ <http://cohere.open.ac.uk/>

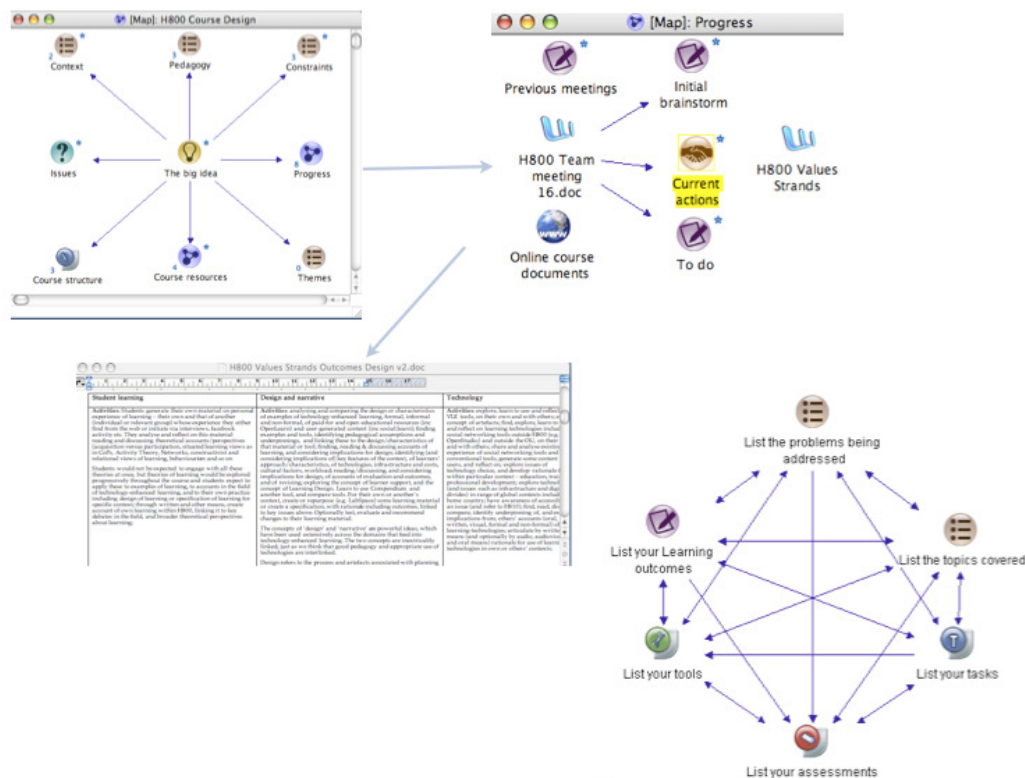


Figure 2: Visual design representations in CompendiumLD

These and other tools are beginning to enable us to embed more meaning in the objects and connections of digital space. These tools can also be used to navigate through the digital space, providing particular narrative paths of meaning to address different goals or interests. In terms of education, these narrative trails could potentially be created either by: the teacher (i.e. designs produced are then used as narrative trail to guide the student’s learning path) or the learner (through their use of these tools to construct meaning).

Conclusion and implications for the future

Despite the hype and rhetoric, web 2.0 and more specifically learning 2.0 is still a relatively new phenomenon, which has not yet penetrated mainstream education. Nonetheless the affordances of web 2.0 technologies and analysis of how they are beginning to be adopted in educational contexts, suggest they could have a profound impact in the near future and that there are a number of potential side effects of the increased use of web 2.0 technologies which we need to be aware of, particularly in relation to vulnerable communities. Negative social practices are already beginning to emerge, such as cyberbullying and online grooming. There are also issues in terms of the ‘openness’ of social networking, such as the ways in which disclosing personal data on sites like facebook might be then appropriated for other purposes (see Grimmelmann, 2008 for a recent analysis of privacy issues associated with social networking site). There are also issues in terms of equity of access and the new digital literacy skills needed to make sense of these new digital spaces.

This chapter has considered the characteristics of new technologies and their impact on both organisations and individuals within an educational context. It has provided some alternative suggestions for new ways in which we can make sense of this complex landscape through specialised tools to guide understanding and through the use of different kinds of representations of the space and metaphors to help meaning making. It has argued that there are significant implications for teachers and their roles; currently the majority of teachers lack any personal direct experience of social computing and there are no institutional incentives for teachers to try out and experiment with these tools. At the institutional level, there is little evidence that there is a corporate understanding of these tools either and there is the lack of vision for how social computing can be used. Policies on the use of web 2.0 technologies are generally inadequate and there is a lack of appropriate training and support to migrate towards greater usage of these tools.

What is evident is that uncertainty and change are the norm; it is clear that we are now working in an environment of constant flux where the future is unpredictable and where changes appear to be ever more rapid and fundamentally radical in terms of their implications. No one individual can be an expert in all the tools and the potential ways in which they can be used; the approach needs to shift to harnessing the networked aspects of new technologies, so that individuals foster their own set of meaningful connections to support their practice; whether this is a teacher in terms of connections to support them develop and deliver their teaching or a learner in terms of connections to support and evidence their learning.

I have argued in this chapter that we need to be mindful that tools do not exist in isolation and that tools and users co-evolve; as technologies become more and more a fundamental part of our working practice, we evolve in the use of the tools and appropriate them to meet our needs, however at the same time our own practice are evolving and being influence/alterd by the affordances of the tools and what they enable us to do.

As argued at the start of the chapter, the implications of these new technologies for education are profound. Unintended consequences of use will arise, misuse and abuses of the system will happen, the digital divide is still present (Warschauer, 2003) – it may be narrower, but it's getting deeper, those not engaging with technologies are getting left further and further behind. We need to be mindful that the egalitarian, liberal view of new technologies is a myth; power dynamics remain, niches develop and evolve. Applications of metaphorical notions of ecology, culture and politics can help us better understand and deal with these complexities.

The chapter has argued that a range of new skills that are needed; for learners, teachers, support staff and senior policy makers. Skills to enable them to navigate through and make sense of digital space, skills to cope with change and the exponential development of new tools, skills to deal with new notions of space, time and boundaries and skills to cope with a multi-faceted and fast moving environment. We have to accept that it is impossible to keep up with all the change so we need to develop coping strategies which enable individuals to create their own personal digital environment of supporting tools

and networks to facilitate access to and use of relevant information for their needs. These skills are needed across the range of stakeholders involved in education from students to senior managers; not just a selective minority. The ultimate goal has to remain harnessing the potential of these technologies to provide better and more engaging learning environments and opportunities for students. The possibilities are exciting, but the challenges daunting.

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Key terms

Web 2.0: This is a term coined in 2005 by O’Riley. It refers to the recent wave of technologies and tools associated with the web, which emphasis the user-focused, collaborative aspects of the affordances of these technologies. It contrast with the first phase of web technologies which were essentially information focused. Social networking is a term also used to describe many of these technologies.

Affordances: ”Affordance” refers to the perceived and actual properties of a thing, primarily those functional properties that determine just how the thing could possibly be used. It originates from work on Gibson in the 1970s and has been used in relation to technological affordances in the last decade or so.

Metaphors: These are ways to describe or make sense of things. A metaphor is a figure of speech used to help others understand something.

Meaning making/Sense making: This is the ability to make sense or meaning of a complex situation.

VLE/LMS: Virtual Learning Environments/Learner Management Systems are overarching learning and teaching systems that have become increasingly important in educational institutions in the last decade. The systems include a set of tools to support the delivery of online education. Tools include facilities for communication –such as chat, forums, etc., reflection and collaboration tools such as blogs and wikis, tools for assessment – such as drop boxes for assignments and e-portfolios for aggregating learning evidence. They include commercial products such as Blackboard and open source systems such as Moodle.

The learner voice/learner experience: This is a term that had come into use in recently years to describe research which is exploring the ‘learner voice’ or student experience. In particular it has been appropriated to refer to students’ use of and experience of technologies.

Key words for index

Web 2.0 technologies Pages: 1, 2, 3, 4, 6, 9, 13, 14, 22

Learning 2.0 Pages 1, 6, 21

Digital literacy skills Pages 2, 8, 9, 14

Social networking Pages 2, 3, 15-16

Meaning making/Sense making Pages 2, 9, 16, 18, 20

Metaphor Pages 2, 16, 18, 19, 20

Learner management systems (LMS) Pages 2, 8, 13

Virtual Learning Environments (VLE) Pages 2, 13

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Learner experience/Student use of technology Pages 10-11

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Learning design Pages 15-16
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Cloudscapes Pages 17
Digital space/digital environment Page 19

Biography

Gráinne Conole is Professor of E-Learning in the Institute of Educational Technology at the Open University in the UK. Previously she was Professor of Educational Innovation in Post-Compulsory Education at the University of Southampton and before that Director of the Institute for Learning and Research Technology at the University of Bristol. Her research interests include the use, integration and evaluation of Information and Communication Technologies and e-learning and the impact of technologies on organisational change. Two of her current areas of interest are focusing on the evaluation of students' experiences of and perceptions of technologies and how learning design can help in creating more engaging learning activities and Open Educational Resources. Updates on current research and reflections on e-learning research generally can be found on her blog www.e4innovation.com.

She has extensive research, development and project management experience across the educational and technical domains; funding sources have included the EU, HEFCE, ESRC, JISC and commercial sponsors). She serves on and chairs a number of national and international advisory boards, steering groups, committees and international conference programmes. She has published and presented over 300 conference proceedings, workshops and articles, including over 100 journal publications on a range of topics, including the use and evaluation of learning technologies. She is co-editor of the recently published RoutledgeFalmer book 'Contemporary perspectives on e-learning research'.

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