

Mapping the digital terrain: New media and social software as catalysts for pedagogical change

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In the emerging digital landscape of the Web 2.0 era, where social software tools like blogs, wikis and podcasts provide instant connectivity, promises of engagement and community building, there is a need to rethink models for teaching and learning. In this paper, the authors argue that outmoded didactic models, which place emphasis on the delivery of information by an instructor and/or from a textbook, may need to be replaced in order for student-centred learning to come to fruition. Currently, e-learning pedagogies at universities and colleges appear to be fuelled largely by learning management systems (LMS's) that replicate these traditional paradigms in an online setting. They conform to a "student-as-information consumer" model, thereby reinforcing instructor-centred approaches to teaching, learning and knowledge, as opposed to being conducive to constructivist modes of learning that enable a high degree of learner self-direction and personalisation. This paper also explores a range of examples demonstrating productive pedagogical applications of social software tools. A number of recent constructivist theoretical paradigms are presented that have the potential to transform teaching, learning and pedagogy in higher education.

Keywords: Web 2.0, social software, constructivism, connectivism, navigationism.

Introduction

"Student-centred" and "constructivist" learning has become somewhat of a mantra in higher education, yet there continue to be significant gaps between the espoused and enacted pedagogies of teachers, both in face-to-face and online environments. With the advent of e-learning, we have managed to overcome the confines of the traditional, four-walled classroom, but instructor-centred pedagogies continue to prevail, as manifested in the classroom or lecture hall metaphor adopted by many popular virtual learning environments (Lee, 2005; Sheely, 2006). In this way, online learning implementations tend to replicate traditional models of teaching and learning whose historical purpose was to maximise efficiency and capitalise on economies of scale (Sheely, 2006; Rogers, Liddle, Chan, Doxey & Isom, 2007). This "industrialised" form of education is highly incongruent with the needs and values prevalent in today's knowledge era.

The advent of the Web 2.0 (O'Reilly, 2005a, 2005b) movement, with its emphasis on community-based sharing, user-created content and personalisation, provokes us to consider how the new wave of social software tools might be leveraged to assist us in breaking away from the highly centralised industrial model of learning, towards achieving individual empowerment of learners through designs that focus on collaborative, networked communication and interaction. Tools like blogs, wikis, media sharing applications and social networking sites are capable of supporting and encouraging informal conversation, dialogue, collaborative content generation and the sharing of knowledge, giving learners access to a wide raft of ideas and representations. Used appropriately, they have the potential to make student-centred learning a reality by promoting learner agency, autonomy and engagement in social networks that straddle multiple real and virtual communities independent of physical, geographic, institutional and organisational boundaries. However, to avoid the dangers and pitfalls of a technology-driven pedagogy (Salaberry, 2001), it is necessary to carefully examine the theories that underpin technology-supported

learning designs. It is imperative that educational uses of technology are conceptualised within theoretical models that relate to how pedagogies can be transformed to capitalise on the affordances of social software tools for learning. The aims of this paper are to analyse a number of productive pedagogical applications of social software tools and to signal recent developments in constructivist theoretical paradigms that have the potential to transform teaching, learning and pedagogy in higher education. Changes in theoretical perspectives are highlighted as these are critical in the digital age.

Past and present views of constructivist learning

The decline of positivism during the latter half of the 20th century facilitated the development of constructivism in various forms as an alternative philosophical and educational theory. Though not a unified theory, constructivism has a number of basic tenets. During the 1970's and the 1980's amongst a number of different versions of constructivism, Piagetian and Ausubelian constructivism played a dominant role. Piagetian constructivism emphasised the need for going beyond expository teaching practice in order to facilitate development of reasoning based on the learning cycle (Driscoll, 2000). In contrast, Ausubelian constructivism promoted meaningful receptive learning based on prior knowledge of the students and use of concept maps. Since then, constructivism in education has developed in many forms by drawing inspiration from various philosophical and epistemological sources (Krause, Duchesne & Bochner, 2006). Despite the popularity of constructivism as pedagogy, almost all forms of constructivism have also been the subject of scrutiny and critical appraisal (Pountney, Parr & Whittaker 2002). From the debate and critique of constructivist learning a number of metaphors of learning have emerged, each pointing to a view of instruction in general, with an associated pedagogy and cluster of collaborative learning tools. Among the most prevalent metaphors are:

- i. learning as information processing – a cognitive skills approach, in which the learning is seen as input and the mind as a process of information (Phillips, 1995);
- ii. learning as experiential growth and pattern recognition – a cognitive constructivist approach (Windschitl, 2002); and
- iii. learning as a sociocultural dialogic activity – a social constructivist or sociocultural approach in which learner interaction and dialogue are central to the learning process (Vygotsky, 1978; Bandura, 1977).

More recently, these metaphors of learning have been revised as society has progressed towards conceptualisations of learning that invoke more active, generative processes. For example, the traditional teacher-centred pedagogy model in which knowledge is “transmitted” from teacher to learner is not deemed to be constructivist and is being replaced by learner-centred models of instruction in which the emphasis is on guiding and supporting students as they learn to construct their understanding of the culture and communities of which they are a part (Brown, Collins & Duguid, 1989; Duffy & Cunningham, 1996; Laurillard, 1999, 2002). In the process of shifting the pedagogic focus to the constructive activity of the learner, the need to anchor learning in real-world or authentic contexts that make learning meaningful and purposeful has been recognised (Reeves, Herrington & Oliver, 2002; Herrington, Oliver & Reeves, 2003).

However, not all student centred learning activities are constructivist in nature. Constructivism, by definition, involves cognitive activity that allows for an understanding of our world often mediated by language (Crook, 1996). Student participation in activities that lack opportunities for cognitive engagement is not considered constructivist in nature (Hendry, 1996). Moreover, many theorists maintain that if learning is a sociocultural dialogic process, then pedagogy should entail opportunities for embedding learning in authentic tasks located within communities of practice (Lave & Wenger, 1991).

Theoretical and technological shifts and advancements that have proceeded throughout the decades since the 1970's have brought an increased focus on learning activity with and through information and communications technologies (ICTs), and with this an increasing array of possibilities for constructivist learning has emerged. As a result, the American Psychological Association created an eclectic mix of principles that provided the impetus for educational and pedagogic reform and across the globe (APA, 1993, 1997, cited in Bonk & Cunningham, 1998). What is apparent is the increased focus on pedagogical transformation and renewal in learning paradigms due to the prevalence of technology-rich learning environments, and blended designs that incorporate both face-to-face and technology-mediated learning.

Expanding the constructivist paradigm

Current educational and social research is making an increasingly strong case for a conceptualisation of learning as networked, collaborative and social activity, supported by a range of ICT affordances, including those provided by social software tools (Mejias, 2005; Brown & Duguid, 2000; Lee & McLoughlin, 2008). In summarising the value and impact of learning networks for learning and knowledge creation, researchers suggest that pedagogical innovation is needed:

... and requires the development of learning episodes for pupils that have dialogue and communication as core features. From this perspective, there is a far greater emphasis on networked rather than linear models of learning and on providing culturally relevant experiential and purposeful learning episodes that than the consumption of abstract knowledge ... (Rudd, Sutch & Facer, 2006, p. 5).

The importance of integrating digital resources and social software tools stems from the fact that such resources are part of the knowledge society and economy and are woven into how we communicate, think and generate knowledge and ideas in everyday life. Knowledge is no longer controlled and stable, but open to interpretation, modification and recreation by anyone, anywhere (Breu & Hemingway, 2002). The traditional macro-structures of the disciplines are being replaced by dynamic microstructures created by networked individuals working collaboratively. These communication networks are able to link people and summon the “wisdom of crowds” (Surowiecki, 2004), so that the collective intelligence of groups can be harnessed to generate ideas that are fresher, richer and more sophisticated than the contributions of individual users. Lindner (2006) quotes Parkin (2005, p. 31), who observes: “it’s not content or even context, but process that gets us going”, indicating that participating, doing and experiencing rather than knowing what or where and creating knowledge rather than consuming it, is the new mindset and modus operandi of learners, online communities and the knowledge economy at large. All in all, we have an environment in which digital technology and information are paramount and in which “learning to learn” (“know-how”) is now far more important than memorising explicit knowledge and facts (“know-what”).

The call for a “new” learner-centred pedagogy is not a matter of simply offering learners the technologies they are likely to use in the knowledge economy – these, like the knowledge itself, are subject to rapid change. According to Beetham and Sharpe (2007), it involves engaging learners in apprenticeship for different kinds of knowledge practice, new processes of inquiry, dialogue and connectivity. Practices underpinning effective, innovative pedagogy will differ depending on the subject area or professional discipline in which learners seek to become proficient, but are likely to include some or all of the following:

- digital competencies that focus on creativity and performance;
- strategies for meta-learning, including learner-designed learning;
- inductive and creative modes of reasoning and problem-solving;
- learner-driven content creation and collaborative knowledge-building;
- horizontal (peer-to-peer) learning and contribution to communities of learning, e.g. through social tagging, collaborative editing and peer review.

As further evidence of the emergence of the need for transformative pedagogies, the report *A Global Imperative* by the New Media Consortium (2005) places great emphasis on the development of 20th century literacy as “a set of abilities and skills where aural, visual and digital literacy overlap ... the ability to understand the power of images and sounds, to recogni[s]e and use that power to manipulate and transform digital media, to distribute them pervasively and to easily adapt them to new forms” (p. 2). Recent research has focussed on the development of range of new literacies that include photo-visual learning, synchronic literacy (combining visual and phonic modes of learning) and reproduction literacy (the ability to create meaningful authentic, creative work by lining and integrating existing pieces of information to create a new synthesis) (Eshet-Alkalai, 2004).

Other researchers have tapped into the pedagogical uses of blogs, wikis and digital portfolios to encourage development of the information navigation skills often required in business/industry and service professions (Downes, 2004). In recognition of the needs of a generation of students who live in a complex global economy, learning environments need to embed “... a blend of Internet and mobile

technologies which enhance student-tutor and student-student communication through multiple media channels, providing responsiveness, customi[s]ability and flexibility to adapt and be adapted to students' needs" (Andone, Dron, Pemberton & Boyne, 2007, p. 41).

Emerging terms, theories and pedagogies

There are distinct calls for a rethinking of pedagogy to meet the demands of an era in which ubiquitous computing and social connectivity mediated by ICT are reshaping academia. This is evidenced in the emergence of a myriad of buzzwords and terms accompanying an ongoing debates on issues depicting changing priorities in pedagogy. For instance, Ashton and Newman (2006, p. 828) note that we have *pedagogy* (teaching of children), *andragogy* (teaching adults), *ergonogy* (teaching people to work). However, none of these terms captures the imperative of innovative knowledge sharing and creation required in the 21st century.

Nevertheless, a number of concepts now in use signal the change from traditional pedagogies to forms of teaching and learning where learners having greater levels of agency, social connectedness and autonomy. For example, some theorists consider *heutagogy*, in which learning is completely determined and directed by the learner, to be the next stage in the evolution of andragogy (Hase & Kenyon, 2000; Aston & Newman, 2006). Heutagogical approaches place the ultimate responsibility for learning on the learner and are aligned with the expectation that individuals must attain "learning-to-learn" and self-directive competencies in order to succeed in the knowledge society. They are based on the premise that an individual learns continuously through interaction with his/her environment and throughout his/her lifespan, often in the face of ambiguity and need. These conceptualisations challenge us to maximise the potential for learning by employing the right blend of metaphors, frameworks and paradigms that capitalise on contemporary social networking tools and ICTs that people use in their everyday lives. Table 1 summarises a number of theories and paradigms of learning that have emerged in recent education and educational technology literature.

Table 1: New and emerging learning theories

Author/date	Theory	Principles	Pedagogy
Lave and Wenger (1991); Wenger (1998)	Communities of practice	Members of a community of practice are practitioners who develop a shared repertoire of resources: experiences, stories, tools, ways of addressing recurring problems—in short a shared knowledge base	Engage learners in "legitimate peripheral participation" so that they participate in building the social and intellectual capital of the community
Hase and Kenyon (2000)	Heutagogy	Goes beyond andragogy by advocating self-directed learning, capability and pro-active participation	Focus on knowledge sharing and creation of new knowledge from existing experience
Tangney, FitzGibbon, Savage, Mehan & Holmes (2001)	Communal constructivism	Students actively create their own knowledge, but are also active in the creation of knowledge for a wider learning community	Create tasks to engage learners in knowledge creation
Laurillard (2002)	Conversation theory	learning occurs through conversations about a subject matter which serves to make knowledge explicit and to promote reflection	For students to learn they must learn relationships among the concepts and ideas. This is enabled by teachers, who engage in explicit conversations regarding subject matter and facilitate student understanding through reciprocal dialogue.
Siemens (2005)	Connectivism	A theory that combines and integrates principles explored by chaos, complexity theory and networking. Making and sustaining connections is more important than simply knowing	The learning process is characterised by connecting information sets and by helping learners see the connections between events and ideas. Learners need competencies to enable them to distinguish important from unimportant information.
Brown (2005, 2006)	Navigationism	Learners should be able to find, identify, manipulate and evaluate information and knowledge and be able to share in the knowledge production process.	Navigationism is a broader and more inclusive term than constructivism but includes knowledge creation. Students need skills in navigating knowledge

Rethinking paradigms and metaphors of learning

In assessing how paradigms of learning are changing in the digital age, it is important to consider how we conceptualise learning. The literature depicts learning in various ways, and evokes a variety of possible scenarios or metaphors. Sfard, for example in (1998) distinguished between two metaphors of learning, the acquisition metaphor and the participation metaphor. The former represents a view of learning that is mainly a process of acquiring chunks of information, typically delivered by a teacher. An alternative model, according to Sfard, is the participation metaphor, which sees learning as a process of participating in various cultural practices and shared learning activities. However, in order to keep pace with knowledge-building processes that are emerging in the Web 2.0 era, it appears to be necessary to go beyond the acquisition and participation dichotomy and include the knowledge creation metaphor (Paavola & Hakkarainen, 2005). The knowledge creation metaphor mirrors the societal shift towards a networked knowledge age, in which creativity, originality and the capacity to gain knowledge from networks are highly valued. In an effort to keep pace with the content creation processes enabled by Web 2.0 and social software tools, it builds on common elements of Bereiter's (2002) theory of knowledge building, Nonaka and Takeuchi's (1995) model of knowledge creation and Engeström's (1987, 1999) theory of expansive learning. In line with the knowledge creation metaphor, learning is mediated by a range of digital tools and affordances that support networking, socialisation, communication and engagement with communities of learning. Web 2.0 tools are not about accessing information, but about social connectivity and participation in networked communities where there is collaborative knowledge construction (McLoughlin & Lee, 2008).

Students as knowledge producers

Traditional approaches to teaching and learning are typically based on pre-packaged learning materials, fixed deadlines and assessment tasks designed and stipulated by teachers. The reality, however, is that today's students perceive little value in the absorption or rote learning of factual information, given the accessibility and ease of use of search engines and web-based reference sites such as Google and Wikipedia (Berg, Berquam & Christoph, 2007). Moreover, students are now very much in control of online content; they are no longer passive consumers but active producers of knowledge (Klamma, Cao & Spaniol, 2007). The Pew Internet & American Life Project reports that approximately 50% of all teens in the United States – 12 million youth – not only participate in online activities but also create their own online content through blogs, personal Web pages and remixing (Lenhart & Madden, 2005). Students, as members of the open culture of the read/write Web, are finding new ways to contribute, communicate and collaborate, using a variety of accessible tools that empower them to develop and share ideas. The most popular and fastest growing Web sites on the Internet (e.g., YouTube and MySpace) are making use of this generativity, to which much of their success may be attributed.

Tangney, FitzGibbon, Savage, Mehan and Holmes (2001) argue for an expanded definition of social constructivism that takes into account the synergy between recent advances in ICT (particularly those that are increasing our potential for communication and giving us the ability to store a variety of data types) and advances in virtual learning environments. They advocate an approach that they call "communal constructivism", in which students not only construct their own knowledge (constructivism) as a result of their interactions with others and with their environment (social constructivism), but are also actively engaged in the process of constructing knowledge for the good of their learning community. According to them, "the modern education process is too like a sanitised pipe system through which large numbers of students are pushed through to emerge from the far end 'educated' but without leaving any discernible trace on the system they have passed through. The 'communal constructivist' philosophy is more akin to a river that shapes its own environment as it flows forward" (p. 3114).

The idea of learning as knowledge creation is supported by a range of digital tools and affordances that allow networking, socialisation, communication and engagement with communities of learning (Lee, McLoughlin & Chan, 2008). Students, enabled by social software tools, are capable of being both producers and consumers ("prosumers") of knowledge, ideas and artefacts. As newcomers to a community of practice, they not only engage in "legitimate peripheral participation" (Lave & Wenger, 1991) to develop their own mastery of knowledge and skills through interaction with experts such as their instructors, but also have a responsibility to take part in the continued advancement of the community's existing body of knowledge, as they move toward full participation in the socio-cultural practices of this

community (Lee, Eustace, Hay & Fellows, 2005). In a knowledge building community, members are managers or “curators” of the community’s knowledge artefacts (Eustace & Hay, 2000; Lee, Eustace, Hay & Fellows, 2005), intent on making responsible decisions in addition to generating novel and innovative contributions to benefit the community as a whole.

“Knowledge creation” and “knowledge building” are now terms that are applied in management, corporate organisations and institutions of higher learning that value innovation and creativity (Leadbeater, 2006; Nonaka & Toyama, 2003). The knowledge construction paradigm can be appropriately applied to learning environments where digital tools and affordances enable engagement in self-directed activities and learners have freedom and choice to move beyond mere participation in communities of inquiry to become active creators of ideas, resources and knowledge artefacts. In today’s knowledge based society, characterised by rapid change, dynamic communication and knowledge advancement, core competencies needed are self direction, problem solving, critical inquiry, creativity, team work and communication skills, which can be fostered through engagement with pedagogies that leverage digital tools, content and services (Bryant, 2006).

Learning through and within communities and networks

The “trialogic” nature of the knowledge creation metaphor (Paaovla & Hakkarainen, 2005) reminds us that learning is an intensely social activity, where ideas are generated in contact with others in the community through mutual exchange, contribution and sharing of ideas. In the Web 2.0 era, new and dynamic forms of community are emerging that are self-directed and open to a global audience. These offer new forms of social and intellectual engagement to students, often based on sharing objects and artefacts, in what is described by Jyri Engeström (2005a, 2005b) as “object-centred sociality”. For example, Flickr allows the posting and sharing of photos and commentary; social bookmarking (Furl, del.icio.us) allows people to connect through shared metadata and user-created tagging; social writing platforms (wikis, Google Documents and Spreadsheets) enable collaborative writing and editing, asynchronous creation of text and personal written commentary. Social networking practices also enable the creation of virtual communities based on shared motives and/or common interests, leading to powerful relationship building. These informal experiences are very often the foundation of learning (Gee, 2003). At face value, Web 2.0 tools appear to prioritise the individual, as anytime, anyplace connectivity is the primary driver; however, these tools also motivate the individual to link personal interests to broader social networks, thereby situating responses and contributions within a dynamic community that provides feedback and reciprocity (Owen, Grant, Sayers & Facer, 2006). These new agendas are already impacting significantly on the re-conceptualisation of pedagogies and practices (for example, personalised learning) in future environments that capitalise on open educational resources (Attwell, 2007; Lamb, 2007; Berg, Berquam & Christoph, 2007).

New learning environments for the profession, for industry and for society in general must take into account the networked nature of knowledge, opportunities afforded by teamwork and participation in knowledge generation in technology-rich environments (van Weert, 2006). A theory that has emerged to describe the social, interconnected and community-based characteristics of learning in contemporary times is connectivism. In the words of its originator, George Siemens (2005, p. 7):

Personal knowledge is comprised of a network, which feeds into organi[s]ations and institutions, which in turn feed back into the network and then continue to provide learning to individual. This cycle of knowledge development (personal to network to organi[s]ation) allows learners to remain current in their field through the connections they have formed.

Connectivism appears to be very much aligned with our changing information environment in the digital age and networked society. It strives to overcome the limitations of behaviourism, cognitivism and constructivism, by synthesising the salient features and elements of several educational, social and technological theories and concepts to create a new and dynamic theoretical construct for learning in the new millennium. It employs a network with nodes and connections as a central metaphor for learning. In terms of this metaphor, a node may be any entity, whether tangible or intangible, that is able to be connected to other nodes, including but not limited to information, data, feelings and images. In connectivism, learning is the process of creating connections between nodes to form a network, a view that accurately mirrors the ways in which people engage in socialisation and interaction in the Web 2.0

world through social networking sites and the “blogosphere”. As with the aforementioned knowledge creation metaphor of learning (Paavola & Hakkarainen, 2005), connectivism recognises the centrality of learning through the generation of ideas, supported by social activity, enabled by personal networks, interactivity and engagement in experiential tasks.

The connectivist paradigm “... is driven by the understanding that decisions are based on rapidly altering foundations. New information is continually being acquired. The ability to draw distinctions between important and unimportant information is vital. The ability to recogni[s]e when new information alters the landscape based on decisions made yesterday is also critical” (Siemens, 2005, p. 7). Siemens (2005, p. 7) lists eight major principles of connectivism:

- i. Learning and knowledge rests in diversity of opinions;
- ii. Learning is a process of connecting specialised nodes or information sources;
- iii. Learning may reside in non-human appliances;
- iv. The capacity to know more is more critical than what is currently known;
- v. Nurturing and maintaining connections is needed to facilitate continual learning;
- vi. The ability to see connections between fields, ideas and concepts is a core skill;
- vii. Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities; and
- viii. Decision making is in itself a learning process; choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality; while there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision.

Navigationism

Given the rapid expansion of available information, particularly on the World Wide Web, not to mention the great diversity in the backgrounds, needs and interests of individual students, it is impossible for a lecturer or course to present students with all the information they need throughout their professional and personal lives. Moreover, as acknowledged by connectivism, information may be quickly surpassed or rendered out-of-date. In navigationism (Brown, 2005) the focus is on “‘navigating’ in the ocean of available knowledge” (p. 11), which its originator, Tom Brown, argues is central to what teaching and learning is all about. Successful learning occurs as a result of learners being able to solve contextual, real-world problems through collaboratively exploring, evaluating, manipulating and integrating available information from an array of sources, as opposed to passively acquiring information from texts selected by the teacher. As described by Brown, navigationism entails the development of information navigation skills that “will have more to do with being able to be your own private, personal reference librarian, one that knows how to navigate through the incredible, confusing, complex information spaces and feel comfortable and located in doing that. So navigation will be a new form of literacy if not the main form of literacy for the 21st century” (Brown, 1999, p. 6, cited in Brown, 2005).

In summary, these emerging paradigms envisage a learning landscape that is underpinned by different principles, based not on the acquisition of isolated facts and knowledge, but on the development of multidisciplinary connections with global networks and participation in communities of practice, together with reformed teacher roles, and greater autonomy and agency for students. To achieve these outcomes, educational practitioners need to adopt pedagogies that move beyond instruction to creativity, innovation and generative thinking.

New conceptualisations of pedagogy that resonate with emerging paradigms

In the digital age and Web 2.0 world, driven by high connectivity and ubiquitous, demand-driven learning, we are beginning to see the growth of paradigms of active learning that enable us to expand our vision of pedagogy, where learners are active participants or co-producers of knowledge rather than passive consumers of content and learning is seen as a participatory, social process supporting personal life goals and needs. Table 2 describes emerging conceptualisations of pedagogy inspired and enabled by ICT advances, emerging forms of digital media and social software, along with their associated values and principles.

Table 2: Terms linked to innovative conceptualisations of constructivist learning

Term	Author	Principles
Network learning	Polsani (2003)	A “form of education whose site of production is the network”, i.e. that enables lifelong and life-wide learning processes through connections and access to networks where there are multiple layers of information and knowledge.
e-learning 2.0	Downes (2005)	Learning content is created and distributed in a very different manner. Rather than being composed, organised and packaged, e-learning content is syndicated, much like a blog post or podcast. It is aggregated by students, using their own personal tools and application. From there, it is remixed and repurposed with the student's own individual learning needs in mind.
social learning 2.0	Anderson (2007)	Learning is essentially social and dialogic and moves beyond didactic modes to learner engagement with social tools. Courses must be negotiated and tap into wider social pools of knowledge as student control and freedom are part of lifelong learning for the 21 st century.
micro-learning	Hug, Linder and Bruck (2006); Lindner (2006)	A new paradigm which involves learning through relatively small learning units and short-term learning activities. Micro-learning processes often derive from interaction with micro-content, which involves small chunks of learning content and flexible technologies that can enable learners to access them easily, anywhere, on demand and on the move. In a wider sense, it describes the way in which informal and incidental learning and knowledge acquisition is increasingly occurring through micro-content, micro-media or multitasking environments, especially those that are based on Web 2.0 and mobile technologies.
nano-learning (n-learning)	Masie (2005, 2006)	An analogue of nano-technology. Similar to micro-learning, in emphasising the trend towards the atomisation of learning beyond the learning object (Menell, 2005) to comprise personalised smaller units of information that can be learnt and recombined. This enables greater relevance for learners as well as enabling just-in-time learning.
University 2.0	Barnes and Tynan (2007)	A new generation of universities using social networking technologies, where pedagogy is reframed to meet the needs of millennial learners and connect them to wider social networks. The key idea is to start with the connections students have made through informal learning.
Curriculum 2.0	Edson (2007)	Curriculum is negotiated, driven by learner needs, personalised and based on providing learners with skills in managing and accessing knowledge and being in control of their own learning pathways and choices.
Pedagogy 2.0	McLoughlin and Lee (2007)	Digital tools and affordances call for a new conceptualisation of teaching ie <i>Pedagogy 2.0</i> , which is focussed on participation in communities and networks for learning, personalisation of learning tasks and production of knowledge

These terms signal changes in pedagogy from teacher controlled, prescriptive and didactic modes to learner-driven social, collaborative and participatory approaches to task design and learner engagement. However, rather than harnessing the technologies that are already integrated into learners' daily lives, educational institutions often adopt a fortress mentality, “battening down the hatches” and excluding mobile technologies and social software tools that are considered disruptive. Being highly outcomes driven and assessment focussed, many colleges and universities see learners not as active, critical participants in their own learning, but as passive consumers of information within LMS's where content is pre-determined and learning pathways are limited.

If we consider and compare the conceptualisations of learning depicted in Table 2 to the narrow, transmissive approaches that are often adopted in higher education, a number of discontinuities become apparent. The big change is happening in e-learning paradigms (both fully online and blended) where new tools and software enable students to create, share and showcase their own ideas and content, for example through e-portfolios, podcasting and blogging. The learner is conceptualised as mobile, active and engaging with peers in collaborative knowledge generation. Downes (2005) notes that social software tools allow learning content to be created and distributed in ways that move beyond pre-packaged course content consumed by students, promoting the view that learning and the content associated with it involve creative processes.

Conclusion and future trends

In an increasingly digital world, where ubiquitous computing and demand-driven learning are the trends, there is a need to expand our vision of pedagogy so that learners become active participants and co-producers rather than passive consumers of content and learning processes are participatory and social, supportive of personal life goals and needs. Siemens (2007) states: "... our institutions need to change because of the increasing complexity of society and globali[s]ation. Schools and universities play a dual role: accommodating learner's method and mode of learning *and* transforming learners and preparing them to function in the world that is unfolding" (para. 6, emphasis in original). Web 2.0 and social software tools promote autonomy and increased levels of socialisation and interactivity, while enabling user-controlled, peer-to-peer knowledge creation and network-based enquiry. The authors envision that the affordances of these technologies, coupled with a paradigm of learning focused on knowledge creation and networking, offer the potential for transformational shifts in teaching and learning practices, whereby learners can access peers, experts, the wider community and digital media in ways that enable reflective, self-directed learning. Nevertheless, it must be recognised that technology is not of itself the sole driver of pedagogical change. We must remain cognisant of the fact that the evaluation of ICT and social software is part of a constellation of societal factors that include but are not limited to changing student expectations, demographics and institutional pressures for improved, innovative and cost-efficient modes of teaching. There are signs of optimism that existing traditional teaching approaches based on the acquisition of decontextualised knowledge will be replaced by pedagogies that emphasise participation in social networks, innovation and productivity. This will result in a digital learning landscape offering a diverse range of educational experiences that are socially contextualised, engaging and community based.

Many social software tools are social and collaborative, reflecting the way youth engage with technologies and connect with multiple social worlds and there is an increasing gap between the formalised interactions that occur in educational establishments and modes of learning, socialisation and communication that occur in the everyday world. Part of the change needed is to recognise the potential of Web 2.0 and social software to enable the transformation of pedagogy, design of learning tasks and promotion of learner autonomy and creativity (Leadbeater, 2006). Learning as knowledge creation is a paradigm gaining increased recognition and support in contemporary learning settings (Lee, McLoughlin & Chan, 2008). Social software tools that enable networking, socialisation, communication and engagement with communities of learning are increasingly being recognised as essential scaffolds and learning tools. Learning outcomes are not about accessing information, but about social connectivity and participation in networked communities where there is collaborative knowledge construction. Equally important, we need to avoid technology-driven approaches and look for theoretical models and theories that involve pedagogical transformation, active student roles and preparation for the 21st century. We are already on the road to pedagogical transformation.

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