International Review of Research in Open and Distance Learning

Vol. 12.3
March – 2011

Connectivism: Its Place in Theory-Informed Research and Innovation in Technology-Enabled Learning

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Abstract

The sociotechnical context for learning and education is dynamic and makes great demands on those trying to seize the opportunities presented by emerging technologies. The goal of this paper is to explore certain theories for our plans and actions in technology-enabled learning. Although presented as a successor to previous learning theories, connectivism alone is insufficient to inform learning and its support by technology in an internetworked world. However, because of its presence in massive open online courses (MOOCs), connectivism is influential in the practice of those who take these courses and who wish to apply it in teaching and learning. Thus connectivism is perceived as relevant by its practitioners but as lacking in rigour by its critics. Five scenarios of change are presented with frameworks of different theories to explore the variety of approaches educators can take in the contexts for change and their associated research/evaluation. I argue that the choice of which theories to use depends on the scope and purposes of the intervention, the funding available to resource the research/evaluation, and the experience and philosophical stances of the researchers/practitioners.

Keywords: Theory; learning; implementation; research; evaluation; connectivism; actor-network theory; social shaping of technology; activity theory; zone of proximal development; change management

> *Those who struggle to create an adequate theory of learning must admit that the process is much like stumbling in the dark. So much of our thought structure is shaped by hidden assumptions evident in our existing learning and educational systems.* (Siemens, 2005)

Introduction

From its origins as a network for sharing data and software amongst scientists, the Internet has become commonplace in the developed world and is growing rapidly in developing countries, as shown in Table 1 (Internet Usage Statistics, 2009). There are still significant discrepancies in Internet penetration rates, with North America, Europe, and Oceania/Australia having the highest penetration rates. The Middle East and Africa are enjoying the greatest growth rate in users based on figures from 2000–2008 (from a low base), and Asia already has the largest number of Internet users. Research on Internet use in the northern hemisphere and Australasia has demonstrated the educational and commercial opportunities associated with significant Internet penetration (although these can be overstated). As a global platform emerges, there are increased possibilities for dialogue both locally and globally and for the sharing of resources, subject to linguistic and socio-cultural constraints.

Table 1

Internet Users, Penetration, and Growth Statistics (from Internet Usage Statistics, 2009)

World region	Internet users 2008	Penetration % population	User growth 2000–2008
Africa	54,171,500	5.6%	1100.0%
Asia	650,361,843	17.2%	469.0%
Europe	390,141,073	48.5%	271.2%
Middle East	45,861,346	23.3%	1296.2%
North America	246,822,936	73.1%	128.3%
Latin America/Caribbean	166,360,735	28.6%	820.7%
Oceania/Australia	20,593,751	59.9%	170.2%
WORLD TOTAL	1,574,313,184	23.5%	336.1%

From the 1990s on, the Internet (or World Wide Web) has been a network of information sources where users either sought specific information by searching or happened upon information as they surfed, clicking from link to link across connected Web pages. Internet users were learning whilst surfing and acquiring information to enrich other learning activities, such as face-to-face discussion. The ordinary Internet user who lacked the technical skills to create Web pages could also contribute online as bulletin board discussions migrated to the Internet where they could attract wider and more diverse audiences (Steinmueller, 2002).

It was always possible for anyone with technical skills and a space to publish to share their own ideas and creative works with others via a Web site. In the mid-1990s, university course Web sites were provided first by early adopters who wanted to publish their own content and links to other sources (Ball, 1995). Subsequently, online support for higher education became confined largely to the closed, controlled spaces of virtual learning environments (VLE) and learning management systems (LMS), such as Blackboard and WebCT. These were used by universities to

manage access to learning materials and activities (Black, Beck, Dawson, Jinks, & DiPietro, 2007), to enhance campus-based education, and to diversify into distance education (Cookson, 2002). Resources could be produced locally or include libraries in digital format, with access to institutionally subscribed journals and e-books permitted to registered students.

The growth of Web 2.0 services has made the "read/write web" more of a reality, with people becoming producers of information, whether that information is their online presence, a read count, comments, tagging of objects, a remix of someone else's content, or original content. The Web offers the possibility for many to distribute their ideas and creative works, although it is often still a small minority who participate by posting and commenting as most only read (Horowitz, 2006). The development of web and internetworked technologies has provoked a broad interest in the activities of knowledge creation and sharing. As more learning activities go online and beyond the walled gardens of VLEs, we can see them escaping the classroom. Widespread online public presence also helps us to acknowledge the informal learning that has always taken place outside the classroom, in the workplace and at home. Web-enabled learning is undertaken by individuals as independent, informal learners, often within a social setting: This may occur in places of formal education, in workplaces, and in society in general.

Knowledge is simultaneously seen as a commodity that can be managed and sold (in digital libraries of e-books and online journals) and as a social activity, a commons within which knowledge flows as people share and refine ideas. Siemens recommends that a practical discussion of knowledge can be held if it is seen as "something that a) describes some aspect of the world, and b) something on which we can act" (2006b, p. 150).

This flexible definition of knowledge includes our own sense-making of the world (shared in conversation and on online forums and blogs), know-how, codified knowledge in texts and multimedia artefacts, and assemblies of all of these. It provides a basis for viewing knowledge as residing in networks of humans and non-human appliances, whilst leaving space for human agency.

Those concerned with education, such as policymakers, researchers, managers, teachers, and learning technologists, want to understand learning in this evolving technological context and to think about how education might be affected as a result. Theories of web-enabled learning have grown out of the disciplines of education and what is called instructional design in the US, resulting in competing and philosophically disjointed theories such as behaviourism, cognitivism, and (social) constructivism, following their own trajectories with occasional collisions and overlaps (Bell, 2003). I would argue that theories of learning based solely on assumptions of students being taught by teachers, usually in a classroom, do not provide an adequate framework for us to think and act in the digitally saturated and connected world in which we live. Networked theories of learning (Goodyear, 2001) and of society (Castells, 2000) have been elaborated to explain the impact of information and communication technologies (ICTs) on education, commerce, and society in general. Learners, teachers, managers, and policymakers are trying to integrate technology into learning in formal and informal settings, looking for theories that can inform their actions in useful ways. Since the scope of the change exceeds personal and

interpersonal learning activities to include larger scale organizational and societal change, additional theories are needed to explain change, to plan interventions, and to develop policy. For example, the development of policy (at institutional, national, and international levels) for open educational resources (OER) cannot be fully informed by learning theories. Additionally, the increasing scope of change and shifting contexts for learning and education are sound reasons for reexamining theories we use to support the design of learning activities and technologies. We also need to understand learning in situations where technology may be used without an explicit learning design provided as part of formal education. Radical theories of education, such as Freire's pedagogy of the oppressed, which links educational practice to liberation, have a broader scope than learning theories that concentrate on an individual or even on social settings, such as classrooms (Smith, 1997). They view knowledge as inseparable from the power relations that exist in its context and respect learning that happens in informal as well as formal settings.

George Siemens proposes connectivism as a learning theory for the digital age, a successor to behaviorism, cognitivism, and constructivism (Siemens, 2004). The goal of this paper is to explore theories for our plans and actions in the dynamic context of learning and education described above. In the first section, I ask, can connectivism alone provide a theory to inform learning and its technology-enabled support in an internetworked world? What other theories can support change in the use of technology in teaching and learning?

The second section critiques connectivism as a learning theory and proposes that connectivism should be viewed as a phenomenon. The third section considers other theories that can be used to conduct and evaluate technology-enabled learning within the context of five scenarios. The paper concludes with a discussion and conclusions for research and practice.

Connectivism as a Learning Theory

The term *learning theory* suggests something that can help us to think about how and why change (in learning) happens (M. K. Smith, 1999). This begs the question of whether we conceive of learning as a process or a product (Duchastel, 1998; M. K. Smith, 1999). In this paper, we are looking at learning as it is experienced and supported in digitally mediated environments.

Behaviorism offers laws to govern behavior that can inform a teacher's manipulation of the learning environment (including texts and activities) to promote learning, for example, using Gagne's nine events of instruction. This is an objective approach, where knowledge is perceived as facts that can be transmitted from teacher to student. Cognitivism opens up the black box of the mind, regarding the learner as an information processor. Social constructivism is an interpretivist approach based on phenomenology, which has an "ontology in which reality is subjective, a social product constructed and interpreted by humans as social actors according to their beliefs and value systems" (Darke, Shanks, & Broadbent, 1998). Hence social constructivism places a greater emphasis on the importance of social interactions in affecting the individual's generation of knowledge or facts about the world. The whole is greater than the sum of the parts, and knowledge becomes a cultural artefact, associated with groups within a specific context.

Connectivism

In proposing it as a learning theory for the digital age, Siemens (2004) characterizes connectivism as a successor to behaviorism, cognitivism, and constructivism. He identifies three limitations of these theories: their intrapersonal view of learning; their failure to address the learning that is located within technology and organizations; and their lack of contribution to the value judgments that need to be made in knowledge-rich environments. Writing about connective knowledge, Downes draws upon the concept of connectivism as it has been used when applying ideas from biological models of the brain to neural networks in machine learning, treating the neural network as part of a whole:

> The overall view that a strongly interconnected neural network and its firing patterns must be considered as part of a whole became an important principle of orientation in the study of the nervous system; it is referred to under the name of connectivism. (Gestzi, 1990)

Downes writes about the epistemology of connective knowledge, relating it to pedagogy, other theories, and innovations in technology (Downes, 2005; Downes, 2006a, 2006b).

Downes and Siemens have brought together their ideas on the use of networks in understanding learning on many levels in a theory called connectivism.

Siemens sets a bold research agenda around the sharing of cognitive tasks between people and technology; coping with rapid change in the "information ecology"; and the impact of theories of networks, complexity, and chaos. He defines a network as connections between entities, which he calls nodes; the nodes can be individuals, groups, systems, fields, ideas, or communities. He established a set of principles for connectivism, and these broad guiding statements are listed in Figure 1.

Connectivism has been disseminated through a book (George Siemens, 2006b), a series of articles (Downes, 2005, 2006a, 2006b, 2007a, 2008; Siemens, 2004, 2005, 2006a), blog posts at http://halfanhour.blogspot.com/ and http://www.connectivism.ca/, a large number of presentations at conferences and workshops (see http://www.elearnspace.org/presentations.htm and http://www.downes.ca/me/presentations.htm), and through two instances of multiple open online courses (MOOCs) titled Connectivism and Connective Knowledge, held in 2008 (CCK08 http://www.elearnspace.org/blog/2008/10/30/connectivism-course-cck08/) and 2009 (CCK09 http://ltc.umanitoba.ca/connectivism/?p=198).

Principles of connectivism:

- Learning and knowledge rests in diversity of opinions.
- Learning is a process of connecting specialized nodes or information sources.
- Learning may reside in non-human appliances.
- Capacity to know more is more critical than what is currently known.
- Nurturing and maintaining connections is needed to facilitate continual learning.
- Ability to see connections between fields, ideas, and concepts is a core skill.
- Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.
- Decision-making is 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.

Figure 1. Principles of connectivism (Siemens, 2004).

Connectivism has been criticized as a learning theory that claims to replace its antecedents. There is an argument that theories can be complementary, as Ally (2004) demonstrates in his explanation of the implications of various learning theories (behaviorism, constructivism, and others) for distance learning. The replacement claim can be challenged because connectivism does not add to principles in existing theories (Verhagen, 2006), and although it recognizes the paradigm shift that is taking place in learning, its contributions do not merit its treatment as a new and free-standing theory (Kop & Hill, 2008). On the other hand, Kop and Hill credit Downes with having elaborated an "epistemological framework for distributed knowledge which provides a strong philosophical basis for the connectivist learning framework."

The exponents of connectivism characterize it as a network theory of learning that draws on a diverse set of theories from learning, education, philosophy of knowledge, and knowledge management, situated within a discourse of change in education and related to the transformative possibilities offered by emerging technologies. In that sense, its scope would appear to be broader than those of existing theories. Although connectivism claims that knowledge can reside in non-human objects and in networks (see Figure 1), it is weakly linked to material semiotic approaches, such as actor-network theory (Bell, 2010). Nor does it draw on the extensive work done on the use of activity theory in learning, where the role of mediating artefacts (suggestive of non-human appliances) has been explored (Engeström, 2001).

On the other hand, Verhagen (2006) places connectivism at the level of curriculum, as opposed to theory. It contributes to the development of new pedagogies where control is shifting from the tutor to more autonomous learners (Kop & Hill, 2008), reminiscent of the constructivist shift identified by networked learning (Goodyear, 2001). Part of its novelty and attraction to practitioners is that it addresses issues beyond the somewhat narrow scope of traditional learning theories such as behaviorism and cognitivism. The principles of connectivism as outlined in Figure 1 emphasize the distribution of learning across networks of people and things and the capacity of learners to be active. Interestingly, technology is referred to only tangentially (as non-

human appliances) in the principles of connectivism, but the wider discourse around it is imbued with the exciting possibilities of technology-enabled learning. Hence the testing of connectivism against what constitutes a learning theory becomes a paradox. Connectivism aspires to redefine learning within the diverse contexts identified in the Introduction and to deliver a learning theory for the digital age. This is a tall order for so young a theory, as it is yet untested: This may account for its lack of rigour. In this paper, I am not only looking for one learning theory but rather theories that will help us to understand and make changes as learners, teachers, and learning technologists in this evolving context. So where can connectivism make a contribution?

Connectivism as a Phenomenon

If connectivism is not a learning theory per se, what sort of theory is it?

Theory n. pl., -ries
1. A system of rules, procedures and assumptions used to produce a result.
2. Abstract knowledge or reasoning.
3. A conjectural view or idea: *I have a theory about that.*
4. An ideal or hypothetical situation (esp. in **in theory**).
5. A set of hypotheses related by logical or mathematical arguments to explain a wide variety of connected phenomena in general terms: *the theory of relativity*
6. A non-technical term for a hypothesis

(*The Collins Concise Dictionary Plus*, 1989)

Figure 2. Definitions of theory.

Connectivism's denial that knowledge is propositional precludes it from complying with definition 1 (Downes, 2007b). Downes' writing on connectionist/connective knowledge qualifies as "abstract knowledge or reasoning" (Downes, 2006a, 2006b); whereas, Siemens' writing on connectivism is engaging and includes other theories, more in line with definition 3. The conjectural view of connectivism could help to explain its appeal to the participants of CCK08 and CCK09, many of whom were able to incorporate it in their own personal theorizing about learning and teaching in a connected world. Although Downes writes extensively on logic (1995–2001), connectivism cannot be described as a set of hypotheses linked by logical or mathematical argument or phrased as a hypothesis that can be tested.

Apparent within the body of writing on connectivism are two connected but slightly separate strands: "connectivism" (in the post-2004 Siemens sense) and "connective knowledge" (the epistemology argued by Downes). Other disjunctions exist: Downes writes about the differences between groups and networks that he sees as an important element of connectivism, though this is one element on which Siemens places less emphasis, seeing groups as a type of network (see http://elearnspace.org/media/CCK08_Wk5/player.html). In their research on CCK08, Mackness, Mak, and Williams (2010) find that when the *theory* of connectivism is situated in the *practice* of a MOOC, its network principles of diversity, autonomy, openness, and emergent knowledge are compromised.

Cormier (2008) acknowledges that connectivism enables a community of people (working with learning technologies) to legitimize what they are doing. When we look at the impact connectivism and actor-network theory have had on the blogosphere and in more traditional academic publishing (using Scholar.google.co.uk as a somewhat less than perfect surrogate for the latter),[1] we can see that connectivism made a big splash in the blogosphere after the publication of Siemens' article in 2004, but had a relatively small impact in scholarly publishing (see Figure 3), whilst discussion about actor-network theory has continued to grow steadily in both spheres (see Figures 3 & 4).

One explanation for this is that actor-network theory and other robust theories of social change have developed not only by argument and exposition but also by the conduct and publication of rich studies. Alternatively, connectivism experienced a huge growth in the blogosphere, the peak coinciding with the very successful MOOC CCK08. Taking 2008 as an example, Siemens and Downes made a huge contribution by way of argument, exposition,[2] and interaction via CCK08, but the contribution to knowledge that emerges from rich studies of practice has been lacking to date. This is changing as at least two funded research projects relating to connectivism are underway: an exploration of personal learning environments led by Stephen Downes (see http://ple.elg.ca/blog/?page_id=35), and research by George Siemens, Dave Cormier, and Bonnie Stewart into how open learning (M)OOCs can support the digital economy (George Siemens, 2010).

Nevertheless, the CCK08 and, to a lesser extent, CCK09 MOOCs provided many opportunities for practitioners to explore connectivism as a frame for their changing practice as they modeled the behaviors they wanted their students to use. The networked interaction that some CCK08 participants experienced through blogs (also interlinked to forums) enabled them to situate connectivism within their personal learning contexts (Mak, Williams, & Mackness, 2010).

The CCK08 and CCK09 MOOCs generated research that critiqued connectivism in the context of CCK08 and CCK09 (Bell, 2010; Mackness et al., 2010; Mak et al., 2010) and revealed details of the participants' views and practices on them (Mackness et al., 2010; Mak et al., 2010).

[1] Updated from graphs in (Bell, 2010), where searches were done in early 2009. It is interesting to note differences with Scholar.google picking up older references (perhaps via institutional research repositories) and the blog search losing hits (perhaps through more sophisticated elimination of duplicates). It should be noted thatScholar Google data is not 100% correct, with occasional errors in dates, etc. being evident.
[2] According to their Web sites, in 2008 Downes gave 38 and Siemens gave 21 presentations (although this only covers the time period between January and August of that year).

However, none of this research was funded, and it responded to connectivism, rather than making a deep impact on it as a theory. Connectivism has not established itself as a distinct learning theory, although its epistemology can make a contribution to new paradigms of learning (Kop &

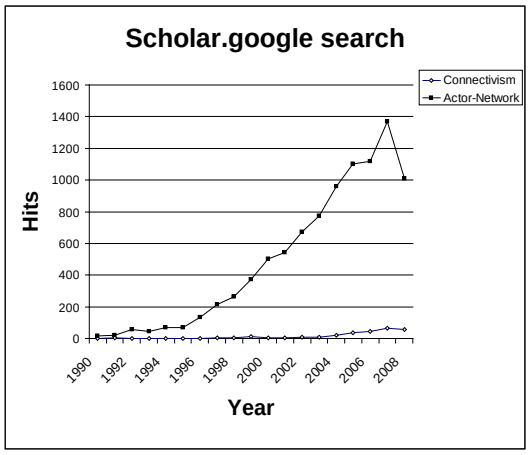

*Figure 3***.** Search of Google Scholar for connectivism and actor-network theory.

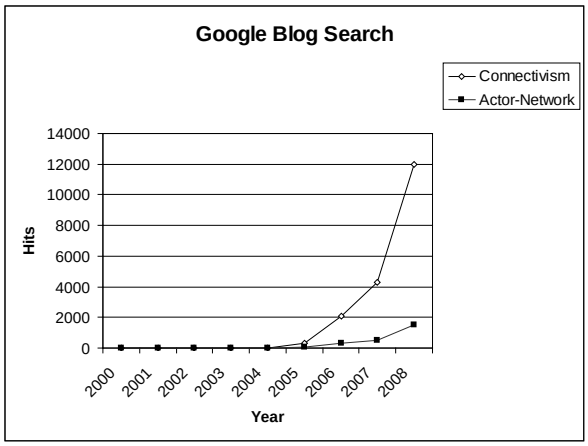

Figure 4. Google Blog Search for connectivism and actor-network theory.

Hill, 2008; Verhagen, 2006), and its study and practice can provide a rich context for exploring those paradigms (Bell, 2010; Mackness et al., 2010; Mak et al., 2010). Therefore, I argue that connectivism makes its contribution mainly as a *phenomenon*, "a thing as it appears, rather than as a thing in itself" (*The Collins Concise Dictionary Plus*, 1989, p. 997), comprised of a book, articles, blog posts, and the vast network of people and things that comprise the CCK08 and CCK09 MOOCs. Connectivism currently has its impact mainly at the level of curriculum (Verhagen, 2006); to go beyond that, it requires further elaboration and development, informed by rich studies that test its application in practice (Bell, 2010). It remains to be seen whether or not Downes' and Siemens' research projects will help to build connectivism as a theory.

One of the participants in CCK08 noted the irony of the protagonists travelling the world giving presentations in which they told the audience that lecturing with Powerpoint slides did not work (see http://www.youtube.com/watch?v=uilkFoe4hQo#t=05m39s).[3]

Theories to Support and Understand Innovation and Change in Technology-Enabled Learning

If connectivism is insufficient, the question remains: Which theories are needed to learn and make change in this dynamic, sociotechnical environment? The scope and intention of research and change are widely variable within this environment. I envisage actions being taken in small, medium, and large scales, with theories informing the agency of practitioners, those intervening with technology, and researchers trying to gain in-depth understanding and knowledge. Good research is not only informed by theory but also helps to build it. In the Introduction, I argued that

[3] This YouTube video is a patchwork of extracts from blog and forum posts from CCK08, presented as a conversation between Sisi Kate (a composite CCK08 learner) and Stephen Downes.

the paradigm shift in learning associated with emerging technologies increases the scope of change beyond individuals, classrooms, and institutions and provokes shifts in roles and power relations. For these reasons, we need to look beyond traditional theories in education.

Likewise, interventions in dynamic organizational and social settings demand evaluations that can generate evidence to reflect on what has worked and what can be done differently in the future.

> Evaluations should be "theory based" in two ways. First, an evaluation can be supported and framed by a theory of change in an organisational setting and second, the change process is shaped by the theories of change implicit in innovation strategies adopted by change agents. These implicit theories of change are an important focus for evaluation and form the basis of "grounded theories" that, once made explicit, are useful in making sense of the change process. It is in the contribution to this sense making (see Weik, 1976 [my insertion]) process that evaluations have their value. (Saunders, Charlier, & Bonamy, 2004)

It is beyond the scope of this paper to explore in detail the range of theories from which we might draw, but the mapping of contexts to possible theories illustrates how technology-enabled learning researchers and practitioners can build on knowledge from unfamiliar fields, preferably within interdisciplinary groups. The following five imaginary scenarios are drawn from elements of existing and proposed projects but are not based in detail on any one project. They are designed to present a range of scenarios of change and learning that suggest different theories for framing the research or intervention. It is important to note that the list of theories used below is not exhaustive but rather is suggestive of a variety that exceeds what are generally called learning theories.

Scenario 1: Teacher Adopting Web 2.0 in the Classroom

Neville, a teacher in a Canadian community college, participated in CCK08 and CCK09, the Connectivism and Connective Knowledge MOOCs. He has been experimenting with Web 2.0 features such as blogs and wikis with his students. Neville was particularly inspired by the video that Wendy Drexler created with her students (see http://teachweb2.blogspot.com/2008/11/cck08-connectivism-networked-studentthe.html). He now feels ready to integrate these small innovations in a more comprehensive approach that encourages increasingly active learning on the part of his students. What Neville learned and practiced on CCK08 and CCK09 has inspired these innovations. He has been able to use what he has learned through connectivism to introduce innovations to his classroom and is reflecting on the outcomes. The "informating"[4] aspects of

[4] Informating is a term coined by Shoshana Zuboff to denote the process by which the use of information technology provides an additional layer of information about the activities being automated, thus rendering them visible to the organization (Zuboff, 1988).

Web 2.0 services have offered "data" on student usage of resources and activities. Student blog posts and reflective assignments have provided Neville with qualitative insights into the impact of his innovations on the students. His main objectives are to improve his own practice as a teacher, to improve the support he offers to learners, and to encourage effective, networked learning in his students.

Participation in CCK08 and CCK09 enabled Neville to experience connectivism as a phenomenon, and he was able to model the behaviors it promotes as a means of exploring and honing the activities he has in mind for his students. Being theoretically open (for example, in the variety of thinkers invited as speakers to CCK08 and CCK09), connectivism also encourages Neville to apply other theories, such as complexity theory, to his and his students' practice.

Scenario 2: Different Interpretations of Open Educational Resources

Higher education institutions sign up to open access initiatives that further the open sharing of knowledge (Budapest Open Access Initiative, 2002) and educational resources globally (Cape Town Open Education Declaration, 2007). However, in the case of educational resources, the roles of institutions and their employees may differ significantly from one institution to another. Mindful of this, a major charity is funding research into how different institutions interpret open educational resources (OERs), specifically in relation to the co-creation of knowledge. A team of social science researchers from three different universities has submitted a proposal for the funding of an actor-network study of the uptake, sharing, and reuse of OERs in their universities:

1. A major American university, which publishes most of its lectures as streamed Internet videos;
2. A Scandinavian university whose computer science department has strong links with an African university;
3. A (different) African university that is currently running a project to reappropriate OERs within the local context.

The objectives of the proposed research are to increase the understanding of development and agency of networks of technologically mediated OERs, institutions, individuals, organizations, and statements by following the human and non-human actors as their networks form and decay.

Scenario 3: Implementation of Information Literacy Strategy in a German University

Recognizing the importance of information literacy in formal education and lifelong learning (vom Orde & Wein, 2009), a German university is implementing its information literacy strategy. The prevailing approach in this university is to make sound decisions on the deployment of technologies and resources to help achieve strategic objectives. Return on investment (RoI) and achievement of planned outcomes are seen as equally important, and senior management wants evidence to monitor both RoI and outcomes. There is also a commitment to ensuring a good

student experience. Whilst standard quality measurements (such as student surveys) are in place, the university is also interested in detailed and revealing stories of the student experience.

A three-pronged evaluation is planned as follows:

1. Waypoints attached to the student life cycle record that capture relevant entry criteria, such as academic and other entry qualifications (including information literacy), attendance at induction and library sessions, disciplinary events (e.g., plagiarism investigations), and any follow-up support actions, marks for relevant modules, average mark for the year, and final classification. These will be complemented by a toolkit that permits analysis of this data by year, subject, cohort, and individual.
2. Reporting will be provided on the impact of the information literacy using traditional quality assurance (QA) routes (program and module reviews) linked to the data analysis from 1.
3. Internal funding of smaller, qualitative studies will uncover the details of student experiences drawn from support activities with librarians, embedded within academic modules, and through informal student learning.

Scenario 4: Study of Young People's Use of the Internet and Social Media for Informal Learning

Researchers in a UK research group have been conducting longitudinal research with families on their experiences in their "digitally saturated" lives. They have noticed that some young people who may not always be high achievers at school are willing to invest a significant amount of time in learning and teaching skills online within informal networks and communities, whilst others do not choose to learn in this way.

The research group has been using social shaping theories (from science and technology studies) (Mackenzie & Wacjman, 1999), extended within a social learning framework that focuses on the reflexive practice in the development of technologies (Stewart & Williams, 2005). This framework draws on two key processes: "innofusion," or innovation that happens at the site of use (Fleck, 1988); and "domestication," where the consumer innovates by using the artefact in ways not anticipated by the designer (Silverstone, Hirsch, & Morley, 1992).

The research team has obtained funding from the UK Economic and Social Research Council to study the online informal learning of young people aged 12–15 in their target families (to tie this in with the OFCOM media audit data, see http://www.ofcom.org.uk/advice/media_literacy/ml_audit/).

For this new research they will avoid Prensky's digital native/digital immigrant dualism (Prensky, 2001) because this has been shown to be an inadequate explanation of young people's competence and effectiveness with digital media and services (Bayne & Ross, 2007; Bennett, Maton, & Kervin, 2008; Selwyn, 2009). They seek more nuanced explanations of how and why young people do and do not consume and create digital media (particularly in collective, informal

learning), and how this relates to their everyday lives. For this reason they are going to use Vygotsky's theory of the zone of proximal development, where young people are learning incrementally and socially with the help of more capable peers (Chaiklin, 2003).

Scenario 5: Investigation into the Use of ICT in a Sheltered Housing Scheme in a Deprived Area

A housing association is building a new sheltered housing scheme in a deprived area in the North of England. They are keen for the housing scheme to become part of the community to strengthen links between the managers, employees, and residents. The use of ICTs is one aspect of this. The regional development agency has funded a partnership between the housing association and the local university so that academic knowledge can be brought to bear on the best use of ICTs to improve the quality of life for residents and employees and on the integration of the housing scheme within the local community.

Conscious of the need to include both human agency and material/societal structures in the analysis and change, the university partner plans to use activity theory (AT), which can support a rich view of human activity mediated by artefacts over time. The human activity systems are dynamic and interact with each other in networks, which can themselves be reconfigured through expansive transformation, a significant reconceptualization of the activity system. This is a collective learning and change effort, and so is suited to third-generation AT (Engeström, 2001).

Table 2

Summary of Key Features of Alternative Research/Evaluation Scenarios

Scenario	**Scope of intervention**	**Research/evaluation approach**	**Intention/ purpose**	**Theories used/ related work**
(1) Teacher adopting Web 2.0 in the classroom	Local, within the freedom of choice exercised by teacher	Reflective practice without funding.	To improve teacher's practice and support and to encourage effective networked learning in students.	Connectivism and other theories explored by teacher Example: Networked student (Drexler, 2008)
(2) Different interpretations of open educational resources	Global at institutional level	Rich, qualitative study funded by charity organization.	To increase understanding of how knowledge is co-created and dissolved through the development and use of OERs.	Actor-network theory (Latour, 2005) Example: Flexible learning (Bigum & Rowan, 2004)
(3) Implementation of information literacy strategy in a German university	Institutional/ local	Managed change informed by evidence captured through institutional processes. Small studies can adopt a variety of research/evaluation approaches. Funded by institution.	To make effective and evidenced change at institutional and curriculum level.	Theories of change management (Scott, 2003) and information literacy (Beetham, 2009). Various theories to inform the small interventions. Example: Learning literacies in a digital age (Beetham, 2009)
(4) Study of young people's use of the Internet and social media for informal learning	Study of networked individuals in domestic settings	Rich, qualitative study funded by a research council.	Generate rich understanding of young people's experiences of informal learning online.	Social learning (Stewart & Williams, 2005; Williams, Stewart, & Slack, 2005) and

				Vygotsky's ZPD (Chaiklin, 2003) Example: (Griffiths & Light, 2010)
(5) Investigation into the use of ICT in a sheltered housing scheme in a deprived area	Institutional/community	Action research, informed by activity theory and funded by regional development agency.	Explore use of ICTs to improve the quality of life for residents, employees, and the integration of the housing scheme within the local community.	Action research (Reason & Bradbury, 2008) Third-generation activity theory (Engeström, 2001). Example: (Engeström & Kerosuo, 2007)

Discussion and Conclusions

The mapping of scenarios to theories in Table 2 explores the range of available theories and purposes of change that practitioners can undertake and that researchers can investigate. In choosing theories, practitioners and researchers make plans and actions within the resource envelope (of knowledge, skill, time, money, support, and goodwill) available to them. There are always alternative theoretical frameworks that we can construct outside of conventional learning theory. Table 2 is intended to demonstrate how we can usefully look beyond the familiar to other related fields. In scenario 1, the teacher draws on his experience of a MOOC to inform his and his students' changing practices. The charity in scenario 2 appreciates that the complex practices around OERs demand a rich study rather than simplistic statements about the benefits of OERs. Although both are networked theories, actor-network theory will give a much more comprehensive picture of what is happening than will connectivism (Bell, 2010). Scenario 3 is a practical mix of managed change and small-scale qualitative and quantitative evaluation. In scenario 4, the researchers are extending their familiar palette of critical and interpretive social theories to include Vygotskyan theory because there is an element of informal learning in a digitally mediated setting. Scenario 5 employs third-generation activity theory to guide and understand the effective use of ICTs to support human activities in a complex community context.

In the current dynamic context for learning and education, connectivism alone is insufficient as a theory to inform learning and its technology-enabled support in an internetworked world. We cannot yet expect a single, all-encompassing theory in this context for learning, if indeed we ever could. Connectivism exists as an influential phenomenon that inspires teachers and learners to make changes in their practice but will not be built as a theory without significant qualitative studies to inform its development within the context of other theories. Five scenarios are presented that argue for the active and justified choice of theories (including but not limited to learning theories) to support change in the use of technology in teaching and learning. These

scenarios demonstrate the variety in the scope and purpose of the intervention as well as in the funding available to resource the research/evaluation. All of these factors, as well as the experience and philosophical stances of researchers, feed into the decision on which theory or combination of theories to use. The theories identified in these scenarios are wide-ranging but not exhaustive, and in each case alternative choices would have been feasible.

It is not surprising that as the scope of changes in learning enabled by technologies increases, so does our need to expand the repertoire of theories and research approaches. As a global society, we also need to invest in funding high-quality research. Technology brings golden opportunities but can leave a trail of disappointment; good research and evaluation can contribute to a world in which we learn from our mistakes and maximize our future opportunities.

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