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Special Issue - Connectivism: Design and Delivery of Social Networked Learning

Editorial

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New technologies that influence how information is created and shared and how people connect and socialize hold promise for adoption in education. Much like the idea of a book necessitated the development of the library or the idea of structured curriculum and domains of knowledge produced classrooms, the idea of the Internet – distributed, social, networked – influences the structure of education, teaching, and learning. Educators and researchers face a challenge in determining how the existing education system will be influenced and the new roles that will be expected of learners, teachers, and administrators. Information-centric fields such as journalism have struggled with the new democracy of information creation for over a decade. The music industry continues to grapple with access issues and the "unbundling of the album" initiated by Napster and firmly entrenched by iTunes. Telephone companies face an uncertain future as Skype, Google Voice, and other web-based communication services increase in popularity. Essentially, the Internet has remade how society creates and shares content and how people communicate and interact.

The implications for education are significant. Educators have explored the role of the Internet as a research and learning tool for several decades. In the late 1990s, social network services (e.g., Friendster) and easy publishing tools (such as blogs) increased the ability for anyone with an Internet connection to both publish and engage in online conversations. Since that time, we've experienced a decade of amazing innovation in social networking sites (Facebook, Twitter), in openness movements (open source, open access), in mobile technologies (mobile phones, iPads), in the growth of broadband, in gaming, in multimedia (YouTube, podcasts), and in new tools that blend the physical and virtual worlds (location-based services such as Foursquare and Groupon, augmented reality, "internet of things").

This special issue of IRRODL provides an opportunity to step back and reflect on how these dramatic social and technological changes impact education. In 2004, connectivism was presented as a new theory of learning that addresses learning in complex, social, networked environments. Since that time, numerous articles, open online courses, and online conferences have explored connectivism's application in education. As articles in this issue reflect, sharp criticism and support have been offered. We hope this issue will help to advance the discussion, to clarify areas of needed research, and to contribute to ongoing debate about the influence of the Internet on teaching and learning.

The first article by Mackey and Evans, "Interconnecting Networks of Practice for Professional Learning," considers how individuals participate in communities of practice and the activities of individual educators in forming their own networks of practice. The article introduces important points of friction that run through discussions of emerging technologies in education: To what degree can and should learners be autonomous in structuring and pursuing their learning? How do informal and formal learning intersect?

The next article by Rita Kop, "The Challenges to Connectivist Learning on Open Online Networks: Learning Experiences during a Massive Open Online Course," contrasts the *potential* of learning in open and social networks with the reality of literacies, autonomy, and skills of learners as evaluated in a large online course. In order for connectivism to make an impact beyond a small cluster of heavy web-users, skills, literacies, and competencies will need to be defined and developed. Implementing a new approach to learning requires acknowledging and addressing numerous challenges and frustrations on the part of learners.

In "Emergent Learning and Learning Ecologies in Web 2.0," Roy Williams, Regina Karousou, and Jenny Mackness explore the conditions and ecologies that best enable self-organized learning to occur. Their emphasis of the impact of learning ecologies on existing educational practices is an important consideration. Existing practices are systemically embedded. How can institutions move from monolithic systems to learning ecologies?

Diego Ernesto Leal Fonseca, in "EduCamp Colombia: Social Networked Learning for Teacher Training," offers a case study on planning and organizing a learning event on connectivist principles. The description of designing and sustaining an interactive learning environment, where individuals help to shape activities through minimal structure provided by organizers, will be of interest to learning designers. The key question of whether EduCamp activities can "transform practices" is open ended, revealing again the clash between ideal and reality in social networked learning.

Terry Anderson and Jon Dron detail "Three Generations of Distance Education Pedagogy" – behaviourism, constructivism, and connectivism. These different generations are evaluated through the community of inquiry model. Educators will be particularly interested in the discussion on the role of the teacher in connectivist pedagogical models.

In "Connectivism: Its Place in Theory-Informed Research and Innovation in Technology-Enabled Learning," Frances Bell offers a critique of connectivism as a standalone theory of learning. Bell emphasizes a concern that "connectivism is perceived as relevant by its practitioners but as lacking in rigour by its critics." To address the concerns of critics, Bell argues that while connectivism is influential, it will not be perceived as a theory of learning without the development of a substantial research base.

Grainne Conole, Rebecca Galley, and Juliette Culver consider existing and emerging perspectives on networked learning in their article "Frameworks for Understanding the Nature of Interactions, Networking, and Community in a Social Networking Site for Academic Practice." Their article evaluates the suitability of communities of inquiry, communities of practice, activity theory, and actor-network theory as frameworks for evaluating interactions in the social network, Cloudworks.

Andrew Ravenscroft raises the importance of dialogue in "open and ambient" pedagogies in the article "Dialogue and Connectivism: A New Approach to Understanding and Promoting Dialogue-Rich Networked Learning." Ravenscroft acknowledges the growing influence of the Web in society and learning. He emphasizes the importance of recognizing that most interactions are socially based and any theory of learning must account for this dialogical orientation.

In "Proposing an Integrated Research Framework for Connectivism: Utilising Theoretical Synergies," Bopelo Boitshwarelo advances a research perspective that emphasizes design-based research, communities of practice, and activity theory. Boitshwarelo advocates "integrating already established theoretical constructs" in developing research into connectivism.

As the first full journal issue, that we're aware of, devoted to connectivism, this special issue of IRRODL presents a somewhat confusing landscape. Some themes are emerging around the relationship of connectivism to existing theories of learning and social interaction (communities of practice, actor-network theory, and activity theory being most prominent). Critiques of connectivism also reveal themes: the need for ongoing research, the suitability of existing theories in answering the questions that connectivism attempts to address, and the status of connectivism as a theory of learning.

The growing profile of social networked learning in formal and informal learning cannot be ignored. Stuart Kauffman has advanced a concept of the "adjacent possible" to describe biological change. The simple concept is that each development in a species or ecosystem enacts a new range of possibilities that weren't possible before. Applying this notion to education, it becomes clear that the advances of the Web and technology in general have opened new "adjacent possibles," such as thin-walled classrooms, distributed real-time learning, and global social networks. It seems futile to debate the merits of connectivism versus behaviourism, cognivitism, or constructivism. Instead, several questions arise. Which theory best maps to the reality of a particular subject content? Which theory most effectively embraces the adjacent possible of our technologically based society? Which theory best meets current and future learning needs of learners? As editors, it is our hope that the articles in this special issue will

serve in advancing the discussion around existing and emerging theories of learning and in provoking researchers to test assertions of each theory and raise new possibilities for teaching and learning.

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Interconnecting Networks of Practice for Professional Learning

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Abstract

The article explores the complementary connections between communities of practice and the ways in which individuals orchestrate their engagement with others to further their professional learning. It does so by reporting on part of a research project conducted in New Zealand on teachers' online professional learning in a university graduate diploma program on ICT education. Evolving from social constructivist pedagogy for online professional development, the research describes how teachers create their own networks of practice as they blend online and offline interactions with fellow learners and workplace colleagues. Teachers' perspectives of their professional learning activities challenge the way universities design formal online learning communities and highlight the potential for networked learning in the zones and intersections between professional practice and study.

The article extends the concepts of Lave and Wenger's (1991) communities of practice social theory of learning by considering the role participants play in determining their engagement and connections in and across boundaries between online learning communities and professional practice. It provides insights into the applicability of connectivist concepts for developing online pedagogies to promote socially networked learning and for emphasising the role of the learner in defining their learning pathways.

Keywords: Connecting online and professional communities; online education; networks of practice; professional learning; communities of practice

Introduction

Research focusing on the intersections between work and study, and particularly the role of online learning for professional development, represents an area of growing interest, not only in teacher education but also in other professional learning, development, and support (Conrad, 2008; Maor & Volet, 2007). The advent of online learning has been accompanied by burgeoning interest in the notion of community to support sociocultural approaches to learning. Garrison and Cleveland-Innes (2005, p. 135) suggest that "an interactive community of learners is generally considered the *sine qua non* of higher education." Networked learning has been accompanied by a growing interest in approaches that employ communication technologies to foster collaborative processes, interaction (Cousin & Deepwell, 2005; Sorensen, 2005), and the social construction of knowledge (Edwards & Romeo, 2003). Consequently, attention has been given to understanding the potential and characteristics of online learning communities (Garrison, 2007; Goodfellow, 2005; Henri, Charlier, Daele, & Pudelko, 2003; Henri & Pudelko, 2003; Palloff & Pratt, 2007).

Higher education institutions adopting these social constructivist theories tend to be prescriptive in the way formal online courses are organised and set expectations for students to participate in online interactions as part of their course work. That is, social networking is mandated rather than organic and, as such, may encourage instrumentalist participation. Such approaches are supported by "a general and intuitive consensus in the literature . . . that the learner builds knowledge through discussions with peers, teachers and tutors" (Dysthe, 2002, p. 343), and others, for example, Geer (2005), Wilson, Ludwig-Hardman, Thornam, and Dunlap (2004), who advocate the role of community in supporting learning via interaction and collaboration. Slevin (2008, p. 116), considering the role of social interaction in e-learning contexts, challenges educators to ask, "How can institutions of learning best deploy modern communication technologies in order to engage and interact meaningfully with those seeking knowledge, guidance and inspiration?"

A problem with institutional perspectives of socially constructed learning is that the zone of interaction is usually confined to the online course community. There is little acknowledgement of the overlapping experiences of participants in communities of practice and other informal learning networks beyond the online course. Downes (2006) hints at this pedagogical weakness, suggesting that within formal online courses there is a tendency for community formation to be an adjunct of the course content, rather than the community itself driving learning interactions and determining salient content and resources. Discussions and interactions are shaped by content and curriculum, and the existence of a course community corresponds with the beginning and end of the course.

This insular view of community, bounded by course curriculum and timelines, is problematic for professional learning and highlights a tension between the underlying philosophical stance and the pedagogies adopted by universities. A central tenet of sociocultural epistemologies is that learning is vitally situated within the context of its development and that "understanding and experience are in constant interaction" (Lave & Wenger, 1991, p. 51). As Lave and Wenger (1991) describe in their theory of social practice, there is a "relational interdependency of agent and world, activity, meaning, cognition, learning, and knowing" (p. 1). Brown, Collins, and

Duguid (1989) champion a similar position, stating that "activity, concept and culture are interdependent" (p. 34). According to Lave and Wenger (1991) learning is entrenched in social activities and occurs naturally in workplace interactions outside formal educational or training endeavours; learning is inextricably entwined with making meaning, sharing social and historical practices, forming identity, and belonging to community. How then do participants in formal, course-based learning make sense of and connect their simultaneous and overlapping experiences? Furthermore, how might participants' experiences inform an understanding of learning as interconnections between practices, communities, members, and opportunities?

This article argues that there are strong links between social learning theory, formal online learning opportunities, and authentic learning in communities of practice. Furthermore, there is merit in positioning multimembership of communities of practice, enabled by e-learning and virtual learning environments, as examples of connectivist pedagogies in action. Wenger (2007, in Dyke, Conole, Ravenscroft, & de Freitas, 2007, p. 93) suggests that "social learning theory has profound design implications for the design of pedagogical e-learning" and that "rather than focusing solely on the design of self-contained learning environments, . . . e-learning also explores the learning potential of emerging technologies, that is, the ways in which these technologies amplify (or curtail) the learning opportunities inherent in the world" (p. 93).

Wenger's (1998) social theory of learning underpins the research reported in this article. The ensuing discussion describes how elements of that framework, such as multimembership of communities, boundary crossing, and brokering can be interpreted as connectivist pedagogies and understood through the multipoint connections teachers develop through their online professional development. The perspectives of the teachers in this study provide insight into how universities might design learning environments that foster personal professional learning in and between networks of practice.

Research Design

The research (conducted by Mackey for her Ph.D.) investigated the learning and professional experiences of 15 teachers studying a Graduate Diploma in ICT in Education at the University of Canterbury, Christchurch, New Zealand, between 2005 and 2008. Case-study methods were used to conduct the research. The case was bounded in the sense that it centred on the teachers involved in the particular online professional development program. However, the boundaries between the teachers' study and their work, and between local and virtual contexts, and the interrelationships with the broader social, political, and economic milieux also informed the case study.

The study was designed, therefore, as a holistic case study with embedded cases (Yin, 2006); a conceptual diagram is provided in Figure 1. The holistic case is about the experiences of 15 teachers enrolled in a specific online professional development program. The embedded cases are sub-cases which contribute to a more comprehensive understanding of an issue or condition. The first level of embedded cases in this study comprises eight of the fifteen teachers and these subcases enable an in-depth analysis of the activities within the online learning environment. The

second level of embedded cases, the professional community subgroup, comprises a nested group of four teachers within the learning community subgroup; these four teachers add depth to the study by including data from their school communities of practice. This nested design, with embedded case studies, enables a deeper level of analysis than is possible across the holistic case. All 15 teachers contributed to an overall understanding of how teachers learn, and where they situate their learning as they engage in online professional development. The purpose of the embedded cases was not to condense teachers' experiences into a homogenous explanation of what it means to engage in online professional development, but rather to identify and illustrate the various experiences, issues, dilemmas, and impacts that contribute in some way to teachers' professional learning in, and between, communities.

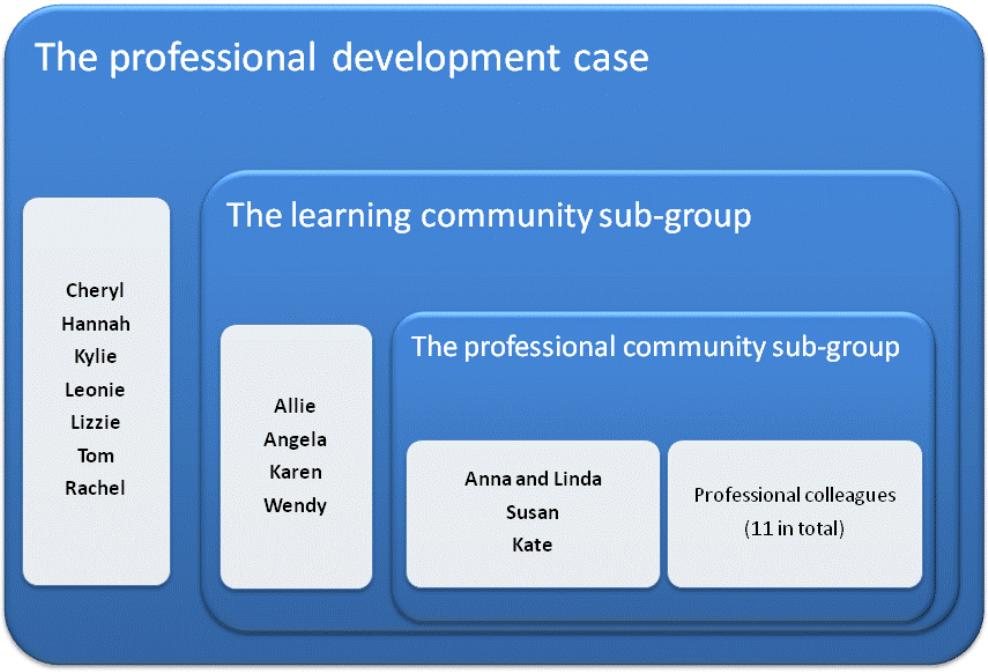

Figure 1. Embedded case design.

Thirty interviews were conducted with 15 teachers to provide in-depth perspectives about online study. In addition, all available online activity records drawn from 65 course enrolments across 11 separate courses were analysed for these teachers to provide a measure of their online engagement. These data sources were complemented with examples of online course participation (forum postings, peer review comments, shared documents, and activities) and assignments; and for the nested subset of teachers, interviews were conducted with 11 school peers to obtain an external perspective from close-at-hand colleagues who were not studying in the online courses. These strategies, along with an examination of official documents and the online course sites, contributed depth and detail to the case data.

From the outset this research drew on Wenger's (1998) communities of practice as a theoretical framework in designing the study, shaping the methodology, and guiding the data collection, analysis, and interpretation. There was a tension in adopting and implementing this framework.

While valuable as a descriptive theory for studying adult learning in natural settings (particularly applicable within the school context), the theory's propositions raised questions around the existence of online communities. Wenger's social learning theory was useful in interrogating the online learning community, but it also highlighted weaknesses, or what *was not* rather than what *was*, social practice. These questions prompted a closer analysis of the participants' perspectives and the responsibility they took for designing their personal learning connections in and between communities. This extends understanding of where participants situate their learning, how they use interaction to meet their own learning needs, and how they manage their professional learning experiences.

The Participants

The research focused on the perspectives of teachers who were motivated to learn *about* ICT, *through* ICT-mediated learning, but who had little or no experience of learning online themselves. They were experienced classroom teachers who were simultaneously encountering the unsettling experience of being learners and novices in a virtual learning environment. They were learning about the pedagogical use of ICT while learning with and through ICT, which added a further dimension to the overlapping environments of work (community of professional practice) and study (professional learning community).

The research also investigated the diffusion of teachers' learning experiences beyond their own classrooms into their schools and professional communities. Some participants were responsible for leading and supporting ICT integration amongst their colleagues, thus creating potential for their professional learning to produce benefits beyond their own immediate practice.

All 15 participants held a teaching qualification and were enrolled in two and up to seven online courses during the data collection period (2005–2008); they represented a range of teaching experiences, ages, and predispositions towards online study. Participants were employed in early childhood (1), primary (8), intermediate (1), and secondary (5) education. The participants were also geographically spread, and although seven lived in Christchurch, none worked in the same school or appeared to know each other previously; another seven were located elsewhere in New Zealand; and one worked in the United Arab Emirates (UAE).

A discussion of selected findings and their analyses follows. It draws on both quantitative and qualitative data, explores one participant's engagement in detail, and uses related theory for the analytical discussion.

Measures of Connection

The quantitative measures of analysis identified wide variations in the levels of participation by teachers. Three quantitative measures were used to evaluate teachers' online participation in each course, namely hours spent logged in to each course site, frequency of log-ins, and number of posts made to discussion forums or activities. The chart below illustrates the variation in

participation reflected in the average measure for each teacher (based on the data analysed from each course in which they participated).

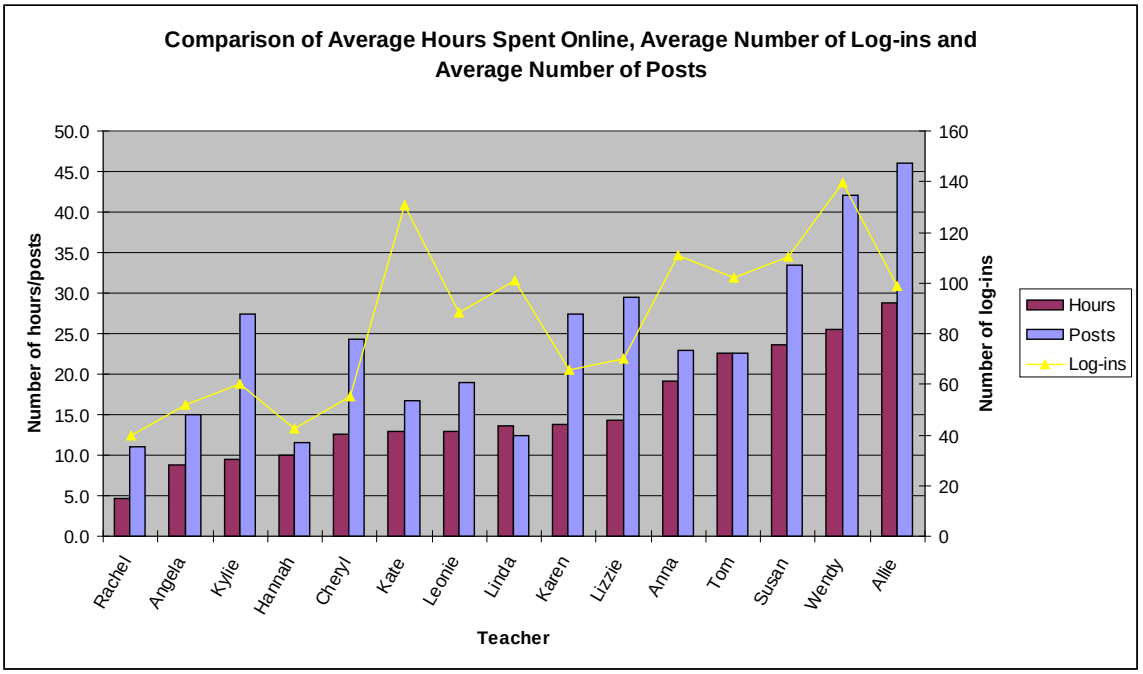

Figure 2. Analysis of online participation using quantitative measures.

Quantitative data from learning management systems (LMSs) provide useful measures of what are rather superficial matters of learning; for example, log-in frequencies do not measure or reflect the learning processes or the quality of learning (Hansmann, 2006; Pena-Shaff & Nicholls, 2004). Interpretations of learning activities are achieved when quantitative records are complemented by contextual information about students' learning and critical thinking within their learning contexts (Janetzko, 2008). This research not only triangulated the quantitative measures with such information but also drew substantially on teachers' own reflections and comments about their online learning experiences.

The interpretation of teacher's experiences was informed by Wenger's (1998) communities of practice with particular attention to the processes of multimembership of communities. Teachers' dual membership in professional and online communities can be conceptualised as boundary spanning which has the potential "to create continuities across boundaries" (Wenger, 1998, p. 105). These continuities or connections can be forged through documents, terms, and concepts, which connect practices from one context into another, and through the actions of "people who can introduce the elements of one practice into another" (p. 105). Not all experiences of multimembership entail brokering—something which Wenger describes as a complex activity requiring "processes of translation, coordination, and alignment between perspectives" (p. 109). The boundary of a community of practice can be envisaged as a delineation of practices and membership, but it can also be regarded as a permeable zone representing opportunities for overlap, connections, and participation by outsiders or newcomers. When community members traverse these intangible boundaries they are exposed to new learning opportunities that can be

translated or introduced to the practices of their originating community. A discussion follows of the participants' experiences of dual membership in relation to their connections with the online community and of their processes of translation, coordination, and alignment between their online and professional communities.

Customised Connections: Purposeful, Pragmatic, and Passing

The analysis of teachers' online participation (as shown in Figure 2), combined with content analysis of online posts and contributions, demonstrated high levels of activity and strong indicators of social presence in the online community by some teachers and much weaker indicators for others. However, what was evident from teachers' interviews was that their perceptions of learning connections and interactions were considerably different from the picture gleaned from the LMS data or from the interpretations that might have been assumed by lecturers. What was most telling, however, was that even the most apparently active teachers in the online environment were pragmatic and purposeful about their involvement in the online community.

In order to illustrate how these characteristics and behaviours played out in the online environment, and how they were perceived by the participants, the following section will describe the experiences of one teacher, Allie, who was particularly active in all of her online courses.

Allie averaged the most time online per course and made the highest average number of posts across the three courses in which she was enrolled. An analysis of Allie's online postings also indicated strong social presence, evidenced through her use of informal language (e.g., "ha," "darn," "yikes"), conversational style (e.g., "so true," "I know, I know"), text symbols (e.g., exclamation marks, ellipsis marks), humour, and emoticons to convey a personal dimension within her posts. She disclosed aspects of her personal life, frequently responded to others, greeted people by first name, used rhetorical questions, referred to the content of their contributions, and wrote affirmatively. Allie was not alone in these behaviours, as almost all of the participants exhibited similar social presence in their online activities. Even the most reticent of the online community subgroup, Angela, slowly gained confidence and reported that she enjoyed facilitating a group activity and felt more at ease in the online environment.

When Allie joined a group activity she was proactive in initiating processes, encouraging others, and taking personal responsibility for contributing to the task. She was also sensitive to others and willing to accommodate different perspectives or approaches. Online posts also indicated that Allie confidently requested clarification or help and addressed questions to both the lecturer and other course members. She was not afraid to respond to feedback from the course lecturer when she felt her ideas might have been misinterpreted.

Allie, like the majority of the online subcommunity participants, conveyed a sense of mutual engagement with others in her online postings. She placed herself in the role of fellow teacher, assuming others to have similar experiences, and identifying with the common practices and experiences of teaching. Allie's language also embraced others as members of the wider teaching community, assuming common ground and mutual interests (e.g., "most of us who have tried

some sort of multimedia project in our room"; and "I really don't think we have a choice as teachers"). Many of Allie's online posts reflected on the prescribed readings for the course or peer presentations, linking theoretical ideas with her own experience. While the posts were practical rather than theoretical, they represented cognitive processes connecting new ideas or strategies with Allie's beliefs and everyday practice. Again, Allie's responses were typical of the online community subgroup, where inclusive salutations, reference to others' work or comments, and reflections on teaching in relation to theoretical ideas were common in the online forums. Two interviews were conducted with Allie in her classroom after school hours, and one interview at a later date after she had moved to a library-based learning centre established to support the use of digital technologies in school and community-based programs. The interviews focused on Allie's perceptions of her online learning, her connections with others online, and the connections she made between her online learning experiences, her teaching, and her school community of practice.

In contrast to her online persona and what appeared to be active engagement in the online environment, Allie's saw herself as "very individual" and someone who did what was required with "not a lot of extra mixing." However, she valued online interactions and commented that she "[replied] to comments—not because you need to—[but because] it's interesting to read comments." Allie admitted that she would gravitate towards some members because she identified with them and their context, and liked making comparisons with her own classes. Allie also described how she followed one course member's contributions (a principal) because she respected his leadership perspective. By her third interview Allie was recognising recurring names from earlier courses, and she related to these participants as digital acquaintances. Although Allie acknowledged a general sense of connection to the online course community, she did not identify any particular relationships that stood out as being significant, apart from the short bursts of activity in groups where interaction was required (e.g., in one course where collaborative group tasks were set). This weak connection to the online community was shared by all of the participants with one or two exceptions. Wendy and Susan, two secondary ICT specialists, began their study in the same semester and developed a closer tie as they studied several consecutive courses, even though they had never met in person. While they felt connected to each other, this familiarity did not extend to other course members. Similarly, Karen recognised an online network resulting from an informal cohort following a similar study plan with developing connections over ensuing semesters. Overall, participants appreciated lecturers' attempts to foster a sense of community but placed little importance on developing meaningful online connections. In spite of this, there was consensus that online contributions supported and initiated learning experiences for teachers and that cross-sector conversations promoted deeper consideration of ideas and theories.

Allie talked explicitly about her professional learning with her own students, telling them, "I talk about you all the time on this course, saying what we are up to." She regularly introduced her class to new strategies or ideas which originated from her coursework, and she was able to point to examples on her classroom walls that bore evidence of this. The connections between Allie's personal interest in ICT, her online study, and her teaching practice were clear. She deliberately embraced the new technologies being introduced into her school. It was clear that Allie

incorporated new ideas and strategies in authentic ways, extending beyond the need to comply with assignment requirements.

When Allie shifted to her new job she adapted the course requirements to suit her new context even though she was not teaching a regular class. She was justifiably proud of one course-related project where she developed a website to introduce a special themed program on creative creatures.

> I purposely picked something that I knew we could use for our holiday program, and our theme had already been set with "Seeing is believing".
>
> I built—using the .EXE program—a website. It was our intro for our holiday program. I broke it down into four [modules] and looked at creatures, and myths and legends, and creatures in movies, creatures in stories, all that kind of stuff. And then from there [the children] would use tablets and draw. So, I used that website for the start of the program and I trialled it on some kids [from a previous school].

The finished website was well-structured, made excellent use of multimedia elements to engage students, and provided an enticing introduction to the planned program. Allie integrated her course-inspired ideas in other ways as she experimented with different strategies. In one example Allie developed a youth heritage project supported by Web 2.0 technologies to ensure that students whom she saw infrequently (once per week) could stay in touch with her and other project members via a wiki. The depth of Allie's learning was evident in her reflections where she justified planning from theoretical perspectives and in an evaluative summary she presented to one online class via her own specially designed website. Not all of these activities were course requirements, and Allie's enthusiasm for technology spurred her to experiment with new strategies and ideas in both her classroom and community learning centre contexts.

In the language of Wenger's (1998) communities of practice social theory, Allie was a newcomer to the learning centre and was aware that she was still establishing herself, becoming familiar with the new culture, and gaining confidence in her new role. Allie was moving on an inward trajectory, from legitimate peripheral participation to a more established role in the organisation as she learnt more about its practices and expectations. When asked how she interacted with her colleagues and if she had opportunities to link her coursework into her new situation, she initially responded that she talked less to colleagues in her new role than she had in her previous job. However, as the interview progressed, this did not seem to be the case as Allie explained how she integrated some of her course activities and projects into the programs she was developing and how she worked with colleagues to do this. Her small team of new colleagues all had teaching backgrounds, and Allie would let her team leader know what she was doing and how her ideas might fit with the program. Later in the interview Allie compared her experiences working in the two different contexts.

> Because my colleagues here, especially M my team leader, is always asking, "so what is it that you are taking in your online this time?"—like she does see that we will use it. Whereas with teaching last year, I don't know, I mean some teachers knew I was taking online [study], but I don't know if they saw that as an opportunity that they might use something that I was doing. Because it was very much, whatever I did, I just used in my class. It could have been shared a lot more now that I look back at it. . . . Whereas here I think whatever I am learning, it will be used. In future courses, I can see that happening.

Although she was a relative newcomer to the learning centre, Allie actively spanned the boundaries between study and work. Encouraged by her team leader, Allie acted as a broker introducing new strategies to enhance the existing repertoire and practice.

Allie's experiences and examples were not dissimilar to those shared by other research participants. Her case is illustrative of the learning experiences encountered by teachers engaged in part-time online formal study while simultaneously working in teaching-related communities of practice. There was sound evidence, particularly from the school community subgroup where participants' perspectives were independently endorsed by colleagues, that teachers made strong connections to their own classrooms, and there were numerous examples of strategies and theoretical approaches informing practice. These examples included using Web 2.0 tools for creative, collaborative, student-led activities; designing and implementing webquests; concept mapping and higher-order thinking strategies; inquiry learning and blended learning approaches; introducing learning management systems into the organisation; providing professional development sessions for colleagues; sharing readings and resources; and lastly, but significantly, implementing practitioner research projects within the wider school (e.g., ICT and creativity in junior classrooms; ICT to support spelling programs; LMS implementation in a secondary school; and the use of Web 2.0 tools to connect a kiwi conservation project to the classroom).

Analysis: A Connectivist Perspective

When school teachers engage in university courses for professional development, they are increasingly turning to online or blended learning as a means to combine work and study (Mandinach, 2005; Means, Toyama, Murphy, Bakia, & Jones, 2009; Roskos, Jarosewich, Lenhart, & Collins, 2007). Web-based technologies can improve access, equity, and quality of professional learning opportunities. Also, establishing online cohorts of teachers in courses can provide rich interactions regardless of location and teaching commitments (Harlen & Doubler, 2007; Robinson, 2008; Teemant, Smith, Pinnegar, & Egan, 2005). In addition, online or blended professional development may provide "real-time, ongoing, work-embedded support" (Dede, Ketelhut, Whitehouse, Breit, & McCloskey, 2009, p. 9); benefits associated with written asynchronous communication, which can enhance learning by allowing more time for reflection and more considered response; the potential of the online community to encourage the sharing of

teachers' reflections and experiences; and extended access to resources and expertise beyond the immediate school environment (Dede et al., 2009; Harlen & Doubler, 2007). Lieberman and Pointer-Mace (2010) discuss the potential of networked technologies and communities to make teaching practice public and the transformative power of sharing teachers' knowledge. They highlight the value and impact of online connections, stating that "from more formal networks designed with particular purposes to informal grassroots connections, teacher professional learning is thriving online" (p. 86). Networked interactions allow teachers to *share* their own practice, rather than being the *passive* recipients of expert knowledge; such interactions provide opportunities for useful discourse related to practice. Laferrière, Lamon, and Chan (2006) similarly note that such technologies enable distributed cognition whereby teachers "create and improve knowledge of the community collectively" (p. 78).

This study showed that participants viewed the online interactions as useful but that, irrespective of their level of participation, they did not form strong connections with others in the online courses. There was evidence of sharing practices and understandings in the networked environment, but generally these were limited to the assessment and practicalities of completing the course. While the short duration of the courses (one 15-week semester) was a factor, teachers commonly found themselves in online classes with teachers from previous courses, which provided some sense of continuity but not enough to develop strong ties. Teachers identified superficial connections with others based around shared activities and a common understanding of roles and responsibilities in their school communities. The participants admitted gravitating towards "like-minded" course members but also recognised that different perspectives challenged their own thinking and prompted them to consider new possibilities. For example, secondary teachers noted that they didn't have a great deal in common with their primary colleagues, but nonetheless several noted that they were inspired to try new pedagogical approaches after reading posts from primary teachers. Such behaviours may also be interpreted in the light of Gravenotter's (1983) sociological theory of the strength of weak ties, whereby individuals benefit in various ways from their associations with acquaintances. While individuals are likely to have close ties with those who share similar world views and understandings, one advantage of weak ties is the opportunity to gain new information or resources via association with people beyond the ring of close relationships. Interestingly, and in alignment with Lave and Wenger's (1991) understanding of what it means to be a broker, Gravenotter also notes that weak ties with acquaintances outside the circle of a close community may act as a network bridge and enable the diffusion of new ideas and practices between groups. Improved global communication systems and the ability to network virtually with others increase the potential to utilise weak connections in this way as seen within this study.

The participants blended the formal learning opportunities with their daily work as teachers. They constructed their own network of practice, selecting those they connected with in both online and school communities; they managed the level of interaction, particularly in the online environment where they were pragmatic about their time and purposeful in selecting those they responded to and whose work they read; and they aligned ideas, theories, strategies, and pedagogical approaches from the course with their own contexts, deciding which to implement and which to discard.

Teachers traversed the boundaries between work and study, managing their experiences of multimembership in ways that made sense to them personally and that aligned with the contextual demands and organisational cultures of their workplace environments. For example, some teachers had strong departmental communities and used these connections to strengthen and extend their learning experiences; some used their own learning to lead ICT development within their schools; others focused on their own classrooms and teaching practice; and some, like Allie, explicitly shared their own learning experiences with their students and included them in the ongoing exploration of new technologies and strategies for learning.

Participants became brokers and conduits between the online learning community and their own community of practice. While their own teaching changed as a result of their study, it was also clear from interviews with participants and their colleagues that ideas permeated beyond their own classrooms. The participants were able to lead discussions, support colleagues, share their research activities, and introduce new ideas in their syndicates and departments. These activities were explained and endorsed by the teaching colleagues who were interviewed in the research. Furthermore, even when participants were less overt about their study and focused more specifically on their own teaching practice and their own classrooms, their colleagues were cognisant of study-inspired innovations emerging through children's work displayed on classroom walls and in presentations at assemblies.

The activities and perspectives of teachers in this study provided insight into the ways that individuals negotiate the formal and informal learning experiences in and between communities. The online learning community exhibited some characteristics of a functioning community of practice described by Wenger (1998), for example shared understandings and repertoire, sense of mutual engagement, and activities resembling joint enterprise. However, participants' perspectives did not support a trajectory of engagement from the periphery to a more centrally connected position within the online community. Although some of the participants had completed six or seven online courses and were active participants in the online environment, they held only a nebulous sense of belonging to the community. Their pragmatic, purposeful approach to the online community suggests that their personal learning strategies may well reflect some of the characteristics of connectivist learning as described by Siemens (2005) and Downes (2006). Participants' experiences and views harmonise with the following synopsis of connectivist theory.

> The starting point of connectivism is the individual. Personal knowledge is comprised of a network, which feeds into organizations and institutions, which in turn feed back into the network, and then continue to provide learning to [the] individual. This cycle of knowledge development (personal to network to organization) allows learners to remain current in their field through the connections they have formed (Siemens, 2004, p. 5).

Siemens (2005) also suggests that weak ties—such as those exhibited by the participants in the online course community—are a valuable source of information within personal learning networks. Furthermore, he suggests that these tenuous or fleeting connections play an important role in prompting and supporting innovative practices as individuals are exposed to new ideas from beyond their familiar network of practice.

Conclusion

A connectivist perspective provides a useful lens to interpret how working professionals (like teachers) access and interact with academic and scholarly expertise in universities and simultaneously with peers in different locations as well as with colleagues in their own workplace. The increasing use of Web 2.0 tools alongside institutional learning management systems enables extended connections with the wider educational community and other interested participants. For example, a course lecturer links to a well-respected national ICT leader's blog, or the course participants themselves contribute to online discussion forums, share work for peer review, or create publicly available artefacts online using Prezi, VoiceThread, etc. Learners are central to the process as they make the cognitive, social, and practical connections across networks enabled by technology.

It was clear in this research that the participants took control of their own online learning experiences. This sense of autonomy was evident in their choices and level of interaction online and offline and in the way they connected the theoretical and practical ideas from coursework to their own work contexts. They were focused on their own learning needs and were not looking for social engagement or sustained connections with others in the online environment. Their pragmatic online connections served a purpose, diversifying their networks and opening up new possibilities for learning, but these connections were different to the sustained interactions which occurred in their communities of practice. Teachers appeared to connect, blend, and design their own learning experiences in ways that dismissed issues of transfer and instead demonstrated permeability and connectivity between the two communities.

For the participants, online professional development provided opportunities to integrate their experiences as learners and teachers. Their experiences suggest there is considerable potential for online learning communities to support professional learning for teachers within schools. A key to realising this potential will be the redesign of online courses to encourage participants to develop their own networks of practice within and beyond the course parameters, accepting that weak online ties offer valuable learning opportunities and facilitating the strong links teachers often have within their school communities.

Such redesign will need to value learning that is synchronised with, and situated in, professional practice; encourage the often invisible interactions that learners have with those outside the formal course structure; promote the sharing of work and school-based examples within the online environment (especially cross-sector interaction); and facilitate critical reflection focusing on the links between theory and practice and between new and existing beliefs, attitudes, and practices.

Above all, effective redesign will embrace creative curricula approaches to enable participants to select and adapt learning activities to align with their own professional contexts. Providing flexibility and choice in relation to course content, assessment, and learning activities requires participants to be independent learners, prepared to take responsibility for interpreting, translating, and connecting their learning experiences to professional contexts. Inevitably this means less emphasis on standard coursework and assessment and increased variety in participant activity, with implications for lecturers to scaffold the processes and support multiple projects within a common framework. Increased flexibility and choice for learners should lead to greater opportunities for connections between communities from the perspective of the learner.

There are further possibilities for research on the effect of intermittent and short-term connections afforded by professional learning networks, including those related to formal settings, such as online qualifications, and the informal connections offered via social networking tools.

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The Challenges to Connectivist Learning on Open Online Networks: Learning Experiences during a Massive Open Online Course

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Abstract

Self-directed learning on open online networks is now a possibility as communication and resources can be combined to create learning environments. But is it really? There are some challenges that might prevent learners from having a quality learning experience. This paper raises questions on levels of learner autonomy, presence, and critical literacies required in active connectivist learning.

Keywords: Connectivism; networked learning; learner autonomy; presence; critical literacies

Introduction

Something fundamental has changed with the latest developments of the Web: The ease of communication and the possibilities of using aggregators to bundle and filter communications and information have meant that the context of learning has changed dramatically. People can now learn on online networks outside of the control of the institution, and depending on the nature of the connections made, the learning experience will vary. If the connections are one-to-many, from the top down, from the educator to the learner, networked learning might be completely different from a setting where the connections are many-to-many and where they might run in any direction between the participant(s) and the resources related to the learning.

In e-learning, two major traditions have been prevalent: one where connections are made with people and the other where they are made with resources (Weller, 2007). These two distinct streams show a different emphasis: the first one has communication and interaction between people at the heart of learning, and the second focuses on engagement with resources. Of course these distinctions have always been present even in traditional classroom learning; there has always been a triangle between educator, learners, and course content, and depending on the

emphasis on one of the three, different teaching and learning strategies have been employed, related to the views of knowledge and learning. Since the 1980s, a fourth component has been added to the mix: the context in which people learn has had more emphasis in learning theories. Initially through the emergence of andragogy and experiential learning (Rogers, 2002) and communities of practice (Lave & Wenger, 2002), and more so, since the emergence and proliferation of information and communication technologies (ICTs) and their increasing encroachment on everyday life, boundaries between settings in which people learn and in which they use technology for other activities have blurred, and perspectives such as connectivism have emerged.

These different views of learning have at their heart different perspectives on knowledge development. The question of how people become more knowledgeable and reach understanding is an old one and has in past decades ranged from a process of transferring knowledge, or a process of aligning new knowledge with earlier experiences and knowledge, to a process of conceptualization, contextualization, and active construction of knowledge, or reflection in action. Some theorists emphasize the social aspect of learning, while others emphasize the personal one.

Sfard (1998) used two metaphors to clarify how people engage with knowledge while learning. The first one is of acquisition, where learners acquire knowledge, pre-packaged by educators, as in behaviourist and cognitive theories, which have been the norm in formal education settings for a long time. The other metaphor is one of participation, where learners are actively involved in a participatory endeavour. This metaphor relates to situated and social theories, such as social constructivism, action theory, and communities of practice. Participation in knowledge development activities is central in these theories. Connectivist developmental theories also fit in the latter category (Kop & Hill, 2008).

Connectivism

Siemens and Downes proposed teaching strategies without formal teaching and dynamics that allow the educator to have the role of facilitator or a total absenteeism from the learning process as they trialled in their connectivism courses (Siemens & Downes, 2008, 2009). The participation metaphor would be the most appropriate here as this type of learning event involves the active engagement of people with resources in communication with others, rather than the transfer of knowledge from educator to learner. Connectivists advocate a learning organization whereby there is not a body of knowledge to be transferred from educator to learner and where learning does not take place in a single environment; instead, knowledge is distributed across the Web, and people's engagement with it constitutes learning.

It is envisaged that learning is enhanced by four major types of activity: 1) *aggregation*, access to and collection of a wide variety of resources to read, watch, or play; 2) *relation*, after reading, watching, or listening to some content, the learner might reflect and relate it to what he or she already knows or to earlier experiences; 3) *creation*, after this reflection and sense-making process, learners might create something of their own (i.e., a blog post, an account with a social

bookmarking site, a new entry in a Moodle discussion) using any service on the Internet, such as Flickr, Second Life, Yahoo Groups, Facebook, YouTube, iGoogle, NetVibes, etc.; 4) *sharing*, learners might share their work with others on the network. This participation in activities is seen to be vital to learning.

In the current complex learning environment, which is one of continuously changing and emerging technologies, new forms of learning are emerging and are possibly desirable (Conole, de Laat, Dillon, & Darby, 2008). Downes (2009) claimed that people can create and use their own personal learning environment (PLE) and network to find information, make connections with knowledgeable others of their choice, and become actively engaged in the four activities suggested above to advance their learning. This paper will highlight three challenges to such an approach, critically assess the challenges of connectivist, informal, personal, and networked learning, and highlight learners' perceptions and experiences related to these challenges on two connectivist courses.

Challenges to Connectivist Learning

Self-directed learning.

A connectivist learner has to be fairly autonomous to be able to learn independently, away from educational institutions, and to be engaged in aggregating, relating, creating, and sharing activities. Whereas in a traditional classroom/learning environment, the educator was responsible for providing information, organizing time, and structuring the learning activities and goals, in a networked environment the learner him or herself takes responsibility for this. Adult learners make choices about the level of control imposed by others on their learning, and Bouchard (2009) identified several factors that are significant. Some of these are related to motivation, initiative, and confidence; others are related to control over the learning activity or to issues of language and communication used in the learning and teaching processes. He also highlighted issues related to the value of learning to learners' lives.

People learning on an informal network will choose the subject they want to learn about or the activity they want to engage in, but in a connectivist environment they have to make other choices as well. For instance, they have to manage time, set their own learning goals, find resources, and try out new tools and make them work. These choices would in a formal classroom be the instructor's responsibility, but are in an autonomous learning environment linked to tasks that the learner will carry out independently, which could be problematic. The availability of particular semiotic features, such as multimedia, might motivate the learner to take on a learning project. Similarly, the language and multimedia used could play an important role in who would be engaged online and who would not. These are related to *presence*, which will be discussed as another challenge later on.

The motivational factors in a traditional adult education classroom are very important in learners either participating in learning or not. If confidence levels are low, it is not likely that a person will take up connectivist learning. The technology itself, or the activity the learner is taking on,

could form a barrier and will have to be engaging and interesting enough for the learner to work his or her way through the problems that will undoubtedly come up during the learning journey. A personal learning environment that would aid the learner in this endeavour could play a positive role (Kop, 2010). A big difference between learning informally, both away from an educational institution and within one, is the level of intrinsic motivation that the learner has. There is clearly a much higher level of motivation that must stem from the self in an informal learning situation as some of the motivational factors in a formal context would more often than not be external, for example getting a qualification or learning a skill for the workplace.

Presence.

Intrinsic motivation has an affective dimension, and the literature highlighting the importance of affective aspects to networked learning is growing (Picard et al., 2004; Zaharias & Poylymenakou, 2009). Other issues related to motivation have been highlighted by Lombard and Ditton (1997) and by Dron and Anderson (2007) in the form of "presence." They argue that the closer the ties between the people involved, the higher the level of presence and the higher the level of engagement in the learning activity.

Lombard and Ditton (1997) emphasised as a main aspect of presence the illusion of non-mediation. In other words, there is a high level of presence when a participant in an online activity experiences the activity as if it were taking place in real life, without the mediation of the computer. Garrison, Anderson, and Archer (2000) argued that deep and meaningful learning results if three forms of presence play a role in education: "cognitive presence," which ensures a certain level of depth in the educational process; "social presence"; and, in a formal educational environment, "teacher presence." In PLE-based connectivist learning, the teacher would not necessarily be present, but one could argue that there are knowledgeable others on the Web who would take on that teacher role to a certain extent. For people to take an active, participative, and critical role in connectivist learning, they need communication and collaboration with and feedback from others, the same as in classroom-based learning.

The higher the level of presence, the higher the level of involvement in the online activity, which makes the level of presence in connectivist learning important as it should enhance the depth of learning and subsequently the learning experience. Another important factor is people's level of critical literacies. The lower the presence of others in the learning environment, supporting and providing scaffolds for learning, the higher the need for particular capabilities in the self-directed learner him or herself to find resources and information, create something with these, and push something out onto the Web for others to engage with and learn from.

Critical literacies.

It has been highlighted by several people in recent months that there are literacies critical to connectivist learning. Downes (2009) speaks of critical literacies, others of 21st century skills (Partnership for 21st Century Skills, 2009). To be able to make the most of a learning environment that is positioned outside the sphere of formal education and that fosters active engagement in

learning activities, learners need different competencies and abilities to feel comfortable. There is no overarching educator present to guide learners, to challenge their ideas and beliefs, or to help in aggregating information and in understanding the media and the way they represent information. The onus is on the learners themselves to make these judgments, to validate information and knowledge, and to find knowledgeable others who can help them. Moreover, the new learning environment requires learners to be active in their learning by editing and producing information themselves in a variety of formats and by communicating and collaborating with others in new ways. People need to have a certain level of creativity and innovative thinking, in addition to a competency in using ICT applications, to be able to do this. Learners need to be flexible to be able to adapt to new situations and are also expected to solve problems that they come across during their learning journey in this complex learning environment.

A major concern is that because people need to aggregate information and resources autonomously, either by (RSS) feeds or through the use of human filters, they require a high level of critical analysis skills to be able to do so effectively. We have seen substantial growth and development of the Web over the past 10 years, and even though many applications and tools started out bottom-up by users who could see their use, increasingly concern is being raised about the influence of commerce on the Web (Lanier, 2010; Mejias, 2009). Lanier (2010) and Mejias (2009) emphasised the high level of influence by a low number of companies, such as Google. The market seems to slowly but steadily influence and control new tools. The freedom and creative potential of the Web for all seems to be increasingly influenced by other interests. Research shows that the Internet and the Web are not value-free and do not act as non-hierarchical networks (Barabasi, 2003; Mejias, 2009; Bouchard, 2010). Barabasi's research shows that power relations prevent network "surfers" from having access to all information at the same level:

> The most intriguing result of our Web-mapping project was the *complete* absence of democracy, fairness, and egalitarian values on the Web. We learned that the topology of the Web prevents us from seeing anything but a mere handful of the billion documents out there. (Barabasi, 2003, p. 56)

It becomes clear that if people are learning on these vast, disparate information networks, they need the ability to understand the intricacies of the networks in order to negotiate their structures. The need for high levels of critical capabilities, in addition to knowledge of the sub-systems of the Web, is important in order to be able to access the information and resources that are relevant and required. It should be questioned if all adult learners are able to do so without help from knowledgeable others. These knowledgeable others are their information brokers, and Boyd (2010) emphasized problems with free access to information even when it comes to these people. She states that the information brokers—rather than the creators of the Web content themselves—have the power, which means that an interpretation of the resources takes place. These free agents do not have a responsibility or an obligation to provide a critical point of view. One could argue that the way in which Twitter is developing might overcome this, as it is now possible to fairly simply aggregate information from a high number of people (Rusbridger, 2010).

Researching Connectivist MOOCs for the Design and Development of a PLE

The three challenges to connectivist learning highlighted previously are 1) the need for critical literacies and the power relations on the network; 2) the level of learner autonomy; and 3) the level of presence. These can all be overcome by what has in traditional formal educational practice been seen as crucial to teaching and learning: social interaction.

What type of structure might then aid learners in overcoming the aforementioned challenges? What can be done to engage learners in critical learning on an open network? Carroll, Kop, and Woodward (2008) see as the crux to engaging learners in an online environment the creation of a place where people feel comfortable, trusted, and valued. The task would be to move toward a space that aggregates content and to imagine it as a community, a place where dialogue happens, where people feel comfortable and where interactions and content can be easily accessed and engaged with, a place where the personal meets the social with the specific purpose of learning.

The National Research Council of Canada's Institute for Information Technology is currently engaged in the research and development of such a structure, a PLE named Plearn, by using a design-based research approach. The research investigates the development of a pedagogical platform that could support networked learning in all its facets outside formal education by combining (intelligent) information streams and editor and publishing tools and by providing scaffolding, communication, and support structures for learners.

One component of the research involves investigating educational issues to find out the requirements for such an environment. This research is still in progress as Plearn is currently under development, but the first part of the educational research, the learning on a "PLE-like" place, has been explored during two connectivist massive open online courses (MOOCs). This paper will share some of the preliminary research findings on the MOOCs run during the summer and fall of 2010. The summer course was Critical Literacies (CritLit) (377 participants) and the fall course was Personal Learning Environments, Networks, and Knowledge (PLENK) (1610 participants).

These courses were based on the four principles to facilitate learning by creative engagement on connectivist courses: the aggregation of information and resources, a reflection on these resources and a sense-making stage in which earlier developed knowledge and experience might be related to this new knowledge, a repurposing of the resources by perhaps creating a digital artefact, and then the sharing on the Web of the newly produced resource.

The course structure of the MOOCs investigated did not change from the earlier formats used by Siemens and Downes on CCK08 and CCK09 (Siemens & Downes, 2008, 2009). It included a Moodle environment, a course wiki on which all resources, course information, and recordings were stored, and a Daily newsletter that was emailed every day to participants and that was generated by gRRShopper software from online contributions by participants on the Moodle

discussion board, blogs, and Twitter. Resources offered at the start of each week were extensive and grew throughout the week with links provided by participants and speakers on discussion boards, on Twitter, on blogs, and during Elluminate sessions.

One of the research questions was whether the four activities highlighted as being crucial to learning (aggregating, relating, creating, and sharing) were actually as important as envisaged by the course planners. Another was to see whether the challenges identified from the literature (critical literacies, presence, and self-directed learning) were actually perceived as being as problematic as identified in the literature.

Research Methodology

A mixed-methods approach was used in the research. Surveys were conducted, consisting of a mixture of quantitative and qualitative questions, while observations, discourse analysis, and secondary data analysis in the form of learning analytics were also carried out to capture data and analyse it. (For more information on the research methods and research ethics, see Kop, Fournier, & Sitlia, 2011, forthcoming.) A focus group of *lurkers* was also conducted as it was impossible to gain an understanding of their experiences from activities on the learning environment because they were invisible to the observer. Data were collected on the Moodle course forums and wiki, the participant blogs, and Twitter posts, and on any other online activities using the #PLENK2010 tag. Because of the volume of data generated by the participants and facilitators and the restrictions on time to produce this paper, a limited quantitative analysis of blog posts, Twitter, and Moodle participation was achievable, and the qualitative analysis of data for this paper has been restricted to the Moodle environment and a sample of the participant blogs.

Who Were the Participants?

To give an impression of the participants' backgrounds, Figure 1 shows a Wordle visualizing the professional backgrounds of participants on the CritLit course. This is also representative of the participants on PLENK.

Chart 1 shows the ages of the PLENK participants and Figure 2 shows a Google Map representing participants' residences. It is available online as a two-page interactive map and was instigated by one of the PLENK participants.

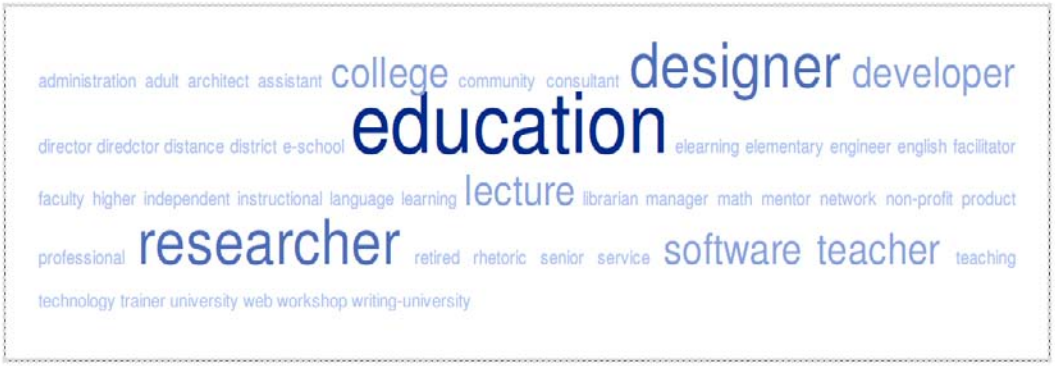

Figure 1. Wordle of participants' professional backgrounds.

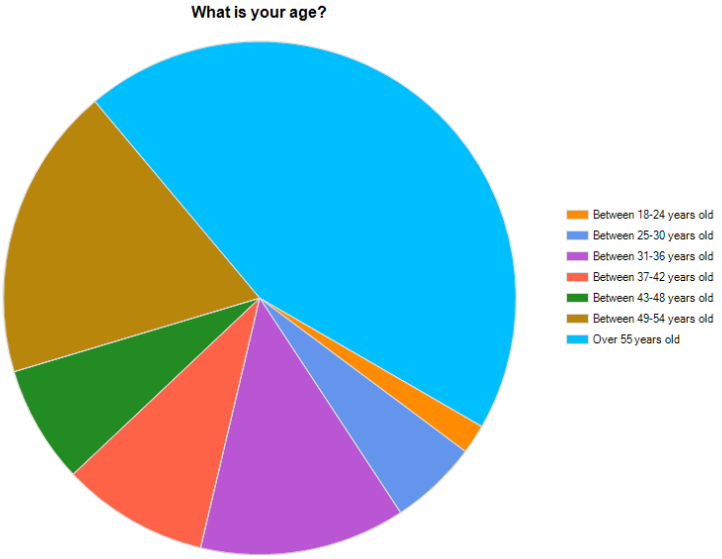

Chart 1. PLENK participants' ages.

Figure 2. PLENK participants' places of residence.

Results

What Did PLENK Participants Think of the Learning Environment?

PLENK's subject of study was personal learning environments, networks, and knowledge, and the course's learning environment resembled a PLE-like structure. This resulted in close scrutiny of the learning environment itself by participants throughout the course.

Participants indicated that course resources such as the Daily newsletter, the Moodle, and the wiki were enough to make them understand what the course was all about before starting (40.4% of the 55 respondents strongly agreed and 36.5% somewhat agreed). During the first few weeks of the PLENK course, however, it was clear that especially participants who had not engaged in a

MOOC before found its distributed nature confusing and the high level of resources and contributions by participants overwhelming. In the words of one of the participants,

> I am so lost. While I do enjoy really the information presented and the fantastic blogs, I am in "over my head" with the technology. But I am not giving up and will keep reading and find f2f support to get me going.

And from one participant's blog post:

> Yes indeed, I found this first week of the #PLENK2010 MOOC totally overwhelming as this is really my first experience of such an environment. Moodle has taken on a life of its own, blog posts are mushrooming left right and centre, the "Dailys" are piling up in my inbox, and then there's Twitter and a plethora of side discussions I am probably not aware of. I feel swamped because everything is interesting. The expertise and experience of the participants, the quality of the discussions is simply phenomenal.

Facilitators provided support by producing videos on how applications and tools worked and by creating posts in the Moodle discussion area about the impossibility of reading and viewing all resources; this helped the learners. One of the participants also started a discussion thread with scaffolds and helpful hints that had 106 replies and that led to the participants' development of a tools wiki and several groups outside the course learning environment (i.e., on Facebook, Friendfeed, & Flickr). Participants used visualization tools such as the Figure 3 Wordle to find out the essence in readings for a particular week.

Figure 3. Participant Wordle related to a particular PLENK resource.

What Else Did PLENK Participants Do throughout the Course?

The PLENK MOOC started with 846 participants, and that number steadily increased to 1616 by the final day, as shown in Chart 2. People valued the twice-weekly Elluminate sessions, once a week with an invited speaker and once a week as a discussion session among the group and facilitator(s). Actual presence at these synchronous sessions decreased over the weeks from 97 people in week two, when attendance was the highest, to 40 in the final week, and there was a similar trend in the access of the recordings. A high number of blog posts was generated during the course (886) and an even higher number of Twitter contributions (3022). The #PLENK2010 identifier made it easy to follow the Twitter contributions by participants, which highlighted a wide number of resources and links back to participants' blogs and discussion posts, and thus connected different areas of the course. Although the number of course registrations was high, an examination of contributions across weeks (i.e., Moodle discussions, blogs, Twitter posts marked with the #PLENK2010 course tag, and participation in live Elluminate sessions) suggested that about 40–60 individuals on average contributed actively to the course on a regular basis, while others' visible participation rate was much lower.

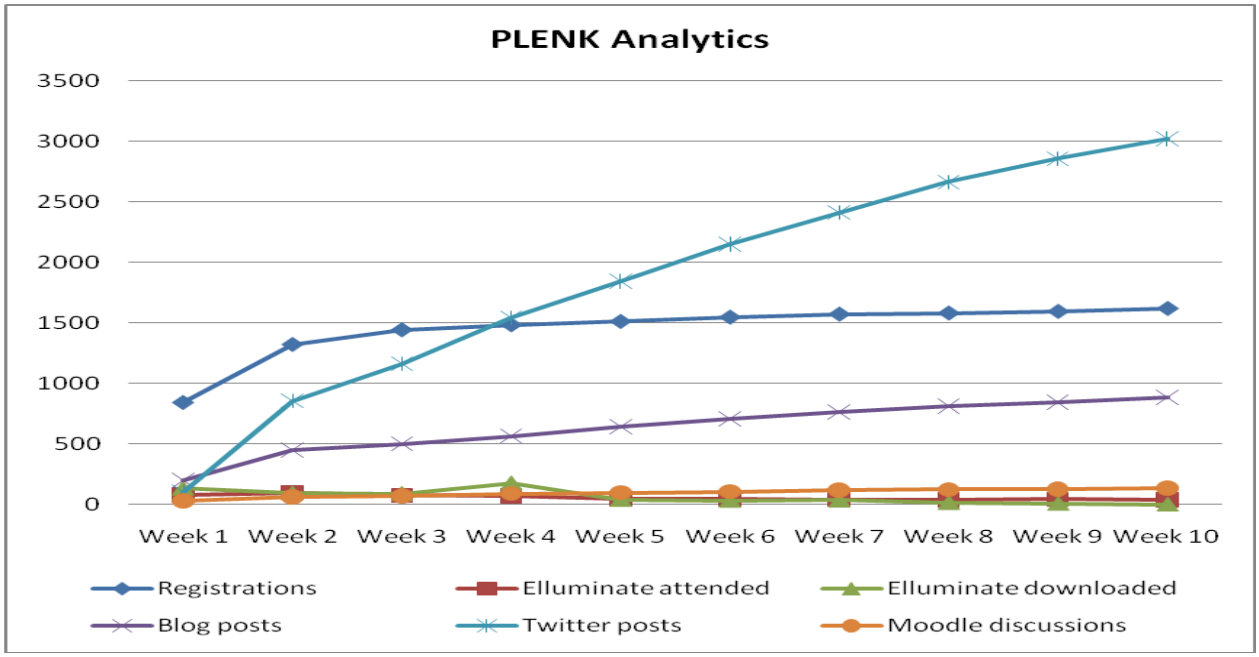

Chart 2. PLENK participation rates.

Some MOOC old-timers were very involved in the course and made things happen, as one participant's blog post highlights:

> The Google Map I made has got 15751 views until today and hundreds of links. So it was useful. My blog has been read in 68

> countries in all continents (more than ever) and I have got some new friends. And this has happened in spite of my absence.

Not all participants contributed in a visibly active way. There was a high number of people "following the pulse of the event" rather than getting involved in producing digital artefacts such as blog posts or videos. They preferred to read, view, or dip in and out of the conversation, as this participant's post shows:

> My lurking provided me with a wealth of information and education into MOOC, PLE, PLN, PLC, and how information and knowledge will be shared by all—teachers, students, kids, adults. . . . PLENK has provided me an opportunity to listen to the experts. . .I come in and read the posts that are of most interest to me. I wanted to know how it affects my teaching efforts, my learning, and how to share this with others. The discussions did give me a clear idea of how they are used by different people. . .Thank you for allowing lurkers, who may not know enough to post, but have learned a great deal in just lurking.

Self-Directed Learning

How easy or hard was it for learners to study independently, with four facilitators available to guide participants, rather than the higher level of direction that an instructor would provide? Here is an excerpt from a blog post by one of the participants:

> I am not a typical course student and I do not want anything from the facilitators. It is enough that they offer the structure and the platform (Moodle). I am ready to study "alone" and find my way. All depends on the time I can and want to use for finding new friends, trying new tools, checking materials, etc. I see no difference between students and facilitators, we have many 55+ students who have much to give to others.

A learner on CritLit said: "I enjoyed the experience of autonomy in relation to my own learning. I learned to design my ple, and all the process helped me to substantiate my ideas on didactics and education."

Another participant highlighted on his blog the importance of an understanding of the change-process and the steps required to achieve it. During the lurker focus group, however, thoughts were expressed that especially novices might not have this understanding and might miss a sense of community to help them.

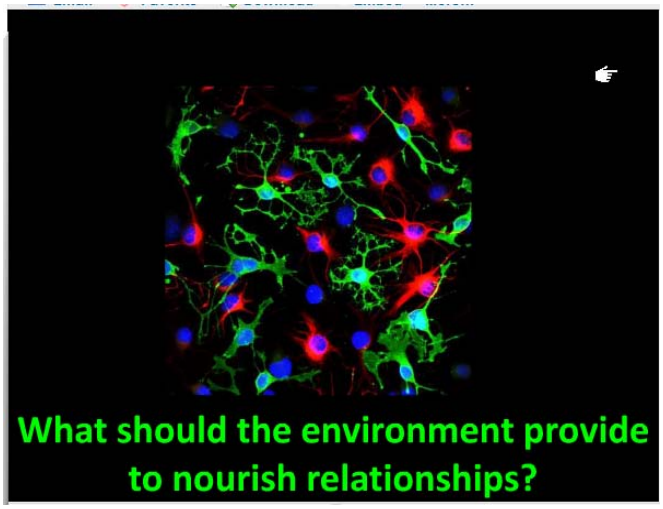

Figure 4. The learning environment.

Figure 5. The community.

Another participant wondered in a presentation, as expressed in Figures 4 and 5, what the environment itself might do to enhance communication and what the learning community might provide to entice people into becoming generators of content, rather than consumers. Another participant clearly found active participation important, as his discussion post shows:

> I believe we are all "self-directed" learners because we all log in to the MOOC forum on our own initiative without being coerced by anyone. But once you are in the forum, it's the appreciation of other participants' ideas and postings that makes us hit the keyboard and type something. . . I am not too sure whether lurking is both acceptable and beneficial. . . To me, there is more to learning than gaining benefits for our own individual needs. . . Individuals have worthwhile ideas that need to be shared. Through sharing, ideas are tested and refined. And that will not happen if we lurk.

Another participant clearly was not happy about this value judgment without further investigation into the nature of different types of learning:

> yep let's condemn modes of learning that are not conforming to some arbitrary personal standard, remain as ignorant as possible as to the forms & variations & motivations of those modes, hand out "names" & pronounce judgment - failure!
>
> Enforced active, energetic participation shall be the rule. Nothing good has ever come from someone quietly observing & going off to have a good think about it all.

And another participant on power relations in a social setting that might be detrimental to expressing oneself said,

> If one is highly socially sensitive and he or she feels included, accepted, and empowered, does that necessarily mean that participation in a collaborative work will result in creative and/or complex problem-solving and thinking? If one feels threatened, he or she might flee or fight back... or not. For example, one might decide to ignore provocation, reserve judgment, ask for clarification, take on the point of view of the other so as to understand the argument better, or just let that pony run and get on with life...

It seemed that on the one hand, some people found it motivating to direct their own learning, and on the other hand, some people would have preferred more coordination and some assignments to give their learning direction. In the lurker focus group there was a consensus that people need time to digest what they read, what transpires in Elluminate sessions, or what happens in the discussion forums and that it might not be possible or desirable for people to respond by producing a digital artefact within the course time frame. They agreed that the benefits, such as developing their own PLE/PLN, the sharing of PLE/PLN practice, and the introduction of social media, which they learned about through PLENK or in their workplace or teaching practice, were significant. These benefits would be invisible to other PLENK participants and also not help their learning but would be valuable to the participant.

Other benefits were seen in the form of the extension of personal networks and in new blogs and Twitter participants to follow. Participants highlighted the need for a sense of trust and feeling comfortable and confident to be able to participate, a sense of presence and community that some participants found on the PLENK Second Life site.

We have to take into consideration the number of people who were involved in particular activities visible during PLENK and the number who were not. As mentioned earlier, 40–60 participants were highly engaged and involved in the course by producing discussion posts, blog posts, Twitter messages, videos, and other digital artefacts. The others, however, were not as much or not at all engaged in these activities, but clearly felt that they were active in different ways: by aggregating, reading, listening, and reflecting and thinking about what was produced and highlighted by others as good resources. It seemed that they did their sharing in a different setting, away from PLENK, for instance in their workplace.

We should also not underestimate the influence of people's mother tongues on confidence levels in expressing themselves; several remarks were made about this. English was the dominant language on PLENK, although a Spanish-speaking and a German-language group were set up, and especially the Spanish group was visible in their own language on Twitter, in blog posts, and bilingually in the forums. Around two thirds of participants came from English-speaking countries, while the others came from countries where another language was spoken.

Presence

Several attempts were made during PLENK to increase the level of presence, and this was seen to be important. At the start of the course, participants were asked to introduce themselves, and one of the participants created a PLENK Google map (see Figure 2) to give people a sense of who their fellow learners were. Facilitators were actively blogging and posting on the discussion forum. The Daily newsletter also provided a presence-building function. One learner suggested a buddy system to enhance presence:

> There's a literacy to online presence that seems distant and too neutral. Regular contact can build something human but it all seems so big with so many choices that detachment almost seems the native condition. As a suggestion, these courses could build in a buddy system or affinity groups that hold for at least the duration of the course. Also, aside from course content, no link-passing "in class." It's become a substitute for talking. Links to things a person has made to aid their expressiveness are enough to keep us all busy.

Another student saw that immersive learning environments play a role in the heightening of presence: Second Life will come and go, but the immersive, telepresence experience of virtual reality could be the big change that will make the next-generation Web a sea change. Another participant saw the creation of a community as the answer:

> Perhaps the biggest factor in communication in a networked environment might be the presence and development of genuine community, which is a term that gets bandied about a little too indiscriminately. Communities require a pretty significant buy-in, some known roles, and coordination. Coordination is always the single greatest challenge, especially in the new networked landscape. It is sorely lacking in most instances.

The facilitators provided a certain level of coordination, especially at the start, but left this to participants later on in the course. The importance of learning about the same subject in close proximity to others in order to reach a level of depth in the learning was highlighted by several participants. The importance of feedback to blog posts and discussion posts from participants and facilitators alike to stimulate engagement was emphasised, but as Charts 3 and 4 show, activities by both went down after about week four. It was clear that it is time-consuming to participate in a course with a high number of activities and participants and that it is impossible to sustain the high level of reading, thinking, and engaging with materials and people that happened at the beginning of the course.

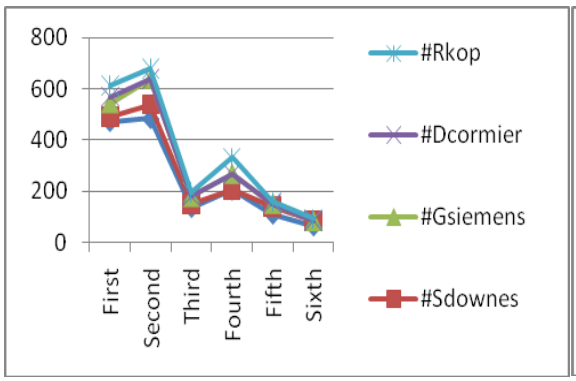

Chart 3. Posting by participants.

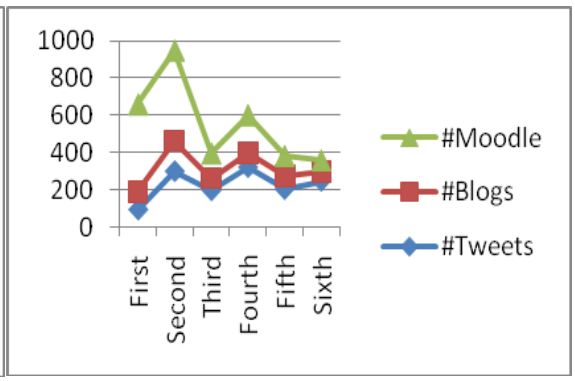

Chart 4. Posting by facilitators.

The role of the technologies in PLENK in creating presence and trust was also emphasised:

> It is the persistence in the environment that provides our voice with the possibility to be listened to and to contribute to sense-making together with other participants. . . I think of a MOOC as a good simulation (so, in a controlled environment) of what it means to "live" in social media, in which building identity and reputation is being developed over time and requires the invention and re-invention of individual strategies of social networking.

In other words, the two important issues are the enculturation in the network and the technologies that can support this. The role of Twitter as a tool in humanizing learning was mentioned to facilitate this, while it was also noted that an awareness of power issues on the network and the literacies required to navigate these would help in this process.

Critical Literacies

There are some competencies, abilities, and skills required to thrive in a complex learning environment. People need the critical ability to not only use network resources, but also to look at them critically in order to "appropriate them and redesign them," as one of the learners stressed. In the Moodle environment, he quoted bell hooks (2010, p.7), who said, "The heartbeat of critical thinking is the longing to know—to understand how life works." And another argued that critical thinking is not what it was 10 years ago: "Critical thinking doesn't stay put, it evolves, and when used as a set of literacies, it becomes practice. PLEs embed practice and not just enable thinking."

Learners on the CritLit MOOC provided their ideas on the skills and competencies they gained through the course, as seen in Chart 5.

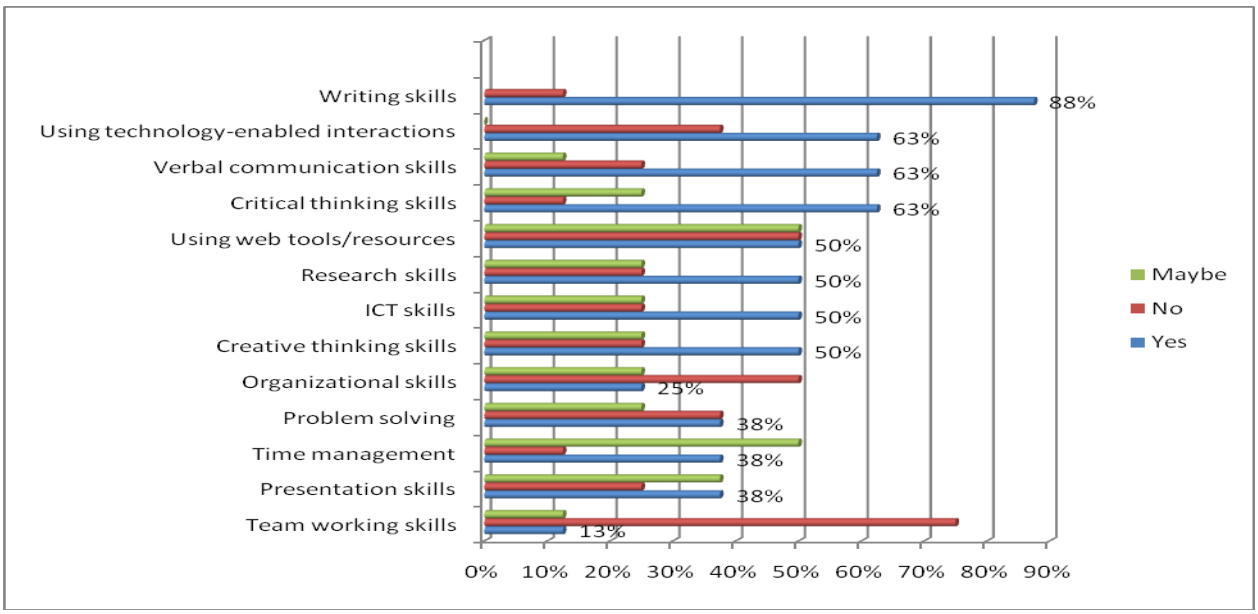

Chart 5. Skills and abilities gained during the CritLit MOOC.

It is interesting to see here that the skills related to organizing and managing learning, which one would expect to be very important in self-directed learning, scored relatively low but that capacities for critical thinking, collaboration, research, and creativity—and especially writing—scored high. Perhaps the student profile (high-level professionals, the majority over 55 years old) played a role in this as their natural development as human beings would involve being more autonomous than younger learners. The participants enjoyed learning about new tools and thought this important, but the most important feature a person might have would be the mindset to deal with complexity within a minimally structured environment.

Conclusions

From observations on PLENK it seems that for networked learning to be successful, people need to have the ability to direct their own learning and to have a level of critical literacies that will ensure they are confident at negotiating the Web in order to engage, participate, and get involved with learning activities. People also have to be confident and competent in using the different tools in order to engage in meaningful interaction. It takes time for people to feel competent and comfortable to learn in an autonomous fashion, and there are critical literacies, such as collaboration, creativity, and a flexible mindset, that are prerequisites for active learning in a changing and complex learning environment without the provision of too much organized guidance by facilitators. Especially at the start of the learning journey, support by more knowledgeable others proved to be helpful in this.

The research showed that there are some other conditions that clearly encouraged people's involvement and engagement in learning in a connectivist learning environment, including the

"social presence" of the facilitators and of participants, which enhanced the "community" forming and the sense of belonging that built confidence and stimulated active participation.

It became clear during the research that the four activities mentioned in the introduction—aggregation, relation, creation, and sharing—were not achieved by the majority of participants. They mostly felt happy to aggregate, relate, and share resources, but only a minority of 40–60 PLENK participants were engaged in the creation of digital artefacts, such as blog posts and videos, and in the distribution of these. It seems that people needed time to feel comfortable and confident to get involved in this type of activity, while it also seems that people needed some time to digest readings and resources that were published and produced during the course before being able to get involved in this active production process themselves. Early indications from this preliminary research were that people were still learning without this type of activity.

Further research and analysis will be conducted to find out if this "creation" stage is really necessary to enhance learning in a connectivist learning environment and exactly how the challenges identified with connectivist learning might best be overcome.

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Emergent Learning and Learning Ecologies in Web 2.0

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Abstract

This paper describes emergent learning and situates it within learning networks and systems and the broader learning ecology of Web 2.0. It describes the nature of emergence and emergent learning and the conditions that enable emergent, self-organised learning to occur and to flourish. Specifically, it explores whether emergent learning can be validated and self-correcting and whether it is possible to link or integrate emergent and prescribed learning. It draws on complexity theory, communities of practice, and the notion of connectivism to develop some of the foundations for an analytic framework, for enabling and managing emergent learning and networks in which agents and systems co-evolve. It then examines specific cases of learning to test and further develop the analytic framework.

The paper argues that although social networking media increase the potential range and scope for emergent learning exponentially, considerable effort is required to ensure an effective balance between openness and constraint. It is possible to manage the relationship between prescriptive and emergent learning, both of which need to be part of an integrated learning ecology.

Keywords: Emergent learning; prescriptive learning; constraints; retrospective sense-making; learning ecologies; emergent learning networks

Introduction

The past decade has seen an exponential increase in the development and use of technologies for interaction and communication across almost all aspects of day-to-day events (at least in the developed world), from learning to work contexts to personal use. The number of blogs, emails, texts, and tweets has gone from zero to numbers in the billions in just a few years. Such innovations have not escaped the attention of higher education, for example, Sharpe, Beetham, and de Freitas (2010) and the related Higher Education Funding Council for England (HEFCE) paper (2009, p.5), which states,

> As a result of the pervasiveness of technology, the term 'e-learning' has come under scrutiny. Personal ownership of technologies coupled with access to social software means that all kinds of learning-related activity can potentially be e-enabled; e-learning can no longer be viewed as a purely institutionally based or narrowly defined set of activities....Yet technology-enhanced learning remains a source of concern for institutions...[and] suggests a need to understand better how to design and support learning involving technology. Access, especially to the internet and social software, may have increased, but this does not mean that technology is always used to its best advantage, either by teachers or learners.

Specifically, De Freitas and Conole (2010, p. 29) write that "the main challenge lies in the real transition to a less tutor-led approach to learning...content will not be delivered to learners but co-constructed with them". This resonates with the notion of emergent learning as learning in which actor and system co-evolve.

The expanded range of teaching and learning possibilities, such as e-books, e-journals, the incorporation of blogs and wikis into standard virtual learning environments (VLEs), Skype, virtual conferencing, and recently Twitter (Malik, 2010), seems to have been welcomed, and many university marketing departments are actively promoting their Web 2.0 profile in the marketplace for student recruitment.

However, their practice is still substantially shaped by traditional teaching modes, prescriptive learning outcomes, normative expectations, and conventional hierarchies. Unless institutions, both in education and at work, broaden their learning spaces to allow greater flexibility and more self-organisation, they might fail to address the possibly growing dilemma that "even when students are in school, much of their education happens outside" (Collins & Halverson, 2010, p.19).

Most students embrace the digitalised world of social networking (Barnes & Tynan, 2007), although this does not necessarily transfer to learning. Some students prefer to keep their social networking and their learning quite separate and resent intrusions into their mobile-phone space

by universities (Conole, de Laat, Dillon, & Darby, 2006; Sharpe et al., 2010). On the other hand, because the use of mobile phones among students is very high in some countries where computer broadband access may be difficult, such as South Africa, students are increasingly using mobile phones to access learning materials on the Internet (Czerniewicz, Williams, & Brown, 2009). Both these examples illustrate how students are taking control of their learning with the result that many currently perceived *novices* are actually becoming *silent experts* in how, where, and by whom they want to be educated (Alexander, 2003; Schmidt et al., 2009, on the emergence of peer-to-peer interaction). This raises important questions about how institutions and individuals can manage and learn from what these silent experts can bring into the learning community. In addition, graduates living in a *learning society* are required to demonstrate a much greater level of autonomy and self-organisation than 15 years ago (Antikainen, Kauppila, & Huotelin, 1996).

In this paper we argue that it might be useful for educational institutions to actively explore alternative frameworks such as connectivism (Siemens, 2005), complexity theory (Cilliers, 2005, 2010), communities of practice (Wenger, 1998, 2006), and the underlying threads of *emergent learning* to inform their planning and strategy. We will attempt to bring together elements of all these areas of research and practice to develop a framework for emergent learning that can be applied across education, work, and social networking, with their increasingly blurred boundaries. Emergence has been discussed and defined by a number of authors, such as Cilliers (2005), Goldstein (2009) and, at the international systems level, Knorr-Cetina (2005). For the purposes of this paper, we interpret emergent learning as

> learning which arises out of the interaction between a number of people and resources, in which the learners organise and determine both the process and to some extent the learning destinations, both of which are unpredictable. The interaction is in many senses self-organised, but it nevertheless requires some constraint and structure. It may include virtual or physical networks, or both.

The debate on networks, connectivism, learner autonomy, and even emergence often has normative overtones as if these things are an end in themselves; the implicit assumption is that if only everyone had the Internet and everyone got connected to everyone else, learning would flourish. See, for instance, Downes (2010a), Siemens (2009), Mitra and Dangwal (2010), and Arora's critique of Mitra, who she says has constructed a "romance that tells of learning free from the chronic obstacles of formal schooling, and children liberated through self-learning" (Arora, 2010, p. 690). See also Mackness, Mak, Fai, and Williams (2010) and Mak, Fai, Williams, and Mackness (2010) for critiques of Downes and Siemens' CCK08 course.

Selwyn (2010) argues the case for a contextual, critical, and social scientific approach to the use of technologies in education. To achieve this, it might be useful to keep in mind that new technologies generally tend to increase discrepancies in power, at least initially, and that, as we argue throughout, connectivity is a necessary but not sufficient condition for learning. It is also important to note that learning that embraces emergence requires us to make decisions about

values – managing emergence is not an objective enterprise (Cilliers, 2005; Snowden & Boone, 2007).

Research Approach and Problem Statement

This is a theoretical paper, drawing on the authors' theoretical and empirical research. The paper explores the theoretical frameworks of complexity, communities of practice, and the notion of connectivism, using qualitative analysis and select cases to try to map out an adequate framework for understanding emergence and its possible use in practice.

The aim of the paper is to describe emergent learning and situate it within learning networks and the broader *learning ecology* of Web 2.0 and beyond. To do this, we need to explore the following:

- What are the conditions that enable emergent, self-organised learning to occur and to flourish?
- What mechanisms of validation are effective, can emergent learning networks be self-correcting, and if so, how?
- Is it possible to link, or even integrate, emergent and prescribed learning, and if so, how?

The distinction between emergent and prescribed learning needs to be unpacked in some detail as it is crucial to the statement of the problem here. Collins and Halverson phrase this slightly differently: They talk instead of "the affordances of digital media" as opposed to "traditional modes of learning," but they share the same concerns, and they stress "the urgency of seeking a [new and] coherent model for the future of education" (2010, p.18).

For the purposes of this paper, we need to be more specific than that, so we draw primarily on complexity theory to map out the distinction between emergent and prescriptive learning (see Figure 1). This provides us with an analytic framework with which to examine the conditions under which emergent learning might occur.

Following Snowden and Boone (2007) and Cilliers (2005, 2010), we can distinguish two different *domains of application* for learning: the domain of predictable events on the one hand, and on the other hand, the domain of complex-adaptive events, which are not predictable because the agents are self-organising. It is nevertheless possible to make sense, retrospectively, of complex events.

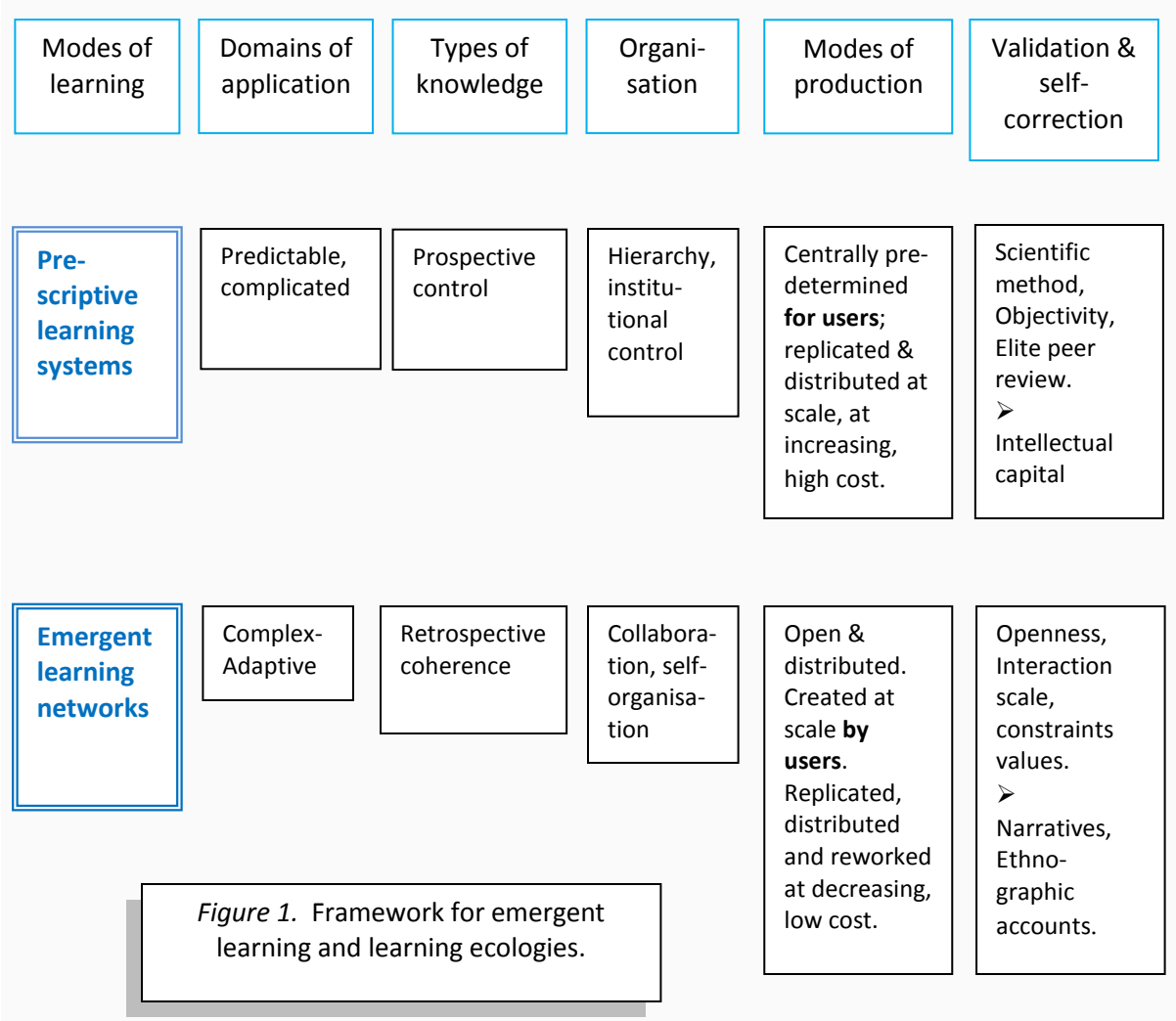

Figure 1. Framework for emergent learning and learning ecologies.

In *predictable domains*, knowledge can be created and applied to provide control. The learning that is traditionally associated with predictable domains is typically organised hierarchically within centralised institutions. We will refer to it as *prescriptive learning*. A better term might be *sutured learning*, in the Lacanian sense of being sewn up and not negotiable, but for the sake of simplicity, we will stick with the more general term. Prescriptive learning, then, is based on knowledge which is pre-determined *for the learners* and duplicated and distributed at scale through traditional schools and universities, through print and other mass media, and through national quality-assurance institutions. This covers most formal education in the UK, as well as most traditional publishing and educational broadcasting, and many VLEs.

In *complex-adaptive domains*, knowledge does not provide prospective predictability but, rather, retrospective coherence: "hindsight does not provide foresight" (Snowden, 2010). The learning that is appropriate is self-organised and typically collaborative. It is open and is created and distributed largely *by the learners themselves.* Examples include social software communities and networks, some personal learning environments (PLEs), and some communities of practice (CoPs).

On this basis, we can distinguish between two modes of learning: *prescriptive learning systems* and *emergent learning networks,* associated with the two domains of application, *predictable* and *complex-emergent* respectively. This is not in itself new. Emergent and prescriptive learning have both always been with us. What has changed is a radical transformation of the modes of production of interaction, communication, and dissemination, collectively referred to as Web 2.0 (see Figure 1), which makes emergent behaviour possible at an unprecedented scale, pace, and breadth of participation. Collins and Halverson (2010) point out that traditional modes of learning arose in response to the industrial revolution and were based on standardised mass-production. The "affordances of digital media," on the other hand, emerged out of the information revolution and the subsequent growth of Web 2.0 social software and "learner-directed technologies" (Collins & Halverson, p.18). This poses "direct challenges to how [formal education] operationalizes learning" (p.19). What seems to be emerging now is a third phase, in which the *information age* is overtaken by the *interactive age*, in which the emphasis is not so much on the transfer of data by individuals and institutions (in information and communication technology, ICT), but rather on interaction and collaboration within social networking.

(Note: In our framework, the two modes of learning and the two modes of application are presented here as quite separate for analytic clarity, but as soon as prescriptive learning is applied in a social context or explored at the doctoral level, emergent factors also come into play.)

One of the central problems for learning is how to ensure the validation of knowledge and self-correction of the system. Validation and self-correction within prescriptive learning systems is based on well-established principles of the scientific method and expert peer review, which successfully produces and disseminates objective intellectual capital. This is not to deny that ethical issues and dilemmas may arise from the application of these "objective" methods, such as in genetic engineering, but the mechanisms for generating and validating knowledge are well established.

This is not the case for emergent learning. The growth and diversity of the modes of production for emergent social networks provide the necessary conditions for an exponential expansion of emergent learning, including openness, interaction, and self-organisation at scale. However, other factors, such as constraints and values, also have to be taken into account. How is it possible, for instance, for the Internet to be used to establish the mistaken consensus of 50 million Americans that Obama is "actually" a Muslim? Where and how did they learn this? (The Times newspaper, UK, 17th September 2010).

Web 2.0 provides the necessary conditions for emergent social behaviour to flourish, but this does not necessarily lead to knowledge or to emergent learning. This is one of the key problems that this paper addresses, but we first need to explore the broader issues of emergence in the next section then return to the specifics of emergent learning.

Analytic Framework

Learning can be defined, broadly, as acquiring "knowledge" or the "capacity for effective action" (St Onge & Armstrong, 2004). It therefore requires individual capacity and a social or institutional context in which to act (Wenger, 2006). Learning has always included both prescriptive learning (which is fixed and predictable) and emergent learning (which is unpredictable and arises out of the interaction between the learners and their context). We will outline the conditions that promote emergent learning, and we will try to show how emergence potentially adds to the affordances for learning but also brings with it requirements for monitoring and rapid response (Snowden & Boone, 2007).

We need to note that, in terms of complexity theory, emergence can be either positive or negative, depending on the perspective of the person and the social context concerned (Cilliers 2005; Snowden & Boone, 2007; Snowden, 2010; Rihani, 2002). Emergence may add value to one community but detract from the value of another. Negative emergence may also include rogue or feral individuals or even communities and institutions, such as the derivatives markets in the late "noughties" and Al Qaeda, both of which Knorr-Cetina (2005) shows in detail to be clear examples of emergent networks.

Emergent Learning

We can now start to add some detail to the framework in Figure 1, specifically for managing emergent learning in a digital, networked world. Siemens describes emergence as

> an attribute exhibited by complex systems. The interactions of multiple agents at a local level can create or contribute to significant system-level change.…When applied to learning, we can appeal to emergence as the outcome (understanding?) that arises from different agents interacting and producing unanticipated outcomes. (2009)

Since emergent learning is unpredictable but retrospectively coherent, we cannot determine in advance what will happen, but we can make sense of it after the event. It's not disordered; the order is just not predictable. We can summarize this as follows: Emergent learning is likely to occur when many self-organising agents interact frequently and openly, with considerable degrees of freedom, but within specific constraints; no individual can see the whole picture; agents and system co-evolve.

Why is it important? Emergent learning is open and flexible, so it is responsive to context and can adapt rapidly, particularly in a world in which careers, professions, identities, competencies, and roles, as well as interactive and communicative media, are rapidly changing. However, openness needs to be counterbalanced by constraint and inclusive values. If all these factors are present, emergent learning is possible, and even probable. If not, however, emergence can

degenerate into isolated virtual ghettoes, or "echo chambers" (self-perpetuating and self-reinforcing enclaves), which may reinforce prejudice rather than produce the "wisdom of the crowd" (Alakeson, Aldrich, Goodman, Jorgenson, & Miller, 2003).

Emergence is not a panacea, it is an option, and we will argue that it has to be situated within – and preferably integrated within – an overall, inclusive learning ecology, along with prescriptive learning as and where appropriate.

Managing Emergence

Snowden and Boone (2007), Snowden (2010), and Cilliers (2005, 2010) provide detailed analyses of the necessary conditions for managing emergent learning. Snowden contrasts two approaches to management: "safe/fail experiments" as opposed to "fail-safe management," in emergent or "complex" domains and in predictable or "ordered" domains, respectively. *Fail-safe management* aims at ensuring compliance with predictable outcomes, whereas *safe/fail experiments* aim at encouraging interaction and self-organisation and enabling emergence and innovation, which is managed by

- a heightened awareness of changes in attractors, boundaries, and emergence;
- a system of *negative constraints* which determine what is not allowed to happen, rather than specifying what does have to happen;
- continuous monitoring, response, and recovery, good weak-signal detection of "outlier" events, light-touch response where possible, and quick and decisive intervention where necessary, including dampening negative emergence and accentuating positive emergence;
- an emphasis on *resilience*, (i.e., allowing mistakes but rapidly responding and recovering), rather than on *robustness*, which does not allow for mistakes or for learning from mistakes;
- creatively using retrospective coherence rather than trying to force compliance and predictability where it might not be appropriate or even possible, particularly in performance targets.

Designing for Emergence?

Wenger (1998, p. 267) writes that designing for emergence can only be an intention; learning will be emergent whether it is designed for or not; we cannot anticipate what will emerge. The design process should be interpreted more as an attitude, a set of principles, or a philosophical approach than a practice. The details of the design are not the issue – it is the interaction between the planned and the emergent that matters. This involves an iterative feedback/feed-forward loop, where one is continually affecting the other and adjusting accordingly. This suggests that the planning and design should be as emergent as the learning.

Structure and Constraint

Cilliers (2005) specifies the dynamics between structure and complexity in some detail:

> The structure of a complex system enables it to behave in complex ways. If there is too little structure, i.e., many degrees of freedom, the system can behave more randomly, but not more functionally. The mere 'capacity' of the system (i.e., the total amount of degrees of freedom available if the system was not structured in any way) does not serve as a meaningful indicator of the complexity of the system. Complex behaviour is possible when the behaviour of the system is constrained. On the other hand, a fully constrained system has no capacity for complex behaviour either. (p.258)

In other words, both openness and constraints must be continuously monitored, managed, and balanced.

Knowledge Ecologies

Prescriptive and emergent learning have always occurred in education, work, and informal settings in some measure. The differences lie in the balances between prescriptive and emergent learning, the degree of formalisation of learning, and the different levels of resources which each sector applies to them.

Learners have always been self-organised to some extent, even if this was on the borders of institutional practices. What has changed is that learners not only have access to the affordances of individualised tools to construct personal learning environments (PLEs), but that these are increasingly embedded in social networks which are, in turn, emergent and self-organising. These PLEs might therefore better be seen as "personal learning ecologies" or "personal ecological niches or nodes." Knorr-Cetina writes that many emergent practices "simply outrun the capacity of [prescriptive, Weberian] structures. Global systems based on micro-structural principles do not exhibit institutional [structures]…but rather the asymmetries, unpredictabilities, and playfulness of complex (and dispersed) interaction patterns" (2005, p.214).

In principle and in practice, we are rapidly moving into much broader knowledge ecologies (Peters, 2009) which link many sites of learning and networks that include both prescriptive and emergent elements. We need a new language to describe and analyse the way in which emergent learning occurs in different settings or how structure and agency co-evolve in complex systems (Snowden, 2010).

The interactive potential of Web 2.0 provides unprecedented opportunities and affordances for emergent learning. However, enabling, resourcing, and managing a learning ecology which

integrates prescriptive and emergent learning requires people who can work across these two very different systems that are based on quite different epistemologies.

Applying the Framework

A number of issues or themes will be explored to flesh out the analytic framework in more detail and test it against practice and research. Various theories, particularly complexity, affordances, and communities of practice, as well as the concept of connectivism, will be drawn upon to analyse these cases to try to provide a better understanding of how we can enable and manage emergence in a digital, networked world.

Validation and Self-Correction

Validation and self-correction within emergent learning networks remains an issue. Many academics still dismiss emergent learning and Web 2.0 as peripheral or even irrelevant to "real" formal learning because they see no mechanisms for validation and self-correction. Wikipedia provides a good example of emergent learning, based on micro-agents interacting at scale. The point is that Wikipedia is an emergent learning network, not a prescriptive learning system, and it would be a mistake to try to judge Wikipedia by any other criteria. It's a paradigm case of what may be called open source content, with mechanisms for validation and self-correction based on frequent interaction by micro-agents in an open system with negative constraints. It turns the commissioning structure of conventional encyclopaedias on its head.

Beyond Prescriptive Learning

In research conducted for the UK Higher Education Academy's Learning Observatory programme, learning narratives were gathered to explore how students actually went about their learning (Williams, Karousou, & Gumtau, 2008). One of these narratives, *Learning Journey*, illustrates the way in which emergent learning may arise serendipitously, as it were, in the learning of someone enrolled for a prescriptive learning programme.

This narrative concerns the learning that takes place when April, a mature part-time student in an Early Years Childhood Education degree, goes on a visit to a preschool centre of excellence and a related preschool. April is a preschool manager. On her visit to the centre, she notices:

> There were certain things that stuck in my mind about their environment that was completely different to my own. For instance, they have glass bottles, glass vases with flowers on the tables. And really, the fact that the children were so well behaved and quiet, made a big impression, thinking: how can I influence my children to be quieter?

April engages with several staff members at the school and the centre and becomes a member of an informal community of practice (CoP). From her interaction within this CoP, she gains enough confidence to embark on a complete change management programme at her own preschool (despite the skepticism of her fellow teachers), incorporating ideas from her visit and from further interaction in this CoP.

April was only required to write up a report on her visit and some lessons learnt. However, her learning journey goes way beyond the requirements of her prescriptive learning programme, particularly at a first-year level, in what might be called emergent learning. April engages in an unpredicted and far more complex task than was prescribed by her course. This learning was retrospectively coherent and influenced by her participation in an implicit and emergent community of practice. Although this community was small and several participants could probably "see the whole picture," April's learning within it was not formally managed. April's case is one of entirely self-organised, small-scale emergent learning with little or no integration into formal, prescriptive learning or the curriculum.

Assessment

Amplifying, celebrating, and recognising this emergent learning was unlikely within the context of April's course. Romer argues that "the traditional interpretation [of assessment] becomes problematic because an assessment of [such a] student according to the principles of [the course]…will be incapable of capturing the student's creativity" (2002, p. 238-239). Examples like this, which are becoming increasingly frequent as more mature students are invited back into higher education as part of the "widening participation" programme in the UK, reflect the need for finding a workable way to integrate and move between the plurality of various communities, the multiple and disjointed individual trajectories, and the possibilities for amplifying, rather than just ignoring, emergent learning like this. The question is whether it is possible to bring such emergence back into a closed learning system and the institution's assessment framework.

Dampening and Amplifying Emergence

As we have said, emergence allows new affordances, but these may be positive or negative. There are many uses of the term affordances, so it might be useful to define the particular sense in which we use it in this paper more precisely, before we continue:

> An Affordance is the product of interactions between a person and their environment, each of which potentially alters their knowledge, competencies and identity, and potentially alters the (micro-) environment...[and]...Learning is the process of exploring, benchmarking and mastering new affordances. (Williams et al., 2008)

Re-defining learning in terms of affordances in this way enables us to account for both prescriptive and emergent learning within an inclusive learning ecology, and it allows us to link

learner, identity, and context, as in Wenger's concept of social learning (2006). This notion of affordances allows for potentially large adaptations by both learner and environment, but does not require it. In general terms, one would expect a lot of mutual adaptation in emergent learning (by definition). In prescriptive learning, on the other hand, one would expect much less adaptation on the part of the learner and possibly none at all on the part of the (virtual or otherwise) learning environment.

A learning programme that requires students to explore a particular field, but in a way that encourages emergence, still has to be managed, albeit differently from the way learning is traditionally managed (see Snowden & Boone, 2007). Most important of all, negative constraints must be put in place and communicated to the participants. Secondly, the instructors or facilitators must dampen negative emergence and amplify positive emergence.

The case that most clearly illustrates some of these issues is the University of Manitoba's massive open online course, CCK08, on Connectivism, designed by Downes and Siemens, which ran between September and December 2008 (Downes, 2009). CCK08 was based on the connectivist principles of *connectivity, openness, diversity, and autonomy.*

The course content was available from the start on the course wiki, and participants were free to plan their own paths through this content, engaging at their own levels in media of their choice. Implicit in the course design was the expectation that information and expertise would be freely shared and knowledge would be created collaboratively. Connectedness and interactivity lay at the heart of the course design. It was expected that knowledge would be emergent in the network and become a resource for the network as a whole.

The course also provided an innovative "blog-aggregator," in which participants' blogs (and some forum discussions) were scanned on a daily basis, and leads and links to these postings were aggregated and captured in a daily electronic newsletter. This is an excellent example of how emergence can be harvested, enabled, and amplified by putting into practice "weak-signal detection of 'outlier' events [blogs]," and communicating them to the whole network (see the Managing Emergence section).

The course was designed to be completely open and self-registering. This was in many ways a radical experiment, which satisfied some of the key conditions for emergent learning: "the interactions of multiple agents at a local level [which] can create or contribute to significant system-level change…different agents interacting and producing unanticipated outcomes" (Siemens, 2009).

However, it did not, in practice, achieve a balance between constraint and degrees of freedom. The tolerance and lack of guidance on what to do about the very disruptive troll behaviour from one participant in the first part of the course (who disrupted the work of course participants through aggressive behaviour), and the total imposition of the "power demonstration" exercise near the end of the course, used too little and too much constraint respectively, and participation and emergent learning were compromised. Wikipedia [2010] defines a troll as

> someone who posts inflammatory, extraneous, or off-topic messages in an online community, such as an online discussion forum, chat room, or blog, with the primary intent of provoking other users into a desired emotional response or of otherwise disrupting normal on-topic discussion.

One of the established ways of dealing with troll behaviour is the 'do not feed the troll' (DNFTT) protocol (i.e., all participants ignore the troll's contributions), but this was not used in CCK08.

The majority of the respondents in the Mackness et al. research (2010) on CCK08 showed that they left the forums, some probably left the course, and many became bloggers exclusively because they were "refugees from the forums," who wished to escape from an environment in which there were no apparent constraints.

So connectedness per se does not ensure interaction, let alone emergent learning. As Siemens said, some months later, "The question for me is not 'how are people connected?' but rather 'what are the implications of people being connected in a certain way?'….Frequency of contact isn't that important to me" (2009b).

The challenge is to map out carefully, in detail, the most appropriate way for people to be connected and to ask the question, can and should a course based on self-organisation also be *self-managed*, or is there a crucial distinction to be made between self-organisation and self-management in practice?

Emergent Curriculum

Courses can also be deliberately designed as adaptive systems, in which learning emerges. The MA in Management Learning and Leadership Programme (MAMLL) course at Lancaster University in the UK is an example in which the curriculum itself is emergent, although still within the quality assurance framework for master's courses (this might have been more difficult in an undergraduate course).

MAMLL subscribes to a belief in an open syllabus and self-managed learning. The curriculum is seen not as a description of content but as the product of the interaction between people who are active in the domain and negotiating workshops and assignments, people who will produce resources for future students.

> We believe that individuals often know what they need to become more effective, and have a keen sense of their own priorities and interests. This is why we work with an 'open syllabus', where the content of the workshops, and the literature drawn upon, is shaped by both tutors and participants.

In this sense, the course is an adaptive system which is not restricted to a pre-determined representation of a student or domain, but allows students to be creative and engage in their own acts of representation (as advocated by Downes, 2010a). This negotiated curriculum means that no two programmes ever look quite the same. The programme is a dynamic network for learning, continuously shaped and re-shaped by its members. The outcomes can therefore be unpredictable and surprising. The course thus satisfies the overall criterion for emergent learning: "a learning ecology in which agents and system co-evolve" (Lancaster University).

The course has been running for 27 years as a part-time programme. It takes a social constructionist approach to learning and has adopted and adapted some of the principles of the theories of communities of practice and networked learning to encourage learners to take control over their own learning and follow their own lines of enquiry (Hodgson & McConnell, 1992). In this sense, the course design promotes emergent learning. The programme also promotes diversity by recruiting mature learners from all around the world and from all employment sectors. It provides a forum for face-to-face and online networking amongst participants, academics, researchers, practitioners, and alumni, thus enabling connections between people, ideas, and online and other resources (Hodgson & Zenios, 2003). In terms of emergence, this emphasis is the specific factor of *diversity*, a factor which was also foregrounded in *connectivism* in CCK08 (Downes, 2010a).

Whilst the programme is informed by social learning theory (Wenger, 1998, 2006), the emphasis has been on developing a network of learners rather than a community of practice because the course leaders believe that CoPs have the potential to be oppressive, exerting pressure towards conformity and crushing individual autonomy (Ferreday & Hodgson, 2008). Specifically, the course leaders believe that resistance to the core values of the community and its norms of behaviour, or difference in terms of gender, role, age, and so on can result in marginalisation and isolation, and that some students may not feel represented by the terms or expectations of a community. The MAMLL course supports the recognition and maintenance of difference and allows "defiant speech" and "talking back." Differences and ambiguity are accepted without an expectation that they should somehow be resolved (Hodgson & Reynolds, 2005). This subtle difference from a community-of-practice approach is, in practice, positively significant for emergent learning, which is ensured by the existence of specific, limited constraints.

Although the course emphasis is collaborative assessment, peer feedback, and students' contributions to the marking process, it is acknowledged that the power of assessment remains invested in the tutors and institution and that there are hierarchical differences between students and tutors. Whilst tutors recognise that academics are not necessarily authorities in a course where students can negotiate their curriculum and that they can learn a lot from the negotiated curriculum and students, the course is not a free-for-all and tutors do not abdicate responsibility for their students' learning.

> [W]e recognise that this process needs to be facilitated to be most effective. Tutors add new perspectives to the ideas participants already have, by sharing thoughts, concepts, models,

> etc, from their own research and practice, their academic interests and the literature. (see http://www.lums.lancs.ac.uk/masters/mamll/aims/)

Emergent learning is therefore enabled in the MAMLL course by a fine balance between networks and communities of practice, to some extent constrained by the practices and regulations of the traditional education system.

Self-Organised Enquiry-Based Learning?

The CCK08 course was an experiment in emergent learning, based on the radically different affordances of Web 2.0. So too is Mitra's Hole in the Wall (HiW) project, in which he tries to address the chronic failure that "rural India has been plagued with…in delivering quality education" (Arora, 2010, p.689). He has built up a body of experiments to attempt to address this, starting with

> a computer...embedded in a wall of a slum area of Kalkaji, New Delhi, to see what use the local children would make of it without instruction or guidance. A touchpad was built into the wall…and a video camera placed on a nearby tree to record the children's activity. (p. 690)

Mitra's research shows that many of the children achieved substantial learning on their own. This learning was clearly not prescribed but emergent. However, in some cases a lack of monitoring and intervention caused the experiments to fail. Arora (2010) applauds Mitra's work but also documents some of the failures that she encountered in her research on HiW projects in two communities in the Himalayas: in Almora, due to vandalism, and in Hawalbagh, due to lack of finance and monitoring and support. In the light of these findings, Mitra has now added facilitators, either locally or, most innovatively, by employing grandmothers, connected to learners via Skype-Internet phone calls, in what he calls the "granny cloud." The facilitators are not subject experts; their main role is to encourage and support the children's own learning. Arora and Mitra have both recognised that for emergent learning to be effectively managed, it needs to be balanced with appropriate intervention and constraints. (Mitra & Dangwal, 2010; Mitra & Arora, 2010).

In one sense it is not remarkable that the children learn to use computers as they learn to use mobile phones without any training. What is remarkable is how much they can learn, with how little guidance, if their self-motivation and self-organisation is encouraged and enabled. For Mitra and Dingwall (2010), the question is, can that self-motivation be sustained and not veer off into computer games, as happened in some cases?

Mitra has now set up a company (HiWEL), which is working with schools, but he is determined to maintain effective self-organised learning because "the absence of a teacher can sometimes encourage children to explore more bravely than they would in their presence" (Mitra & Arora,

2010). This is, if anything, a more risky project as reforming schools is notoriously difficult, particularly if you want to convince them of the value of the "absence of teachers." As Arora points out, "the conundrum HiWEL has to face is that it has to strategically engage with schools to justify its presence due to the absence of instruction" because it could be seen to imply that "teachers should stay away to encourage children towards free learning" (2010, p. 696).

Mitra has built up a meticulous body of research to show maintained and even increased retention of knowledge by many of the children following his *minimal interventionist* approach. But as Arora points out, there is an inherent clash of cultures, of institutional discourses, between rural teaching "embedded in rote learning" and "knowledge discovery and knowledge creation," or emergent learning (2010, p. 696). Mitra's current definition of emergence – "emergence occurs when a system starts to do things that it was never designed for" – may confuse and unsettle teachers even more (Mitra, 2010). There is no doubt that Mitra's project is breaking new ground in at least three quite distinct areas: self-organised learning, cloud-based facilitation, and rural education. The strategic questions about how to find a point of engagement for this emergent learning with the Indian education system, however, seems to have a long way to go.

Conclusion

In this paper, we have described the unprecedented affordances that Web 2.0 offers for interaction and communication and for emergent learning, as well as some of the substantial challenges in realising this potential in education. We have mapped out the characteristics of emergent learning and situated it within learning as a whole, distinguishing it from more traditional modes of learning in order to provide the basis for integrating both of these two modes of learning within an overall learning ecology. To do this, we have drawn on complexity theory, communities of practice, and connectivism and analysed cases that illustrate some of the key issues. In the process, we hope to have provided some foundations for a framework for emergent learning as well as for a more inclusive, flexible, and adaptable learning ecology.

Such a framework would be based first on the technical or infrastructural conditions for emergent learning. ICT is fast morphing into the social software of Web 2.0 and the augmented reality of cloud-based Web 3.0. ICT has changed beyond recognition, providing global open access at extremely low cost, for not only consuming, producing, and distributing texts and artefacts but for interaction, communication, and networking.

Secondly, emergence requires new institutional and social memes and structures. Some innovative legal frameworks which are already in place provide clear protocols and resources for collaboration and sharing, notably Open Source licences for collaborative software and Creative Commons licences for collaborative and shared content. Many free (mostly advertising-driven) platforms are also in place, from Google to a range of social software and cloud-based "apps" – downloadable applications.

And thirdly, there is a need for a shift from a monolithic *learning environment* in which everything must be controlled and predictable to a more pluralistic *learning ecology* in which

both prescriptive and emergent application domains and modes of learning have their place, and in which it is possible to celebrate the unpredictable. This requires quite a different mindset, in which there is a role for safe/fail as well as fail-safe management, a role for resilience as well as robustness, and a balance between pro-spective and retro-spective sense-making of teaching and learning (see section on Managing Emergence).

Institutional change is also at issue. The debate between Mitra and Arora highlights the difficulties in convincing teachers to change. Curriculum change, and particularly radical curriculum change, is difficult, precisely because it challenges embedded practices – embedded pedagogically, culturally, and socially. The question for proponents of emergent learning and Web 2.0 is whether this just "triggers a romance which tells of learning free from the restrictions of formal schooling and children liberated through self-learning" (Arora, 2010, p. 690) or whether a new *two-state* learning ecology can be achieved, in theory and in practise.

The degree to which the learning can usefully be based on self-motivation and self-organisation depends on three things: the quality of the interaction afforded by the resource and the facilitator, the range of affordances for open interaction with other peers (or micro-agents), and the moderation of the balance between openness and constraints. This is true whether the learning takes place in a Hole-in-the-Wall kiosk linked to a granny cloud, an open learning network, or within moderated peer learning in an online course in higher education.

There are a number of approaches to learning that are premised on a mix of self-interest, internal motivation, self-organisation, and peer-interaction, from Montessori classrooms to enquiry- and problem-based learning, to negotiated curricula and a range of online and open learning programmes. It is fairly obvious that any learning model, and particularly enquiry-based ones, would benefit from more interaction and access to information. The point about what Mitra (2010) initially called *minimally invasive education* and is now calling *self-organised learning environments* (SOLEs) is not that emergent learning networks should replace or displace prescriptive learning or teachers or that enquiry benefits from access to better resources, but rather that space needs to be made for substantial, self-motivated, self-organised, emergent learning, per se. This should be recognised as a vital – not a peripheral – part of a learning ecology that includes both emergent and prescriptive learning in a world in which Web 2.0 platforms offer unprecedented affordances for information, interaction, networking, and collaboration, as well as for unique challenges.

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EduCamp Colombia: Social Networked Learning for Teacher Training

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Abstract

This paper describes a learning experience called EduCamp, which was launched by the Ministry of Education of Colombia in 2007, based on emerging concepts such as e-Learning 2.0, connectivism, and personal learning environments. An EduCamp proposes an unstructured collective learning experience, which intends to make palpable the possibilities of social software tools in learning and interaction processes while demonstrating face-to-face organizational forms that reflect social networked learning ideas. The experience opens new perspectives for the design of technology training workshops and for the development of lifelong learning experiences.

Keywords: EduCamp; connectivism; personal learning environments; e-learning 2.0; unconferences

Introduction

If you imagine a workshop on the use of information technology aimed at teachers or anyone else, a recurring image will be that of computers arranged in rows, all facing the same direction, with a facilitator at the front indicating to participants the steps they are to take. This arrangement reflects the typical organization of a classroom, and even when there are laptops available, it is common to organize participants so they look straight ahead or toward wherever the expert might be. It can be argued that such a spatial disposition reflects a logic of scarcity and information transmission that lies behind the way we think about many of our physical spaces and educational activities (both face-to-face and online), including workshops for the use of information and communication technologies (ICTs).

Emerging opportunities made possible by new technologies have, so far, changed very little about the technology training programs offered to teachers. Although technology is used, the

image of the teacher as an expert who not only decides what makes sense to learn, but also has the final word (through evaluation) on whether someone has learned remains dominant. The learner remains, in most cases, a consumer of the information the teacher deems appropriate. In fact, Benavides and Pedró (2007) go beyond this observation to conclude that in Iberoamerica there is nothing to indicate that ICT use has achieved "a revolution in pedagogical models, which still do not embody the paradigm required by a knowledge society."

These observations were the starting point for a series of experiences developed by the Office for the Promotion of Higher Education at the Ministry of Education of Colombia, aimed at exploring opportunities and alternative scenarios for helping higher education teachers to discover new ways of using ICT in their practice.

During the second semester of 2007, a series of workshops on the use of social software tools was designed and implemented. These workshops, called EduCamps, modeled a face-to-face social networked learning space in which several emerging concepts (such as e-Learning 2.0 and personal learning environments, or PLEs) were brought into play. EduCamps were intended to enable a different learning environment, directly related to the possibilities of current technologies, in which individual responsibility in the use of ICTs was made evident, as well as the need to consider how (and when) to distribute the role of the expert among a community of learners. So far, over 1,000 teachers in seven cities nationwide have attended the workshops.

This experience suggests that, for some teachers, a change in their perception about technology use can be achieved through activities that confront their deepest convictions about what it means to learn and teach, allowing them to discover themselves as apprentices in a continuous process and as members of a larger community to which they can turn for answers.

Background

The Origin of the EduCamp

The Vice Ministry of Higher Education of Colombia, through the Office for the Promotion of Higher Education, launched an ambitious project in 2004 to foster the development of different aspects of the integration of ICT in Colombian higher education institutions. An important part of this project was focused on the use and adoption of media and ICT, and several strategies to enable the adoption of emerging technologies and methodologies were developed.

Starting in 2005, several teacher and administrator training programs were offered nationwide. These included, for instance, three-day workshops aimed at university provosts and online courses on virtual learning environment design and facilitation aimed at higher education teachers. Also, an online community for teachers was created, and several international seminars were organized.

The international seminar held in 2007 discussed emerging concepts such as e-Learning 2.0, personal learning environments, and informal learning, and it posed the challenge of introducing

these ideas and their implications for the design of learning environments to higher education teachers. However, it was not clear whether the existing online courses would be the most effective way to communicate these ideas. Also, these courses were focused on the development of fully online learning environments, while most teachers were involved in blended learning scenarios. Therefore, there was a window of opportunity to offer complementary training alternatives.

The original idea of the EduCamp workshops emerged from conversations with Nancy White, Jay Cross, and Fernando Diaz del Castillo (at the time, the person in charge of the use and adoption of ICT for Basic Education at the Ministry of Education). Brainstorming took place in August, 2007 about how to design an experience to facilitate what White called "over-the-shoulder" learning (White, 2007).

"Over-the-shoulder" learning is a fairly common practice in software development training, where students share solutions to specific problems as they appear, working side by side, generating a relationship different from that seen in a typical classroom. It is recognized that any one can act as an expert in a specific area (the use of a tool, for example) and that knowledge is not exclusively transmitted from one to many (teacher to students), but also can be transmitted among unstructured groups of people. "Over-the-shoulder" learning would be, in fact, an example of what Bandura (1986) described as *vicarious learning*, with *modeling* playing a fundamental role in the process.

So the question was how to enable technology adoption processes for teachers, based on "over-the-shoulder" learning and in an environment that reflected some of the emerging concepts mentioned earlier. It was not enough to talk about the possibilities of technology. Rather, it was essential to make them visible and to model them for all attendees. With these thoughts in mind, a full-day workshop was designed, mixing several techniques of individual and collective work. It was presented as a "workshop on the use of social software tools" and designed to be offered to about 100 people at once.

The Concepts Embedded in the Design

The workshops were focused on exploring the use of a broad set of social software tools, articulated around the characterization and enhancement of the personal learning environment (PLE) of each participant, a concept whose first documented appearance corresponds to a workshop held by the UK's Joint Information Systems Committee (JISC) in November, 2004 (Wikipedia contributors, 2009).

Interestingly, the notion of a PLE does not yet have a precise definition in the academic community (Trafford, 2006). In some cases, it is an essentially technological approach (Downes, 2005; e-Framework, 2005; Wilson, 2005; Harmelen, 2006), appearing as an alternative to the concept of the virtual learning environment (and hence the so-called learning management systems, or LMSs) (Anderson, 2007; Wilson et al., 2007; Hand, 2007); in others, it is recognized (and displayed) as a map that shows the environment in which a person learns (Leslie, 2008b).

In the latter case, a PLE diagram may include, with more or less detail, the physical spaces in which people learn, the people from whom or with whom learning happens (teachers, mentors, colleagues, other learners), the media used to access relevant information (textbooks, academic articles, television, radio, newspapers, blogs, wikis, mailing lists, etc.), and the tools used to compile that information or to interact with others (including, usually, a variety of social software tools). This is the approach used in an EduCamp.

The components of a PLE vary from person to person, as do their relative importance. More than an application or computer platform, a PLE is composed of people, spaces, resources, and tools that are interrelated and that interact in different ways depending on the habits and needs of each person.

There was an interest in getting participants to experience different forms of organization for collective work, enabling each learner to discover and explore his or her interests using technology, outside of a curriculum and objectives predetermined by others. For this reason, the design of the workshop was based on several techniques used to carry out unconferences.

An unconference relies on minimal structure, allowing participants to decide the issues to be addressed within a broader subject area. Given that many unconference techniques come, in fact, from more established methodologies of conversation, some of these techniques were explored. The workshop made use of ideas from Open Space Technology (see http://www.openspaceworld.org/), The World Café (Brown & Isaacs, 2005), BarCamp (see http://www.barcamp.org/), PodCamp (see http://podcamp.pbworks.com/), Pecha Kucha (see http://www.pecha-kucha.org/), and even an approach called Speed Geeking (see http://facilitation.aspirationtech.org/index.php/Facilitation:SpeedGeeking). The name *Educamp* itself comes, in part, from unconferences having the suffix *camp* in their names (FooCamp, BarCamp, PodCamp, etc.), but with an educational emphasis.

The workshops were designed with a defined yet flexible structure, which brings together several concepts and has a specific interest in the adoption of social software tools. They were not designed as a BarCamp, whose discussions are related to education (as can be seen in other experiences called *educamps*; see http://educamp.pbworks.com/).

It is important to note that, to the author's knowledge, back in 2007, there were no documented training experiences specifically related to personal learning environments, even though there have been courses and workshops related to the use of social software tools for several years now. In 2008, some workshops that focused on the development of personal learning environments started to appear (see Leslie, 2008c and Gray, 2009, for example), as well as online resources related to the building of personal learning networks (Waters, 2008). This means the original 2007 design of EduCamp was not influenced by other experiences in the area.

The Structure of an EduCamp

Identifying the PLE

The workshop began with a check-in, at which each participant received a laptop computer to use throughout the day. In all cases, the logistics team of the Ministry of Education leased the computer equipment, given that most Colombian teachers did not own laptops.

A sheet listing software tools was provided as reference material. It contained general descriptions of various categories of tools, including picture, audio, video, and document publishing and sharing, as well as platforms for social bookmarking, blogs, wikis, RSS aggregators, and social networks, among others. Each category included links to some of the web applications available. The sheet has since evolved to include guiding questions for the characterization and expansion of the PLE for each participant, and a white outline on the back, in which each person can draw his or her own PLE (see Figure 1).

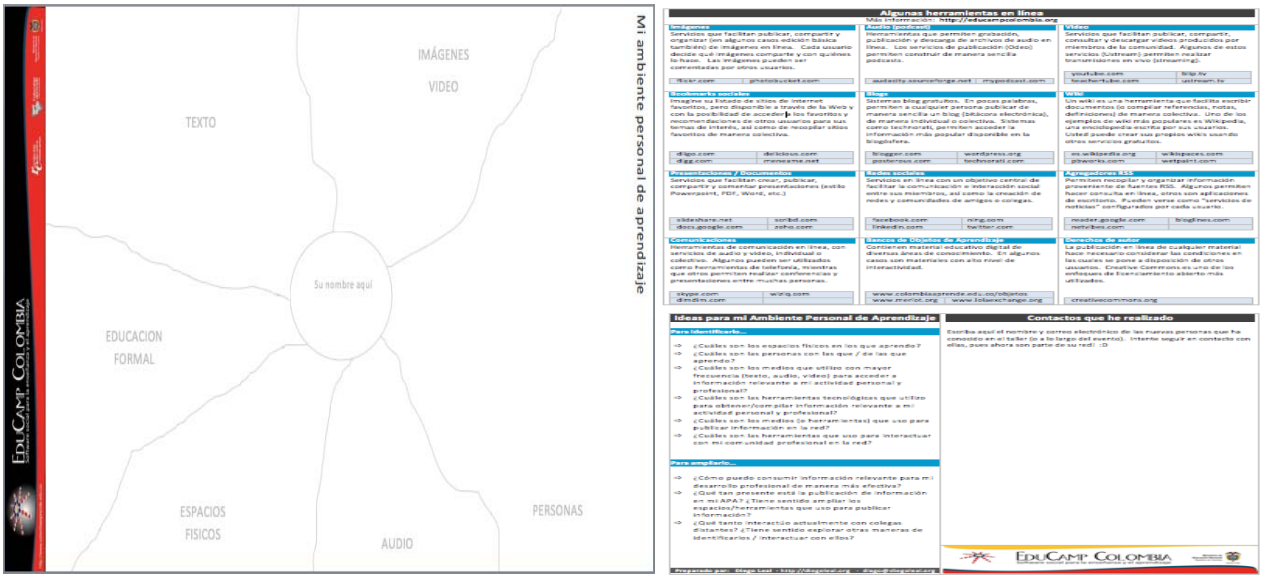

Figure 1. Facsimile of the PLE outline and the tool sheet (Available in Spanish at http://www.scribd.com/doc/8325751/Ambiente-Personal-de-Aprendizaje and http://www.scribd.com/doc/19330108/Hoja-de-Apoyo-EduCamp).

The session started with an initial introduction of the participants, using chat tools such as Chatterous to facilitate the quick collection of information. This activity helped to identify both technical network problems, as well as the attendees' skills in the use of technology. In addition, it represented an opportunity to encourage the more skilled attendees to help those who were having problems.

The chat was presented as the workshop *backchannel*, a space to discuss both presentations and activities during the day. While in other events the backchannel is often articulated through the use of specific tags on platforms such as Twitter, the diversity of this workshop's participants

(who may not have known what Twitter is) made it imperative to select a tool closer to the previous experiences of most attendees (a chat).

After a presentation of the context of the workshop and some ground rules, the basic ideas related to the concept of a personal learning environment were presented. The discussion included the usefulness of its characterization and the relationship it has with social software, referring to the definition presented earlier in this document.

Then each participant characterized the current state of his or her PLE in the way he or she saw fit (list, diagram, graph, etc.), using as guides the tool sheet and some questions proposed. These questions led to an analysis of the physical spaces in which each person learned, the people with or from whom he or she learned, and the media (text, audio, video) most frequently used to access information relevant to personal and professional activities, as well as the technological tools used to obtain and compile that information. Also, participants identified the media and tools used to publish information and the tools they used to interact with their professional community on the Web.

Given that the elements of a PLE change from one person to the next, this exercise usually turns into a personal reflection, where there are no right or wrong answers but simply opportunities for growth. Starting in 2008, even though the PLE sheet contained an initial scheme, participants had the freedom to use a scheme relevant to each individual case from a series of diagrams compiled by Scott Leslie (Leslie, 2008a).

An important part of PLE characterization is to identify the technological tools that are part of the PLE, so the workshop participants used the descriptions and links included in the tool sheet as a guide. Then everyone wrote the names of any social software tools that were part of their PLE (even those not included in the tool sheet) on stickers handed out at the beginning, which they stuck to their clothes (see Figure 2). This *tagging* exercise had two purposes: one, to familiarize participants with the concept of labelling resources, and two, to make visible to others those tools that each participant knew.

Figure 2. Participants with tags on their clothing.

Expanding the PLE

During the final part of the first exercise, participants identified on their tool sheet those tools that could expand or enrich their PLE, depending on their personal needs. Starting in 2009, the tool sheet included some guiding questions to address this process, such as how information relevant to professional development can be accessed more effectively and whether it made sense to broaden the opportunities/tools used to publish information online. Other considerations included the analysis of the current level of interaction with distant colleagues and whether it made sense to explore new ways to identify and interact with them.

It is worth noting that this exercise helped participants to think about the environment in which they learned, making visible that such activity happens not only in formal spaces. The PLE diagram showed information consumption trends that were unnoticed by them, as well as opportunities for growth based on personal needs.

Based on the set of available tools, each learner selected those he or she wanted to learn. To that extent, the role of the expert in charge of defining what was to be learned disappeared, and control over this specific curriculum (if I can refer to it in such a way) was transferred to the learners.

With this roadmap, participants worked on the expansion of their PLE, using as an input the stickers representing those social software tools that each person knew and the tool sheet showing the tools each person wanted to learn about. Participants became involved in a collective searching and learning process with the support of other participants, not just with an "expert instructor."

The stickers were critical because the presence of a sticker meant that whoever was wearing it knew about a specific tool. Thus, the first step in the learning process was to find others who had stickers related to the learner's personal interests. In this sense, the first step of the activity brought into play an assertion made by Siemens (2006, p. 32): "'Know where' and 'know who' is more important today than knowing what and how."

One rule for this stage stated, "If someone approaches you to learn about a tool, you are obliged to help." Thus, once learners identified potential teachers, it was just a question of saying hello and asking for information about the tool of interest. It is worth noting that, in an auditorium with 100 strangers, this became a great excuse to strike up conversations and create new contact networks.

Taking advantage of the fact that each participant had a laptop with a wireless connection, the expert explained and showed the apprentice how the selected tool worked, helping him or her to explore it and subscribe to it, using his or her own computer. Given that most of the selected tools allow the publication of material almost immediately, at the end of each consultancy, the learner would leave with an additional subscription to the tool he or she wanted to explore and, ideally, with some form of material published online. The apprentice was then invited to add a new tag to his or her clothing as a way of making visible the learning achieved. Also, participants had the opportunity to explore on their own, using the information provided at the beginning, and several stations addressing different tools were put in place so that each person could choose among different learning alternatives.

This activity challenged the idea that it is essential for everyone to cover the same curriculum in the same time frame, as well as the notion that it is possible to learn everything about a topic. In the workshops, learning was modeled as a complex, messy, social process, completely dependent on the context (external and internal), features that made the methodology very close to cognitive and constructivist principles.

Talking about Opportunities and Challenges

After working on the expansion of their PLE for a couple of hours, participants were invited to brainstorm about how the tools explored could be used in their personal and professional practice. This collective inventory of affordances sought to give a broader meaning to the expansion of each PLE. Depending on the available space and number of attendees, several stations (i.e., discussion tables, one for each tool category included in the tool sheet) were arranged for small-group discussions. At each station, someone assumed the role of reporter.

Once the participants were distributed at the different stations, they began five-minute brainstorming sessions about the educational affordances of the tool assigned to that station. Upon completion of a five-minute session, participants (except the reporters) went to the next table to repeat the exercise with a new tool.

Each reporter took notes of the ideas generated at each station, which were then posted on a wiki. At the end of this activity, the contributions made by all participants during their transit through the different stations were collected.

Using this design of distributed brainstorming, attendees covered 12 different tools in just one hour, listening both to the ideas of their peers and the additional ideas recorded by the groups that preceded them. Additionally, there was a public record of the activity, available for future reference.

As mentioned above, one of the intentions of the workshops was to expose participants to several types of collective learning methodologies that would enable them to discover new possibilities for their daily practice. For this reason, after the brainstorming session, participants had the option of experimenting with a short unconference.

Using the stations from the previous part of the workshop, participants were invited to lead and participate in half-hour group discussions. Each table had a reporter, who recorded the most important points of the conversation.

The discussion topics were proposed throughout the day, using an idea from Open Space Technology: a large board was put in place with two half-hour slots in which attendees could propose, at any time of the day, their discussion topics around a global issue (the challenges associated with the use of social software tools, for example). In 2008, instead of a board, a computer was used to record and display the discussion topics.

During this segment of the workshop, a variation of the "rule of two feet" (also from Open Space Technology) was stated: "If you are not learning or participating in a discussion, please use your two feet and go to another one." This message was a reminder to all participants to be where they wanted to be. At the end of the half-hour discussion, one person per table reported some of the partial conclusions to the whole group.

The last part of the workshop was focused on a personal reflection on what each participant had learned. An online survey was used, which included questions that explored specific aspects of the organization, activities, dynamics, and facilitation of the workshop.

The survey invited participants to reflect on what they had learned, what they would have liked to have learned, the immediate actions to perform with the things learned, and whether they would recommend the workshop to someone else.

This activity led to a collective reflection in which the facilitator went back to the principles proposed at the beginning of the day, anchoring them in the experience lived, emphasizing the importance of understanding the workshop as a starting point along a road on which we are all learners and where we each need, in the words of Gandhi, to "be the change you want to see in the world."

A Word on Physical Space

The workshop included activities that created new opportunities for interaction among participants. An equally important aspect was the space in which these activities were carried out: an unstructured, disorganized space that, along with the furniture used, conveyed a clear and positive message about the nature of the activity developed throughout the day (see Figure 3).
This aspect was the first un-structuring element, because the attendees came to a workshop on technology and discovered an informal and flexible environment, which was integral to the activities taking place. It is worth noting that the level of un-structure of the space depends largely on local conditions. (For a more detailed discussion on this topic, see Leal, 2010.)

Figure 3. Examples of furniture and space.

An EduCamp requires good Internet connectivity. This is a critical aspect for the workshop because an inoperative network has negative effects on the experience of participants. It is interesting to note that the setup (about 100 laptops connected all day long) was challenging in most of the venues where the workshops took place. In this way, the workshops actually helped to test the infrastructure conditions for this kind of event around the country.

It is also important to consider the convenience of wireless versus fixed connections. Two factors are involved: mobility and reliability. Fixed connections mean less mobility but usually higher reliability. This does not mean that a wireless connection is unreliable, just that support for fixed connections for such a high number of people is a more complex demand.

Finally, music was incorporated into the environment in all workshops. Sometimes it was used as a background for activities; sometimes it was used as an indicator of changes that were part of the dynamics of the workshop. Music served to energize or relax the atmosphere.

An Experiment that Grows

The initial experiment was conducted in the cities of Bogotá and Medellín in December, 2007, including over 100 attendees in each city. In 2008, additional workshops were added, reaching seven cities: Bogotá, Monteria, Pereira, and Cartagena during the last week of November, and Bucaramanga, Medellín, and Cali during the second week of December. Although a very well-defined structure for the workshops was in place, different auditoriums and targets led to continuous experimentation to adapt the EduCamp to multiple settings.

In 2008, a group of people was coached to act as workshop facilitators. Some of these new facilitators, as well as several participants, later decided to take the experience to their own institutions, adapting it to their specific context. To date, at least 12 Colombian higher education institutions have held EduCamps in their own spaces, using their own resources, led by people who have found such great value in the experience as to attempt to replicate it. Also, workshops based on these ideas have been held in Mexico and Argentina, and there have been experiences with primary education teachers, Ministry of Education staff, and even secondary school students.

The duration of the workshops has varied, from eight hours in 2007 and 2008 to six, four, and even three hours in 2009. Clearly, this means that not all activities can be developed and that the outcomes of the experience vary accordingly. The infrastructure used through 2009 has also been diverse, with desktop computers arranged in rows or along the perimeter of a room with fixed network connections. From these experiments, it is clear that the unstructured environment has a great impact on the attendees' perception of the learning experience.

Given that hosting an EduCamp is not an easy task, its voluntary multiplication is an unexpected and happy situation. Many other participants have transferred what they learned during the experience to their personal and professional spaces, changing elements of their teaching and initiating processes to strengthen their online presence.

Since 2008, the results of the activities developed in the EduCamps have been compiled in a wiki (see http://educampcolombia.org), where it is possible to obtain information about the different tools explored in the workshop, its methodology, and the resources used. This information is published under a Creative Commons license of attribution, non-commercial use and share alike, which turns it into an open educational resource. Ning spaces have also been created, aimed at fostering discussion about methodology issues among facilitators of the workshop (see http://educampcolombia.ning.com). While these spaces are still incipient, they represent a toolbox for new people to bring this kind of experience into their own environments, representing a latent opportunity in terms of testing new configurations for the workshops.

Discussion

Analysis of the Concepts behind the Workshops

It is important to emphasize that the relation between theory and practice, in this case, began to surface *after the workshops were done*. While it is clear that there are certain theoretical bases to which the workshops respond, originally they were designed pragmatically to solve specific problems, rather than responding to the postulates of a specific theory or the indications of a given methodology.

Therefore, although it is possible to find relations to specific techniques, methods, or theories, the workshops did not intend to represent a determined theoretical position. It can be argued that there is a clear relation here with what Siemens suggests in his book *Knowing Knowledge* about the importance of *doing* (2006, p. 124; emphasis in original):

> The pragmatics of implementation is important in our society today. The days of academic theorizing no longer exist outside of implementation. The work of the **philosopher** gave way to the **scientist**. The work of the **scientist** is giving way to the **DOER.**

This means that the following account is necessarily incomplete, and perhaps the reader will be able to identify new patterns and relationships that are not covered in this analysis.

The EduCamp reflects some of the ideas on connectivism and connective knowledge proposed by George Siemens and Stephen Downes. A strong catalyst for the workshops was the ideas expressed by Stephen Downes in his article "E-Learning 2.0" (Downes, 2005), as well as the presentation made on this subject by Graham Attwell at an international seminar held in Bogotá in 2007 (Attwell, 2007). The key design element for the EduCamps, that of encouraging collaborative practices among strangers in an environment that allows them to discover that everyone can be teacher and learner at the same time, coincides with several elements of the ideas of Siemens and Downes.

Throughout the workshop there are neural connections created that reflect the external social network, for example, "I learned about this tool with this person." In this sense, the EduCamp implements some connectivist ideas, especially those related to diversity of opinion, the connection of specialized information sources, and decision-making. In fact, what Siemens calls the "epitome of connectivism" is an adequate description of the activity to which participants are exposed: the "amplification of learning, knowledge, and understanding through the extension of a personal network" (Siemens, 2004). This amplification was not restricted to knowing a set of tools; it was complemented with the exploration of their possibilities and potential problems.

In addition, the EduCamp acknowledges learning as *chaotic*, *continuous*, and *complex*, made possible by *co-creation* and *connected specialization*. Additionally, it recognizes the impossibility of having *certainty*, accepting *uncertainty* and *ambiguity* as essential and

unavoidable aspects of the process. All these elements are part of the way Siemens defines learning (2006, p. 39). Now, it is only fair to note that this is possible, in part, because the workshop is an informal space, which does not depend on evaluation or certification by an institution. It is an open question whether similar effects can be achieved in formal environments.

The strategy adopted by the workshop also reflects some characteristics of a network of connective knowledge, referred to by Downes as "semantic condition" (2006). The workshop

- depends on diversity in knowledge, expertise, and application;
- delivers a high level of autonomy to learners, who act according to their own values and decisions;
- encourages greater interactivity among a number of people (and, it could be argued, helps to expand the social network of participants, creating new bonds, taking advantage of weak ties and strengthening existing ones);
- fosters openness among participants, allowing the entry of any perspective, without disqualifying any in advance.

The role of the participants mirrors the expected role of a learner in what is proposed by Downes as a possible *network pedagogy* (Downes, 2006): They are part of an *authentic environment*, are involved in *observation and emulation* of good practices, and engage in *conversations about practice*. It is somewhat difficult to talk about the role of the facilitator, which certainly is different from that expected in a longer educational process. However, the elements of transparent work (modeling and demonstration) mentioned by Downes are visible, as is the involvement in network activity.

Nevertheless, it is worth saying that the role of the teacher is actually distributed among all the participants in the workshop. In this sense, the ideas of Cormier (2008) concerning a rhizomatic model of education can be linked as well to the EduCamps:

> In the rhizomatic model of learning, curriculum is not driven by predefined inputs from experts; it is constructed and negotiated in real time by the contributions of those engaged in the learning process. This community acts as the curriculum, spontaneously shaping, constructing, and reconstructing itself and the subject of its learning in the same way that the rhizome responds to changing environmental conditions.

As mentioned earlier, the identification of these ideas was a process subsequent to design and implementation. Arguably, the workshops resemble or reflect some of those ideas, but it is important to clarify once again that they were not included explicitly in their design.

Results and Perspectives

So far, about 1,054 people have participated in the workshops. Since 2007, different surveys have been used to collect the perceptions of participants, reaching over 620 people (about 59%), as seen in Table 1.

Table 1

Summary of Answers Included in the EduCamp Survey

	Bad	*Average*	*Acceptable*	*Good*	*Excellent*	*N/A*	*N*
1. Did the workshop meet your needs and expectations?	3	2	29	201	392	2	629
2. Did the proposed activities allow you to reach your goals?	1	3	29	228	365	3	629
3. Is there practical application for the things learned in the workshop?	2	7	44	158	207	2	420
4. How efficient were the strategies used?	2	10	64	204	344	5	629
5. Was facilitation appropriate?	0	7	33	192	386	11	629
6. Did the workshop structure/organization meet your expectations?	0	11	45	208	356	9	629
7. Was the time available enough for the activities proposed?	1	19	88	168	139	5	420

When asked whether the workshop met their needs and expectations, 62% of the respondents qualified the experience as “Excellent” and 32% as “Good.” This pattern is seen in other aspects of the survey, where an “Excellent” rating was selected in over 50% of all cases, and the combination of “Good” and “Excellent” was consistently over 85%. It is worth noting that questions 3 and 7 were not included in all the surveys.

One of the most common themes in the comments registered was related to the time available. For most participants, there was not enough time to explore all the tools. This was expected

given the number of software tools, but could also be explained by participants' pre-conceived notions regarding the learning expected in formal environments: Learn all you have to learn (in our case, that would be all the tools included in the tool sheet) in a fixed time.

The survey also included open-ended questions exploring several subjects (see Figure 4). One of them had to do with the most important thing learned in the workshop. Nearly one quarter (24%) of participants highlighted the opportunity of learning specific tools, with blogs, YouTube, and Second Life the most frequently mentioned. Also, 22% pointed out the pedagogical and learning possibilities of many of these tools, which were initially perceived as essentially social.

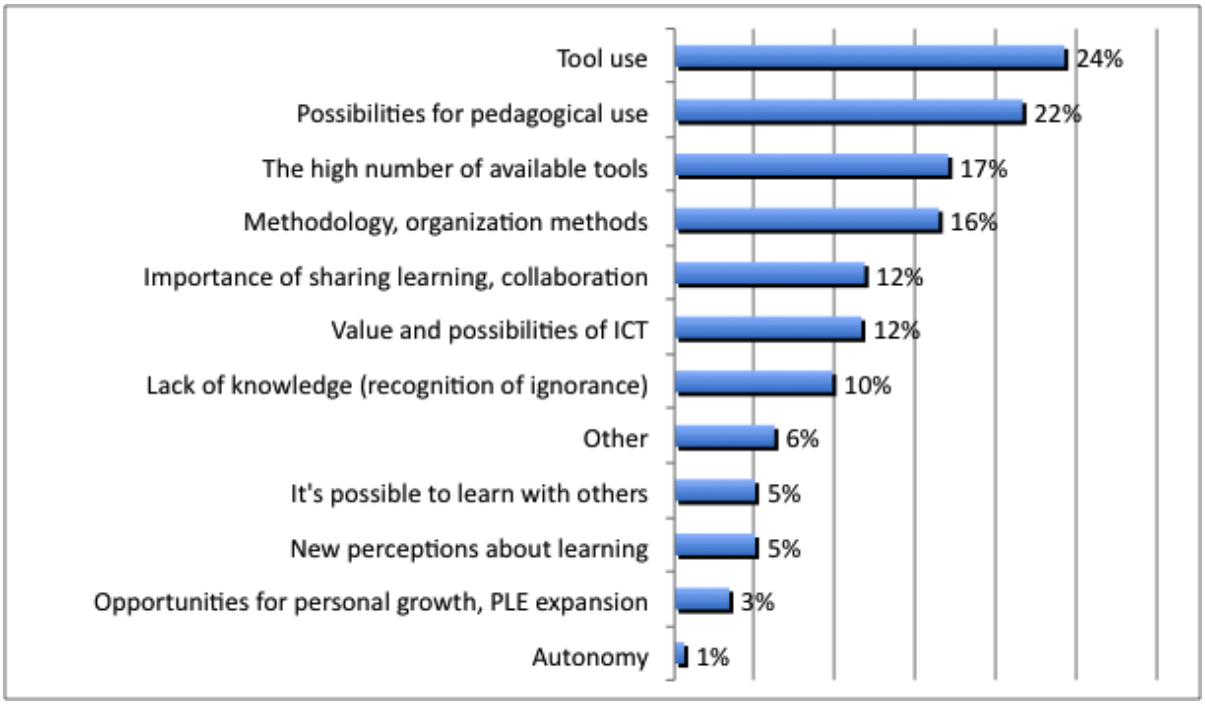

Figure 4. Answers to the question "What was the most important thing you learned in the workshop?"

On the other hand, 17% expressed their surprise at the huge number of available tools and the importance of now being aware of their existence, while 16% mentioned the methodology as the most important thing learned during the workshop, focusing on the different forms of group organization and the importance of sharing and learning with/from others.

In addition, 12% expressed a new perception of the value and possibilities of ICT in their personal lives, and only 5% mentioned new perceptions about the nature of learning and the role of the learner in a networked world.

Finally, it is worth mentioning that 10% of participants expressed recognition of how little they knew about this area and of the need to continue with the exploration and adoption of these tools.

These comments suggest that the experiment was successful not only in terms of its objectives, but that such a proposal could represent a real alternative to more traditional training programs in terms of transformation of attitudes about the role of technology in learning processes. However, it is important to point out the low number of explicit answers related to new perceptions about learning (5%) and autonomy (1%), something that is central to the design of the workshops. Even though some of the other answers can be related to these two subjects, few people recognize them directly.

One of the most interesting (yet anecdotal) comments came from the first workshops done in Medellín in 2007. This attendee said

> I have never learned so much in so little time. I thought that learning about blogs or Flickr (I didn't even know how they were used) would cost me much time and training and an impressive investment… I can't wait to get home to practise all of this…

It is important to note a few things that could bias the survey results: 160 people experienced a shorter version of the workshop, which means that they did not have enough time to develop some of the activities planned. The survey was given at the end of each workshop, so those who could not attend the session for the whole day missed the opportunity to express their opinion. Finally, there are data missing from the 2007 workshops because due to technical problems, the survey could not be given at the end of the day.

It remains to be seen whether an experience like this can actually transform practices (which should be the ultimate goal of any training program, beyond improving the discourse). Also, it is worth asking to what extent the audience perceives some of the underlying messages related to new learning and teaching perspectives.

Final Thoughts

The EduCamps have served as a testing ground for the exploration of ideas concerning the design of learning environments. The results suggest the experience has an important impact on the perception of attendees about technology and its possibilities as a learning tool, but there are questions that remain open.

One area for further research is how the connections established through the EduCamps continue to develop over time and what the impact of the experience is on the educational practices of the participants in the medium and long term. Measuring changes in the participants' daily educational practices would be the truest measure of the success of the EduCamp workshops and would confirm whether the methodology (or parts of it) can be used in formal environments.

Even though there are some online spaces available, there has not been an explicit effort to bring participants into them. There is an ongoing discussion about the desirability of a centralized

discussion/meeting area, considering that it may be secondary to the emergence of such distributed spaces as a result of an EduCamp workshop. Participants have created their own spaces on platforms such as Facebook and Ning during and after the workshops, so the experience could be aimed just to trigger these processes without attempting to centralize them in a single location. Yet, there has not been any monitoring activity to confirm whether participants keep in touch after the workshops using these spaces, and the activity in the public wiki remains very low.

It is clear that the workshops have the potential to be a trigger for the development of a community of practice around the social software platforms explored, which helps participants to sustain and enhance the connections they create during the workshop. However, this potential currently remains unrealized.

Even though the methodology has been tested with good results, there is room to explore new possibilities of application, both in face-to-face and online settings. There are also opportunities of application in subjects other than social software, including the use of mobile devices, for example.

The impact of this work goes beyond the face-to-face classroom because the design of new online learning experiences going beyond the LMS depends on teachers who have adopted some of these social software tools in their personal and professional practice. The ongoing challenge is to transcend the discourse and make it real, offering concrete examples of the potential that technology may have not only in our educational institutions, but also in our family, community, and professional environments.

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Three Generations of Distance Education Pedagogy

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Abstract

This paper defines and examines three generations of distance education pedagogy. Unlike earlier classifications of distance education based on the technology used, this analysis focuses on the pedagogy that defines the learning experiences encapsulated in the learning design. The three generations of cognitive-behaviourist, social constructivist, and connectivist pedagogy are examined, using the familiar community of inquiry model (Garrison, Anderson, & Archer, 2000) with its focus on social, cognitive, and teaching presences. Although this typology of pedagogies could also be usefully applied to campus-based education, the need for and practice of openness and explicitness in distance education content and process makes the work especially relevant to distance education designers, teachers, and developers. The article concludes that high-quality distance education exploits all three generations as determined by the learning content, context, and learning expectations.

Keywords: Distance education theory

Introduction

Distance education, like all other technical–social developments, is historically constituted in the thinking and behavioural patterns of those who developed, tested, and implemented what were once novel systems. The designs thus encapsulate a worldview (Aerts, Apostel, De Moor, Hellemans, Maex, Van Belle, & Van Der Veken, 1994) that defines its epistemological roots, development models, and technologies utilized, even as the application of this worldview evolves in new eras. In this paper, we explore distance education systems as they have evolved through three eras of educational, social, and psychological development. Each era developed distinct pedagogies, technologies, learning activities, and assessment criteria, consistent with the social worldview of the era in which they developed. We examine each of these models of distance education using the community of inquiry (COI) model (Arbaugh, 2008; Garrison, 2009; Garrison, Archer, & Anderson, 2003) with its focus on teaching, cognitive, and social presence.

Given the requirement for distance education to be technologically mediated in order to span the geographic and often temporal distance between learners, teachers, and institutions, it is common to think of development or generations of distance education in terms of the technology used to span these distances. Thus distance education theorists (Garrison, 1985; Nipper, 1989), in a somewhat technologically deterministic bent, have described and defined distance education based on the predominate technologies employed for delivery. The first generation of distance education technology was by postal correspondence. This was followed by a second generation, defined by the mass media of television, radio, and film production. Third-generation distance education (DE) introduced interactive technologies: first audio, then text, video, and then web and immersive conferencing. It is less clear what defines the so-called fourth- and even fifth-generation distance technologies except for a use of intelligent data bases (Taylor, 2001) that create "intelligent flexible learning" or that incorporate Web 2.0 or semantic web technologies. It should be noted that none of these generations has been eliminated over time; rather, the repertoire of options available to DE designers and learners has increased. Similarly, all three models of DE pedagogy described below are very much in existence today.

Many educators pride themselves on being pedagogically (as opposed to technologically) driven in their teaching and learning designs. However, as McLuhan (1964) first argued, technologies also influence and define the usage, in this case the pedagogy instantiated in the learning and instructional designs. In an attempt to define a middle ground between either technological or pedagogical determinism, we've previously written (Anderson, 2009) about the two being intertwined in a dance: the technology sets the beat and creates the music, while the pedagogy defines the moves. To some extent, our pedagogical processes may themselves be viewed as technologies (Dron & Anderson, 2009), albeit of a softer nature than the machines, software, postal systems, and so on that underpin distance education. Some technologies may embody pedagogies, thereby hardening them, and it is at that point that they, of necessity, become far more influential in a learning design, the leaders of the dance rather than the partners. For example, a learning management system that sees the world in terms of courses and content will strongly encourage pedagogies that fit that model and constrain those that lack content and do not fit a content-driven course model. The availability of technologies to support different models of learning strongly influences what kinds of model can be developed; if there were no means of two-way communication, for example, it would prevent the development of a pedagogy that exploited dialogue and conversation and encourage the development of a pedagogy that allowed the learner and the course content to be self-contained.

In this paper, we introduce a simple typology in which distance education pedagogies are mapped into three distinct generations. Since the three arose in different eras and in chronological order, we've labeled them from first to third generation, but as in generations of technology, none of these three pedagogical generations has disappeared, and we will argue that all three can and should be effectively used to address the full spectrum of learning needs and aspirations of 21st century learners.

The Cognitive-Behaviourist Pedagogy of Distance Education

Cognitive and behaviourist (CB) pedagogies focus on the way in which learning was predominantly defined, practiced, and researched in the latter half of the 20th century. Behavioural learning theory begins with notions of learning which are generally defined as new behaviours or changes in behaviours that are acquired as the result of an individual's response to stimuli. Note in this definition the focus on the individual and the necessity for measuring actual behaviours and not attitudes or capacities. Major behaviourist learning theorists include American psychologists Edward Watson, John Thordike, and B.F. Skinner. These theoretical ideas led directly to instructional designs and interventions such as the Keller Plan (Keller & Sherman, 1974), computer-assisted instruction, and instructional systems designs. For example, Gagne's (1965) events of instruction proceed through linear and structured phases, including to

1. gain learners' attention,
2. inform learner of objectives,
3. stimulate recall of previous information,
4. present stimulus material,
5. provide learner guidance,
6. elicit performance,
7. provide feedback,
8. assess performance,
9. enhance transfer opportunities.

Behaviourist notions have been especially attractive for use in training (as opposed to educational) programs as the learning outcomes associated with training are usually clearly measured and demonstrated behaviourally. From the behaviourist tradition emerged the cognitive revolution, beginning in the late 1950s (Miller, 2003). Cognitive pedagogy arose partially in response to a growing need to account for motivation, attitudes, and mental barriers that may only be partially associated or demonstrated through observable behaviours. Also important, cognitive models were based on a growing understanding of the functions and operations of the brain and especially of the ways in which computer models were used to describe and test learning and thinking. Much research using this model proceeded from empirical testing of multimedia effects, cognitive overload, redundancy, chunking, short- and long-term memory, and other mental or cognitive processes related to learning (Mayer, 2001). Although learning was still conceived of as an individual process, its study expanded from an exclusive focus on behaviour to changes in knowledge or capacity that are stored and recalled in individual memory. The tradition continues with the successful application of experimentally verified methods like spaced learning (Fields, 2005) and applications of brain science, as well as more dubious, scientifically unsound and unverifiable learning style theories (Coffield, Moseley, Hall, & Ecclestone, 2004) that achieved popularity towards the end of the twentieth century and that still hold sway in many quarters today. The locus of control in a CB model is very much the teacher or instructional designer. Such theories provide models of learning that are directly generative of models of teaching.

It is notable that such models gained a foothold in distance education at a time when there were limited technologies available that allowed many-to-many communication. Teleconferencing was perhaps the most successful means available but came with associated costs and complexity that limited its usefulness. The postal service and publication or redistribution of messages was very slow, expensive, and limited in scope for interactivity. Methods that relied on one-to-many and one-to-one communication were really the only sensible options because of the constraints of the surrounding technologies.

Cognitive Presence in Cognitive-Behaviourist Models

Cognitive presence is the means and context through which learners construct and confirm new knowledge. In cognitive–behaviourist models of learning, cognitive presence is created through structured processes in which learners' interest is stimulated, informed by both general and specific cases of overriding principles and then tested and reinforced for the acquisition of this knowledge. CB models of distance education pedagogy stress the importance of using an instructional systems design model where the learning objectives are clearly identified and stated and exist apart from the learner and the context of study. Later developments in cognitive theory have attempted to design learning materials in ways that maximized brain efficiency and effectiveness by attending to the types, ordering, timing, and nature of learning stimulations.

Social Presence in Cognitive-Behaviourist Models

What most defined the cognitive-behavioural generation of distance education was an almost total absence of social presence. Learning was thought of as an individual process, and thus it made little difference if one was reading a book, watching a movie, or interacting with a computer-assisted learning program by oneself or in the company of other learners. This focus on individualized learning resulted in very high levels of student freedom (space and pace) and fitted nicely with technologies of print packages, mass media (radio and television), and postal-correspondence interaction. It is also interesting to note the backlash against distance education that arose amongst traditional campus-based academics, partially in reaction to this individualized affordance. This suspicion continues today (Garrison, 2009), though 30 years of research has yet to show differences in learning outcomes between learning designs with high or low levels of social presence, that is if one confines the definition of learning to the CB notions of acquisition of pre-specified facts and concepts.

Teaching Presence in Cognitive-Behaviourist Models

Teaching presence in CB models was also reduced or at least radically reconstructed in many forms of CB distance education. In its earliest instantiation as correspondence education, the teacher had only their words on printed text to convey their presence. Holmberg (1989) described a style of writing that he called guided didactic interaction which, through personalization and a conversational writing style, was supposed to transmit the personality and caring concern of the teacher or author. Later technologies allowed voice (audio) and body language of the teacher

(video) to be transmitted through television, film, and multimedia-based educational productions. Despite the general absence of the teacher in these CB pedagogies, one cannot discount the teaching presence that potentially could be developed through one-to-one written correspondence, telephone conversation, or occasional face-to-face interaction between teacher and student, as amply demonstrated in the movie and play versions of *Educating Rita*. Despite this potential, the teaching-presence role is confused in that the learning package that instantiates CB pedagogical models is supposed to be self-contained and complete, requiring only teacher–learner interaction for marking and evaluation. No doubt some distance education students using this model do experience high levels of teaching presence, but for many, teaching presence is only mediated through text and recorded sound and images. This reduction of the role and importance of the teacher further fueled resentment by traditional educators against the CB model of distance education and gave rise to the necessity of creating single-mode institutions which could develop educational models free from the constraint of older models of classroom-based and teacher-dominated education.

Strengths and Weaknesses of Cognitive-Behaviourist Models

To summarize, CB models defined the first generation of individualized distance education. They maximized access and student freedom, and were capable of scaling to very large numbers at significantly lower costs than traditional education, as demonstrated by the successful mega-universities (Daniel, 1996). However, these advantages were accompanied by the very significant reductions in teaching, social presence, and formal models of cognitive presence, reductions that have come under serious challenge since the latter decades of the 20th century. While appropriate when learning objectives are very clear, CB models avoid dealing with the full richness and complexity of humans learning to be, as opposed to learning to do (Vaill, 1996). People are not blank slates but begin with models and knowledge of the world and learn and exist in a social context of great intricacy and depth.

Social-Constructivist Pedagogy of Distance Education

While there is a tradition of cognitive-constructivist thinking that hinges on personal construction of knowledge, largely developed by Piaget and his followers (Piaget, 1970), the roots of the constructivist model most commonly applied today spring from the work of Vygotsky and Dewey, generally lumped together in the broad category of social constructivism. Social-constructivist pedagogies, perhaps not coincidently, developed in conjunction with the development of two-way communication technologies. At this time, rather than transmitting information, technology became widely used to create opportunities for both synchronous and asynchronous interactions between and among students and teachers. Michael Moore's famous theory of transactional distance (1989) noted the capacity for flexible interaction to substitute for structure in distance education development and delivery models. A number of researchers noted the challenges of getting the mix of potential interactions right (Anderson, 2003; Daniel & Marquis, 1988). Social-constructivist pedagogy acknowledges the social nature of knowledge and of its creation in the minds of individual learners. Teachers do not merely transmit knowledge to

be passively consumed by learners; rather, each learner constructs means by which new knowledge is both created and integrated with existing knowledge. Although there are many types of social constructivism (see Kanuka & Anderson, 1999), all the models have more or less common themes, including the importance of

- new knowledge as building upon the foundation of previous learning,
- context in shaping learners' knowledge development,
- learning as an active rather than passive process,
- language and other social tools in constructing knowledge,
- metacognition and evaluation as a means to develop learners' capacity to assess their own learning,
- learning environment as learner-centred and stressing the importance of multiple perspectives,
- knowledge needing to be subject to social discussion, validation, and application in real world contexts (from Honebein, 1996; Jonassen, 1991; Kanuka & Anderson, 1999).

The need for social construction and representation, for multiple perspectives, and for awareness that knowledge is socially validated demanded the capacity for distance education to be a social activity as well as the development of cohort, as opposed to individual study, organizational models of instruction. As Greenhow, Robelia, and Hughes (2009) and others have argued, learning is located in contexts and relationships rather than merely in the minds of individuals.

The locus of control in a social-constructivist system shifts somewhat away from the teacher, who becomes more of a guide than an instructor, but who assumes the critical role of shaping the learning activities and designing the structure in which those activities occur. Social-constructivist theories are theories of learning that are less easily translated into theories of teaching than their CB forebears.

It is notable that social-constructivist models only began to gain a foothold in distance education when the technologies of many-to-many communication became widely available, enabled first by email and bulletin boards, and later through the World Wide Web and mobile technologies. While such models had been waiting in the wings for distance education since Dewey or earlier, their widespread use and adoption was dependent on the widespread availability of workable supporting technologies.

Cognitive Presence in Social-Constructivist Pedagogy

Constructivists emphasize the importance of knowledge having individual meaning. Thus, cognitive presence is located in as authentic a context as possible, which resonates with distance education, much of which takes place in the workplace and other real-world contexts outside of formal classrooms. Cognitive presence also assumes that learners are actively engaged, and interaction with peers is perhaps the most cost-effective way to support cognitive presence (not requiring the high costs of simulations, computer-assisted learning programming, or media production). Cognitive presence, for constructivists, also exploits the human capacity for role

modeling (Bandura, 1977), imitation (Warnick, 2008), and dialogic inquiry (Wegerif, 2007). Thus, Garrison (1997) and others could argue that constructivist-based learning with rich student-student and student-teacher interaction constituted a new, "post-industrialist era" of distance education. However, this focus on human interactions placed limits on accessibility and produced more costly models of distance education (Annand, 1999). It remains challenging to apply learning where it can blossom into application and thus demonstrate true understanding.

Social Presence in Social-Constructivist Pedagogy

Social interaction is a defining feature of constructivist pedagogies. At a distance, this interaction is always mediated, but nonetheless, it is considered to be a critical component of quality distance education (Garrison, 1997). Much research has been undertaken to prove that quality interaction and subsequent social presence can be supported in both synchronous and asynchronous models of distance education. More recent developments in immersive technologies, such as Second Life, allow gestures, costumes, voice intonation, and other forms of body language that may provide enhancements to social presence beyond those experienced face-to-face (McKerlich & Anderson, 2007). It is likely, as learners become more acclimatized and skilled in using ever-present mobile communications and embedded technologies, that barriers associated with a lack of social presence will be further reduced, allowing constructivist models to thrive.

Teaching Presence in Social-Constructivist Pedagogy

Kanuka and Anderson (1999) argued that in constructivist modes of distance education, "the educator is a guide, helper, and partner where the content is secondary to the learning process; the source of knowledge lies primarily in experiences." Given this critical role, one can see the importance of teaching presence within constructivist models. Teaching presence extends beyond facilitation of learning to choosing and constructing educational interventions and to providing direct instruction when required. The requirements for high levels of teaching presence make the scaling of constructivist distance education models problematic (Annand, 1999), with few classes ever expanding beyond the 30–40 student cohort. Assessment in constructivist models is much more complicated than in behaviourist models, as David Jonassen (1991) has argued: "Evaluating how learners go about constructing knowledge is more important from a constructivist viewpoint than the resulting product" (p. 141). Thus, teaching presence in constructivist pedagogical models focuses on guiding and evaluating authentic tasks performed in realistic contexts.

Strengths and Weaknesses of Constructivist Models

Constructivist distance education pedagogies moved distance learning beyond the narrow type of knowledge transmission that could be encapsulated easily in media through to the use of synchronous and asynchronous, human communications-based learning. Thus, Garrison and others argue that the rich student-student and student-teacher interaction could be viewed as a "post-industrialist era" of distance education. However, Annand views the focus on human interaction as placing limits on accessibility and producing more costly models of distance

education. Ironically, constructivist models of distance education began to share many of the affordances and liabilities of campus-based education, with potential for teacher domination, passive lecture delivery, and restrictions on geographic and temporal access.

Connectivist Pedagogy of Distance Education

The third generation of distance-education pedagogy emerged recently and is known as connectivism. Canadians George Siemens (Siemens, 2005a, 2005b, 2007) and Stephen Downes (2007) have written defining connectivist papers, arguing that learning is the process of building networks of information, contacts, and resources that are applied to real problems. Connectivism was developed in the information age of a networked era (Castells, 1996) and assumes ubiquitous access to networked technologies. Connectivist learning focuses on building and maintaining networked connections that are current and flexible enough to be applied to existing and emergent problems. Connectivism also assumes that information is plentiful and that the learner's role is not to memorize or even understand everything, but to have the capacity to find and apply knowledge when and where it is needed. Connectivism assumes that much mental processing and problem solving can and should be off-loaded to machines, leading to Siemens' (2005) contentious claim that "learning may reside in non-human appliance." Thus, connectivism places itself within the context of actor-network theory with its identification of the indiscriminate and overlapping boundaries between physical objects, social conventions, and hybrid instantiations of both, as defined by their initial and evolved application in real life (Latour, 1993).

It is noteworthy that connectivist models explicitly rely on the ubiquity of networked connections between people, digital artifacts, and content, which would have been inconceivable as forms of distance learning were the World Wide Web not available to mediate the process. Thus, as we have seen in the case of the earlier generations of distance learning, technology has played a major role in determining the potential pedagogies that may be employed.

Cognitive Presence in Connectivist Pedagogy

Connectivist cognitive presence begins with the assumption that learners have access to powerful networks and, as importantly, are literate and confident enough to exploit these networks in completing learning tasks. Thus, the first task of connectivist education involves exposing students to networks and providing opportunities for them to gain a sense of self-efficacy in networked-based cognitive skills and the process of developing their own net presence. Connectivist learning happens best in network contexts, as opposed to individual or group contexts (Dron & Anderson, 2007). In network contexts, members participate as they define real learning needs, filter these for relevance, and contribute in order to hone their knowledge creation and retrieval skills. In the process, they develop networks of their own and increase their developing social capital (Davies, 2003; Phillips, 2002). The artifacts of connectivist learning are usually open, accessible, and persistent. Thus, distance education interaction moves beyond individual consultations with faculty (CB pedagogy) and beyond the group interactions and constraints of the learning management systems associated with constructivist distance-education pedagogy. Cognitive presence is enriched by peripheral and emergent interactions on networks,

in which alumni, practicing professionals, and other teachers are able to observe, comment upon, and contribute to connectivist learning.

Connectivist learning is based as much upon production as consumption of educational content. Thus, tools and skills of production (or *produsage*, as Bruns [2008] refers to the means of production when producers are also users of the resources). The results of this produsage are archives, learning objects, discussion transcripts, and resources produced by learners in the process of documenting and demonstrating their learning. These dialogic encounters become the content that learners and teachers utilize and collaboratively create and recreate. Connectivist cognitive presence is enhanced by the focus on reflection and distribution of these reflections in blogs, twitter posts, and multimedia webcasts.

Social Presence in Connectivist Pedagogy

Connectivist pedagogy stresses the development of social presence and social capital through the creation and sustenance of networks of current and past learners and of those with knowledge relevant to the learning goals. Unlike group learning, in which social presence is often created by expectation and marking for participation in activities confined to institutional time frames, social presence on networks tends to be busy as topics rise and fall in interest. The activities of learners are reflected in their contributions to wikis, Twitter, threaded conferences, Voicethreads, and other network tools. Further, social presence is retained and promoted through the comments, contributions, and insights of students who have previously engaged in the course and that persist as augmentable archives to enrich network interactions for current students. Connectivist learning is also enhanced by the stigmergic knowledge of others and the signs that they leave as they navigate through learning activities. The activities, choices, and artifacts left by previous users are mined through network analytics and presented as guideposts and paths to knowledge that new users can follow (Dron, 2006). In this way, the combination of traces of people's actions and activities generate an emergent collective, which may be seen as a distinctive individual in itself, both greater and lesser than the sum of its parts: it is a socially constituted entity that is, despite this, soulless, a reflection of the group mind that influences but does not engage in dialogue (Dron & Anderson, 2009).

Teaching Presence in Connectivist Pedagogy

As in constructivist learning, teaching presence is created by the building of learning paths and by design and support of interactions, such that learners make connections with existing and new knowledge resources. Unlike earlier pedagogies, the teacher is not solely responsible for defining, generating, or assigning content. Rather, learners and teacher collaborate to create the content of study, and in the process re-create that content for future use by others. Assessment in connectivist pedagogy combines self-reflection with teacher assessment of the contributions to the current and future courses. These contributions may be reflections, critical comments, learning objects and resources, and other digital artifacts of knowledge creation, dissemination, and problem solving. Teaching presence in connectivist learning environments also focuses on teaching by example. The teachers' construction of learning artifacts, critical contributions to

class and external discussion, capacity to make connections across discipline and context boundaries, and the sum of their net presence serve to model connectivist presence and learning. A final stress to teaching presence is the challenge presented by rapidly changing technologies. No one is current on all learning and communications applications, but teachers are often less competent and have less self-efficacy; thus, connectivist learning includes learners teaching teachers and each other, in conjunction with teachers aiding the connectivist learning of all.

Strengths and Weaknesses of Connectivist Approaches

Learning in connectivist space is, paradoxically, plagued by a lack of connection. CB models provide a strong structure to learning that makes explicit the path to be taken to knowledge. When done well, a cognitivist or behaviourist approach helps the learner to take a guided path towards a specific goal. Constructivist models still place an emphasis on scaffolding, albeit in a manner that is more conducive to meeting individual needs and contexts. What they lose in structure, they make up for in dialogue, with social-constructivist approaches (especially the Vygotsky-influenced variety), relying heavily on negotiation and mediation to help the learner from one state of knowledge to the next. In connectivist space, structure is unevenly distributed and often emergent, with that emergence seldom leading to structure that is optimally efficient for achieving learning goals.

Connectivist approaches used in a formal course setting, where top-down structure is imposed over the bottom-up emergent connections of the network, often rely heavily on foci that are typically provided by charismatic and popular network leaders. For example, David Wiley's paradigmatic Open Edu 2008 (http://opencontent.org/wiki/index.php?title=Intro_Open_Ed_Syllabus) and the highly acclaimed and emblematic CCK08 provided by George Siemens and Stephen Downes (Downes, 2008) were both notably run by network leaders with many followers. This is not a coincidence: Such people occupy highly connected nodes in their networks and can encourage a sufficiently large population to engage so that there is continued activity even when the vast majority does not engage regularly. Even then, learners often yearn for a more controlled environment (Mackness, Mak, & Wiliams, 2010). When scaled down and superimposed over a formal teaching pattern, connectivist approaches require a great deal of energy on the part of the central connector to actively maintain the network, and it is a common complaint that students at least start by feeling lost and confused in a connectivist setting (Dron & Anderson, 2009; Hall, 2008). This is only partly due to difficulties in learning multiple technologies and navigating cyberspace, although this aspect can be an important issue (McLoughlin & Lee, 2008). The distributed nature and inherent fuzziness of goals, beginnings, and endings implied by a connectivist approach often fit poorly with a context in which students are taking more formal and traditional courses that use a constructivist and or a cognitive-behaviourist model. Furthermore, as Kop and Hill (2008) observe, not all learners have sufficient autonomy in a given area to be able or willing to exercise the control needed in such an environment. Cognitive-behaviourist models are most notably theories of teaching and social–constructivist models are more notably theories of learning, but both still translate well into methods and processes for teaching. Connectivist models are more

distinctly theories of knowledge, which makes them hard to translate into ways to learn and harder still to translate into ways to teach. Indeed, the notion of a *teacher* is almost foreign to the connectivist worldview, except perhaps as a role model and fellow node (perhaps one more heavily weighted or connected) in a network.

While a great many speculative and theoretical papers have been written on the potential of connectivism, most reports of experience so far are equivocal and, to cater to diverse learner needs, there is a clear need for a richer means of establishing both networked and personal learning environments that offer control when needed in both pedagogical and organizational terms. The crowd can be a source of wisdom (Surowiecki, 2005) but can equally be a source of stupidity (Carr, 2010), with processes like preferential attachment that are as capable of leading to the Matthew Principle (where the rich get richer and the poor get poorer) and rampant bandwagon effects as to enabling effective, connected learning.

Future Generations of Distance Education Pedagogy?

We have seen how different models of teaching and learning have evolved when the technological affordances and climate were right for them. Cognitive-behaviourist pedagogical models arose in a technological environment that constrained communication to the pre-Web, one-to-one, and one-to-many modes; social-constructivism flourished in a Web 1.0, many-to-many technological context; and connectivism is at least partially a product of a networked, Web 2.0 world. It is tempting to speculate what the next generation will bring. Some see Web 3.0 as being the semantic Web, while others include mobility, augmented reality, and location awareness in the mix (Hendler, 2009). All of these are likely to be important but may not be sufficient to bring about a paradigmatic change of the sorts we have seen in earlier generations of networked systems because the nature and mode of communication, though more refined, will not change much with these emerging technologies. We see a different paradigm emerging. As concerns about privacy mount and we come to adopt a more nuanced approach to connections and trust, our networks are bound to become more variegated and specialized. It is already becoming clear that connectivist approaches must become more intelligent in enabling people to connect to and discover sources of knowledge. Part of that intelligence will come from data-mining and analytics, but part will come from the crowd itself.

Another notable trend is towards more object-based, contextual, or activity-based models of learning. It is not so much a question of building and sustaining networks as of finding the appropriate sets of things and people and activities. CloudWorks, a product of the OU-UK, is an example of this new trend, in which objects of discourse are more important than, or at least distinct from, the networks that enable them (Galley, Conole, Dalziel, & Ghiglione, 2010). When we post a message to a public space like CloudWorks, a blog, or a microblog (e.g., Twitter), much of the time the post is not addressed or customized to a network of known entities but to an unknown set of people who we hope will be interested in what we have to say, typically defined through tags, profile fields, or hashtags. The next step in this cycle would seem to be, logically, to enable those sets to talk back to us: to find us, guide us, and influence our learning journeys. This represents a new and different form of communication, one in which the crowd, composed of

multiple intelligences, behaves as an intentional single entity. Such set-driven computing is already perhaps one of the most common ways that learning is supported online: The PageRank algorithm behind a Google search works in exactly this way, taking multiple intelligent choices and combining them to provide ranked search results (Brin & Page, 2000). Wikipedia, though partially a farmed process, includes many crowd-based or collective elements to help others guide our learning. Amazon recommends books for us, using complex, collaborative filtering algorithms that use the crowd as their raw materials. In each case, it is not individuals, groups, or networks that help us to learn but a faceless intelligence that is partly made of human actions, partly of a machine's.

We and others have described these entities in the past as *collectives* (Segaran, 2007). Despite the ubiquity of such systems, what still remains unclear is how best to exploit them in learning. However, it seems at least possible that the next generation of distance education pedagogy will be enabled by technologies that make effective use of collectives.

Conclusion

Distance education has evolved through many technologies and at least three generations of pedagogy, as described in this paper. No single generation has provided all the answers, and each has built on foundations provided by its predecessors rather than replacing the earlier prototype (Ireland, 2007). To a large extent, the generations have evolved in tandem with the technologies that enable them: As new affordances open out, it becomes possible to explore and capitalize on different aspects of the learning process. For each mode of engagement, different types of knowledge, learning, and contexts must be applied and demand that distance educators and students be skilled and informed to select the best mix(es) of both pedagogy and technology. Although the prime actors in all three generations remain the same—teacher, student, and content—the development of relationships among these three increases from the critical role of student–student interaction in constructivism to the student–content interrelationship celebrated in connectivist pedagogies, with their focus on persistent networks and user-generated content. The popular community-of-inquiry model, with its focus on building and sustaining cognitive, social, and teaching presence, can be a useful heuristic in selecting appropriate pedagogies. Table 1 below summarizes these features and provides an overview and examples of both similarities and differences among them.

Table 1

Summary of Distance Education Pedagogies

Generation of distance education pedagogy	**Technology**	**Learning activities**	**Learner granularity**	**Content granularity**	**Evaluation**	**Teacher role**	**Scalability**
Cognitive–behaviourism	Mass media: Print, TV, radio, one-to-one communication	Read and watch	Individual	Fine: scripted and designed from the ground up	Recall	Content creator, sage on the stage	High
Constructivism	Conferencing (audio, video, and Web), many-to-many communication	Discuss, create, construct	Group	Medium: scaffolded and arranged, teacher-guided	Synthesize: essays	Discussion leader, guide on the side	Low
Connectivism	Web 2.0: Social networks, aggregation & recommender systems	Explore, connect, create, and evaluate	Network	Coarse: mainly at object and person level, self-created	Artifact creation	Critical friend, co-traveler	Medium

We conclude by arguing that all three current and future generations of DE pedagogy have an important place in a well-rounded educational experience. Connectivism is built on an assumption of a constructivist model of learning, with the learner at the centre, connecting and constructing knowledge in a context that includes not only external networks and groups but also his or her own histories and predilections. At a small scale, both constructivist and connectivist approaches almost always rely to a greater or lesser degree on the availability of the stuff of learning, much of which (at least, that which is successful in helping people to learn) is designed and organized on CB models. The Web sites, books, tutorial materials, videos, and so on, from which a learner may learn, all work more or less effectively according to how well they enable the learner to gain knowledge. Even when learning relies on entirely social interactions, the various parties involved may communicate knowledge more or less effectively. It is clear that whether the learner is at the centre or part of a learning community or learning network, learning effectiveness can be greatly enhanced by applying, at a detailed level, an understanding of how people can learn more effectively: Cognitivist, behaviourist, constructivist, and connectivist theories each play an important role.

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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 &

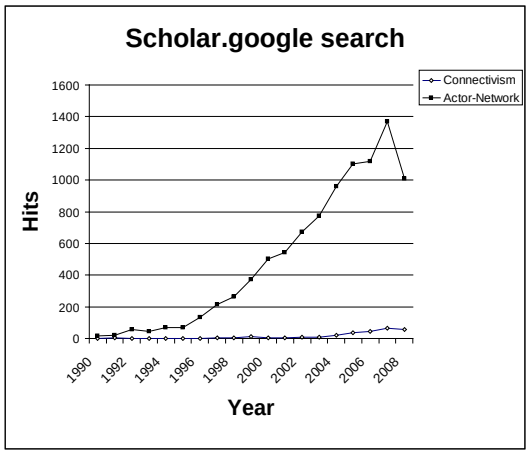

*Figure 3***.** Search of Google Scholar for connectivism and actor-network theory.

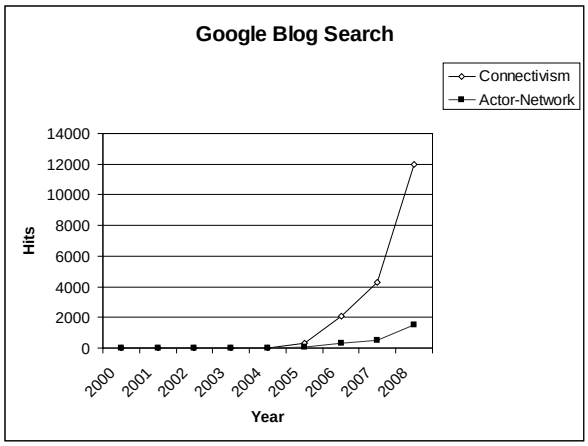

Figure 4. Google Blog Search for connectivism and actor-network theory.

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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Frameworks for Understanding the Nature of Interactions, Networking, and Community in a Social Networking Site for Academic Practice

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Abstract

This paper describes a new social networking site, Cloudworks, which has been developed to enable discussion and sharing of learning and teaching ideas/designs and to promote reflective academic practice. The site aims to foster new forms of social and participatory practices (peer critiquing, sharing, user-generated content, aggregation, and personalisation) within an educational context. One of the key challenges in the development of the site has been to understand the user interactions and the changing patterns of user behaviour as it evolves. The paper explores the extent to which four frameworks that have been used in researching networked learning contexts can provide insights into the patterns of user behaviour that we see in Cloudworks. The paper considers this within the current debate about the new types of interactions, networking, and community being observed as users adapt to and appropriate new technologies.

Keywords: Cloudworks; social networking; Web 2.0; social and participatory web practices; frameworks; connectivism; actor-network theory; activity theory; communities of practice; communities of inquiry; design based research

Introduction

Research into the use of technologies and in particular networked technologies is now well established (Andrews & Haythornthwaite, 2007; Conole & Oliver, 2007). Niche research sub-domains have emerged, such as networked learning, computer-supported collaborative learning (CSCL), e-learning, and technology-enhanced learning (TEL), each with its own particular focus, underlying principles, and preferred methodologies (such as case studies, evaluations, ethnography, quasi-experimental studies, discourse analysis, and social network analysis). See Conole (2010c) for a more detailed discussion of theory and methodology in the field. In a recent

series of interviews, broad notions of socio-cultural theoretical perspectives and in particular activity theory, actor-network theory, and design-based research seemed to be commonly cited points of reference for TEL researchers (Conole, Scanlon, Mundin, & Farrow, 2010). In addition, a range of popular frameworks and models have been used, such as Laurillard's conversational framework (Laurillard, 2002), Salmon's e-moderating framework (Salmon, 2000), Garrison et al.'s community of inquiry framework (Garrison, Anderson, & Archer, 2000), and Wenger's community of practice framework (Wenger, 1998). Collectively, research in the field, and in particular the application of these frameworks, has given us insights into the nature of interactions within these online spaces and some indication of barriers and success factors. However, the emergence of new forms of social and participatory technologies, sometimes referred to as Web 2.0 practices, has given rise to new challenges in terms of understanding the nature of user behaviour in these spaces. Specifically, what is the nature of interactions, networking, and community in these spaces?

It has been five years since publication of the key paper by O'Reilly (2005) that coined the phrase *Web 2.0*. Since then the breadth and variety of Web 2.0 tools have expanded rapidly (see Conole & Alevizou, 2010 for a recent review of Web 2.0 tools and practices). There are now many examples of different ways in which Web 2.0 tools are used, and there are empirical accounts of user behaviour and interactions. Perhaps a more descriptive term for these tools is *social and participatory technologies*, as this indicates more clearly the affordances these technologies provide. At the same time, a number of new theoretical and methodological insights have emerged, including new ideas/conceptualisations around the nature of learning in these spaces, most notably connectivism (Siemens, 2005a) and broader notions of networked learning (Steeples & Jones, 2002). However, it is evident that there is no clear understanding of exactly what these user behaviours and interactions are. This paper will attempt to provide a critique of these issues through the lens of an evaluation case study on the use of a new social networking site for learning and teaching, Cloudworks. It will consider in particular descriptions of user behaviour and interaction, including notions of interaction, connectivity, networking, and community.

Co-Evolution of Tools and Practices

Before considering some of the frameworks that have been used to describe and make sense of interactions in online environments, it is worth first discussing in general terms the nature of tool-user interaction.

Tools and users are not static. Of course technologies are continually developed and upgraded, but more importantly users adapt and change their behaviour and interaction with tools over time, as they a) gain more proficiency using the tools, b) begin to appropriate and personalise use, and c) see new ways in which the tool can replace previous patterns of behaviour. Think, for example, of the way tools such as word processors, email, and mobile phones have become more ingrained in everyday practice since their original introduction. This shift is both at an individual and an organisational level. For example, Internet use for finding and disseminating information is now ubiquitous across education, email has replaced memo communication, and secretaries no longer

laboriously type up handwritten letters (Conole, White, & Oliver, 2007). Gibson defines *affordances* as "All 'action possibilities' latent in an environment… but always in relation to the actor and therefore dependent on their capabilities" (Gibson, 1979). In considering the nature of user interaction with tools, this definition is useful.

Salomon describes Gibson's concept of affordances this way: "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" (Salomon, 1993, p. 51).

Simplistically, a tall tree has an affordance of food for a giraffe but not for a sheep; two parallel strips of wood with connecting rungs construe a ladder when against a wall or a fence when horizontal. Application of this concept to a technological context is useful because it describes the inter-connection between tools and users. As Pea et al. (cited in Borgeman et al., 2008) argue, there is a co-evolution of tools and users over time; interactions and patterns of user behaviour are not static. This co-evolution depends on both the inherent affordances of the tools and the characteristics of the users (i.e., their skills base, personal preferences and beliefs, and the context and culture within which they are interacting with the technologies). While this has always been the case, arguably the pace of change/co-evolution has increased dramatically in recent years, particularly around use of Web 2.0 tools. There has been a shift from a static-content Web to one that is more interactive; peer critiquing, user-generated content, sharing, personalisation, adaptation, and remixing are the kinds of user behaviours that characterise these new tools.

Frameworks for Describing Networked Learning

Understanding existing and evolving user behaviour in such online environments and being able to trace the co-evolution described above is a key challenge in networked learning research. Numerous frameworks and models have been developed and used in networked learning, both as guidance in the development of learning systems and as frameworks to structure the nature and form of analysis for understanding patterns of behaviour in networked learning contexts. These frameworks and models are valuable as they provide a specific lens on practices, which enables us to view them and understand them in a particular way. For example, some foreground communicative aspects of practice, and others aim to describe the context within which practices occur. There are too many to describe in detail here; instead, a selection of four is considered to give a representative overview of the breadth and types that have been used. The four frameworks are as follows: communities of inquiry (Garrison, 2009; Garrison, Anderson, & Archer, 2001); communities of practice (Wenger, 1998); activity theory (see for example Daniels, Cole, & Wertsch, 2007; Engeström, Punamäki-Gitai, & Miettinen, 1999); and actor-network theory (Latour, 1997). These were chosen because they provide distinct and different lenses on existing practices. Conole (2010b) provides a more detailed review, and describes twenty frameworks and models commonly used in networked learning, mapping these against the classification of learning theories derived by Mayes and De Freitas (i.e., where theories are grouped according to whether they are fundamentally associative, cognitive/constructivist, or situative) (Mayes & De Freitas, 2004).

After briefly describing the four frameworks and how they have been used in networked learning contexts, we will explore to what extent they are useful in describing patterns of user behaviour and interaction in a new form of social networking site, Cloudworks, which has been developed to promote sharing and discussing of learning and teaching ideas and in particular to support reflective practice. It is worth stating at this point that a broad definition of *learning* and *learners* has been used, covering learning across formal, non-formal, and informal contexts, and including learners in professional practice contexts. In particular, the Cloudworks site was primarily developed to support scholarly reflection and academic practice, and therefore sits within an informal learning context with professionals as learners.

Before describing the frameworks it is important to give some notion of the types of interaction with others that occur in modern online environments. Certainly within a formal educational context, much of the reported research into the use of the Web in the 1980s and 1990s centred on fairly well-defined groups, such as cohorts of learners. The research focus tended to be around analysing their use of tools, such as email and forums, in predominately *closed* settings (Hiltz & Goldman, 2005; Mason & Kaye, 1989). Social and participatory tools and their associated *open* practices enable learners to connect and interact with a broader audience beyond their class cohort, which has resulted in a blurring of the boundaries between formal and informal learning, moving beyond groups to more loosely connected actors. Researching these new environments raises new methodological challenges as the approaches used to describe relatively closed contexts often do not scale and are restricted by the inherent constraints of tightly defined contexts.

Dron and Anderson (2007) argue that in addition to groups in learning contexts, interactions in new social mediating tools lead to a network and a collective category (i.e., collectives) with a progressively looser connectivity across the three. Therefore *groups* are defined as relatively tightly formed with shared interests and intentions; *networks* are a more fluid form of social entity in which members join, create, and remove themselves through informal and semiformal connections; and *collectives* consist of individuals whose networked activities are harvested to generate the "wisdom of crowds" (Surowiecki, 2004). Dron and Anderson argue that most individuals use a mixture of all three in their practice, and the affordances of different tools may lend themselves better to use in a group, network, or collective context. Their categorisation provides a useful set of guidelines and strategies for how to use tools most effectively to suit the needs of the three different types of learning contexts.

The four frameworks chosen for discussion were all developed before the emergence of recent social and participatory tools; nonetheless, it is interesting to see to what extent they are applicable in terms of describing the rich mix of interactions and interplay of the groups, networks, and collectives Dron and Anderson describe. Each is briefly described then the next section considers to what extent they can be applied to describing patterns of user interaction in the Cloudworks site.

Communities of Inquiry

Originating out of CSCL research, and in particular analysis of online discussion forums, the community of inquiry (CoI) model developed by Garrison et al. (2000) has been used extensively. The model focuses on a community of inquiry consisting of teachers and students. Learning occurs within the community when three key prerequisites are sustained: cognitive presence, teaching presence, and social presence. This framework is often used as a basis to derive coding templates for analysis of online discussions, used to develop student evaluations of learning contexts (Arbaugh et al., 2008) and is particularly powerful when triangulated with methods such as critical recall and social network analysis (De Laat, 2006; De Laat et al. 2006).

Communities of Practice

Although originating from a different research context (social anthropology and the analysis of work-based community practices), Wenger's communities of practice (CoP) framework (1998) has also been extensively applied to understand networked learning and it shares a number of similarities to the CoI model. It is very much an example of a socially situated theory of learning where learning is seen as social participation and consists of four aspects: learning as community, learning as identity, learning as meaning, and learning as practice. Wenger's theory is valuable in that it considers the ways in which communities of practice are formed and developed; notions of trajectories of belonging, legitimate participation, and boundary objects/crossings have provided useful lenses to describe many interactions observed in online spaces. However, it does not lend itself as easily to direct codification or participant assessment as the CoI framework does; rather, it provides a generic, descriptive approach for contextualising community formation and identity.

Activity Theory

Firmly derived from socio-cultural perspectives, activity theory (AT) provides a descriptive framework for considering online interactions (see for example Daniels, Cole, & Wertsch, 2007; Engeström, Punamäki-Gitai, & Miettinen, 1999). The central premise is that activities occur in a context and that this context needs to be taken into account if we are to make meaning of the situation and appropriately interpret the results. One of the most common ways of representing activity theory is as a triangle diagram, showing a subject-object nexus of mediating artefacts (MAs) intended to achieve an outcome; around this are rules and regulations, divisions of labour, and community. Both the broader contextualisation that AT enables and the foregrounding of mediating artefacts are useful in terms of understanding interactions in online environments (see Conole, 2008, for a description of the use of mediating artefacts in learning design). Enablers and constraints can be identified by focusing on questions such as what environment is the activity occurring in, how is this influencing it, who is involved, and what are their roles? In addition, the focus on mediating artefacts helps to identify and crystallise the role of the tools in the process.

Actor-Network Theory

Latour (1997) argues that instead of thinking in terms of surfaces or dimensions, actor-network theory (ANT) focuses on nodes and connections. The central concept is the notion of an evolving, dynamic *actor-network*. A second key aspect of ANT is that it combines the basic properties of a network with *actors* (or *actants*) who do some work; these actors include both human and non-human entities. "Actors and networks are mutually constitutive, meaning that there is no actor without action; that is, relationship with other actors, and the network is built on the mutual influences and intermediaries that actors exchange between each other" (Esnault, 2007).

The inclusion of non-human actants is one of the attractions of using ANT in a networked learning context as it enables researchers to foreground technological mediating artefacts and to describe their interactions with other actants within the networked context. ANT is also useful because of its focus on networks and connections instead of on physical distances, which arguably is a more appropriate metaphor to apply to technological communication and interaction environments.

Indicators of Online Interaction

The examples described above give an indication of some of the different approaches that have been used to study and understand networking learning contexts. Of course each emphasises different aspects of the network: CoI focuses on individuals and types of presence; CoP focuses on the group or community; AT foregrounds the context within which the event occurs; and ANT emphasises connectivity and privileges of both human and non-human actants within the network.

The next section describes an example of a social networking site, Cloudworks, and describes in particular the approach we have taken to the design and evaluation of the site. A major focus of our research is on analysing and understanding evolving user behaviour and interactions in the site. The paper will conclude by considering the extent to which the four frameworks described above can be used to shed light on interactions in Cloudworks.

The Cloudworks Case Study

An Overview of Cloudworks

Cloudworks is a social networking site to support the sharing and discussing of learning and teaching ideas and designs (see http://cloudworks.ac.uk). The site combines social and participatory functionalities and enables multiple forms of communication, collaboration, and cross-boundary interactions among different communities of users. The core object in the site is a

cloud, which can be aggregated into community spaces called *cloudscapes*. A cloud can be anything to do with learning and teaching (e.g., a description of a learning/teaching practice, an outline about a particular tool or resource, a discussion point).

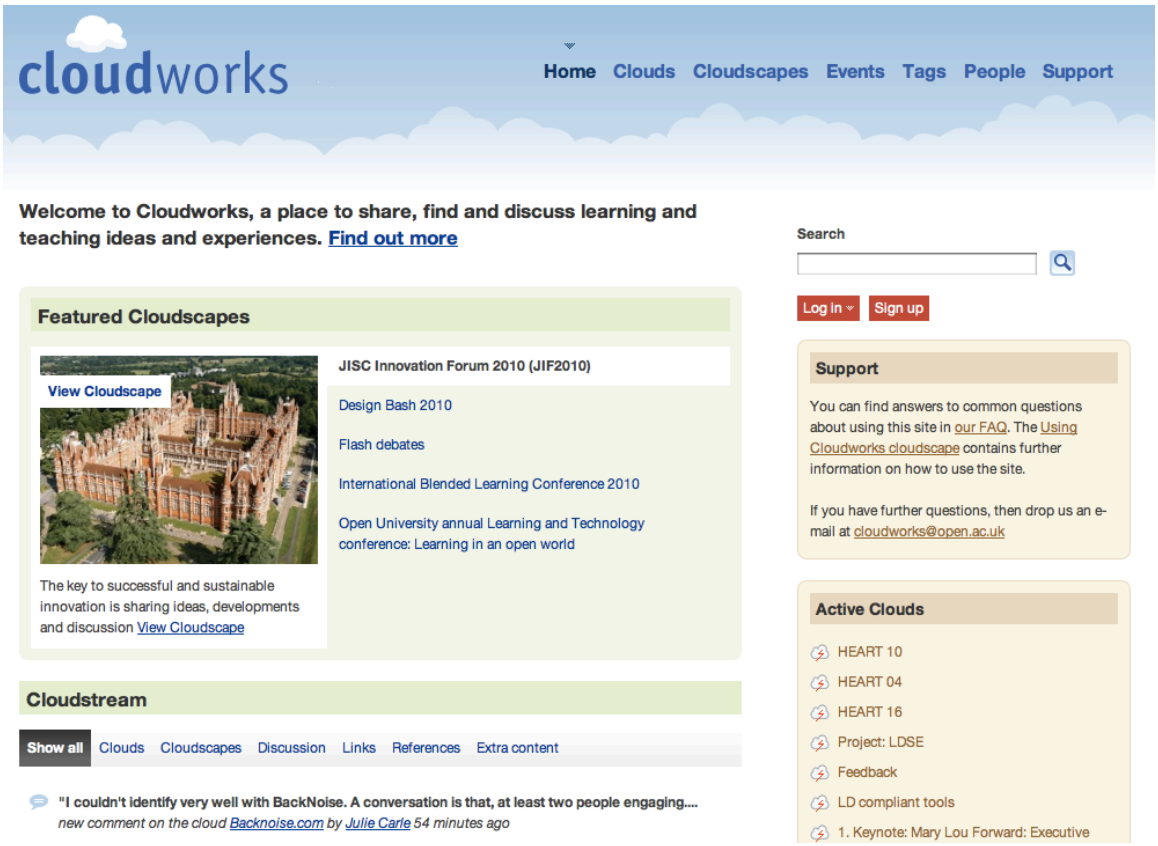

Figure 1. Screenshot of the Cloudworks homepage, July 2010.

Clouds combine a number of features of social and participatory technologies. Firstly, they act like multiuser blogs: Links and resources can be added to a cloud, which appear as series of sequential entries under the first contribution. Secondly, they are like discussion forums as users can post comments that appear sequentially. Thirdly, they are similar to social bookmarking sites, enabling the aggregation of resources (both links and academic references can be added). Finally, they have a range of other functionalities common to networking sites, such as tagging, favouriting, RSS feeds, Twitter-like follow-and-be-followed options, and activity streams for different aspects of the site. Cloudscapes are aggregations of clouds, and clouds can belong to more than one cloudscape. Collectively these features provide a range of routes through the site and enable users to collectively improve clouds in a number of ways. The homepage of the site, in addition to providing standard navigation routes (such as browsing of clouds, cloudscapes, people, and searching), shows recent activities, currently active clouds, and featured cloudscapes.

Methodology

We have adopted a design-based research (DBR) approach to the design and evaluation of the site. Design-based research has emerged in recent years as an approach for studying learning in context through systematic design and study of instructional strategies and tools (Barab, 2006; Design-Based Research Collective, 2003). It is used to study learning in environments that have been designed and systematically changed through interventions by the researcher and practitioners (Barab, 2006). Wang and Hannafin (2005, pp. 5-6) define DBR as "a systematic, but flexible methodology aimed to improve educational practice through iterative analysis design, development and implementation, based on collaboration between researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories."

Reigeluth and An (2009, pp. 378-379) articulate a comprehensive set of characteristics of DBR that readily map to the approach we are taking with Cloudworks: It is driven by theory and prior research, which is pragmatic, collaborative, contextual, integrative, interactive, adaptive/flexible, linked to actual practice, and generalisable (Conole, 2010a). We subscribe to the notion of co-evolution of tools and practices discussed earlier, and hence within our DBR approach we have adopted a socio-technical co-evolution approach (Figure 2) with two parallel strands of intervention, one technical and one social. Alongside this we have put in place a rich virtual ethnographic approach to evaluation of the use of the site and identification of emerging user behaviours.

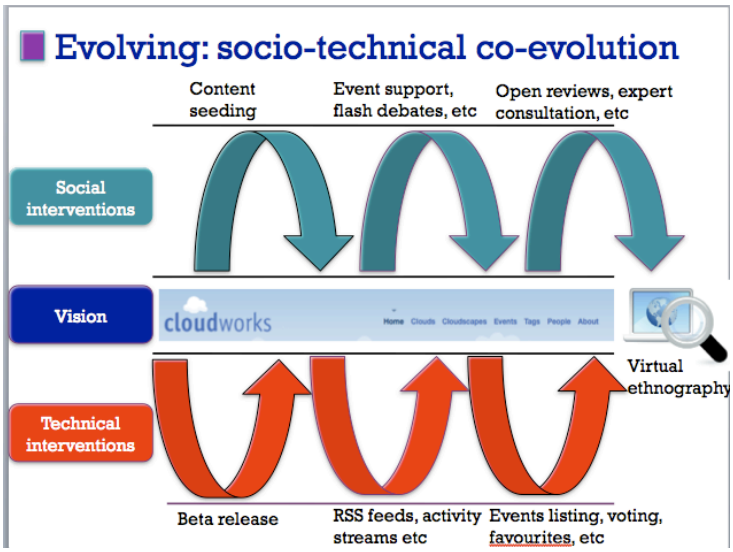

Figure 2. The approach to development and evaluation of Cloudworks.

Evaluation

Use and development of the site is being monitored in a number of ways (see Conole & Culver, 2010, for a description of the first few phases of design and evaluation of the site). Data

collection has included Web stats and Google analytics, analysis of site activities and discussions, collation of references to Cloudworks elsewhere (such as in the blogosphere and on Twitter), and use and evaluation of the site at numerous workshops and conferences. A Cloudworks evaluation and feedback questionnaire is also available online (see http://cloudworks.ac.uk/cloud/view/1906). This multifaceted evaluation strategy has gathered data that has then been used to inform ongoing design activities, thus ensuring an alignment between evolving technical developments and user needs. The data, and particularly the user feedback, has given us a rich understanding of how the site has evolved and how it is being used. At key points we have commissioned an expert review of the site and have to date undergone three site redesigns, commissioning an expert external designer.

A range of standard statistics is gathered routinely, along with an administrative cloudstream, which, in addition to listing activities on the site chronologically (in the way that the main site cloudstream does), documents when new users register with the site (the site is open, but users need to register if they wish to post anything or create clouds or cloudscapes) and when users choose to follow others. We will also be capturing the following on a biannual basis: the number of users who have posted clouds, the number of users who have posted comments, and the number of unique users posting a cloud or comment in the last 60 days. To measure sustainability and longevity of contribution, we are also capturing the following: the number of registered users who post a cloud or comment at least one month after registration (this way we don't count the initial use of the site for, say, a conference or workshop) and the number of registered users who post a cloud or comment at least one year after registration. Table 1 provides a summary of some of the cumulative quantitative figures for the site in mid-July 2010. By distinguishing between team and non-team contributions we are able to get a measure of the impact of our social interventions described above and the extent to which the site is moving toward being self-sustaining. The team consists of the authors of this paper and an additional researcher. They are all e-learning researchers with a range of both pedagogical and technical expertise.

Table 1

Statistics, Mid-July 2010

Aspect	**Everyone**	**Team**	**Non-team**
Cloudscapes	338	111	227
Clouds	2897	1260	1637
Comments	4065	1103	2962
Links	3733	1770	1963

The site is also linked to Google analytics, which shows the growth of the site since its launch in July 2009. As is evident with other social and participatory sites, the number of active contributors to the site (currently 2,935 registered) is less than the number of unique visitors

(87,325 visits from 167 countries). The top five countries are the UK, the United States, Canada, Australia, and Italy. From the monthly statistics we can see both a steady growth in the number of users signing up and in the number of unique visitors. In addition, from the contributions made, we can see that there is a growing number of users who are regular contributors both in terms of their activities and their reflections on the value of Cloudworks for their practice (see for example some of the comments in Table 2).

Classifying and Understanding Patterns of User Behaviour

We have used a mix of theoretical perspectives for the design of the site and the analysis of the way in which it is being used. Conole and Culver (2009) describe the theoretical perspectives that informed the initial design of the site, and Alevizou et al. (2010) describe recent work drawing on broader theoretical frameworks in order to understand emerging patterns of behaviour. In particular, Engestrom's notion of social objects (Engeström, 2005) has formed the basis for the design of Cloudworks around clouds as social objects. Similarly, Bouman et al.'s framework for sociality (Bouman et al., 2007) has provided a useful approach to the design and development of the site, based on developing environments that both mimic existing user behaviour and provide opportunities to expand and shift to new patterns of behaviour. We have undertaken a number of qualitative studies of the use of the site, including explorations of how the site is being used by a particular community or theme and through a series of interviews with users. Galley has developed a community of indicators framework as a mechanism for analysing interactions on the site and we have begun exploring how this might be used for analysing evaluation case studies of the site (Galley, Conole, Dalziel, & Ghiglione, 2010).

Applying a broad range of theoretical perspectives is proving necessary because of the unique structure/functionality of Cloudworks and the way in which we are seeing emergent patterns of user behaviour on the site. For example, one of the distinctive features of Cloudworks (in comparison to other social networking sites) is the way it enables and facilitates not only connections within communities but among them. It facilitates boundary crossings among communities, enabling different stakeholders (policy makers, researchers, teachers, learners, etc.) to interact in unanticipated ways. It has a genuine global reach with different kinds of stakeholders. The affordance of clouds, arising from their general layout/functionality (i.e., the initial cloud entry plus collective additional entries, embedded content, links, and references, coupled with a social space for discussion), seems to promote new and interesting forms of social interaction. A core principle of the site is that it is totally open; anyone can see anything in the site. This ensures that the site harnesses the best of social and participatory practices and affordances. Serendipity has been built into the site in a variety of ways, which enables individuals to cross community boundaries and to make unexpected connections. The site offers powerful mechanisms for supporting social networks in a range of ways and at different levels.

To date we have identified eight ways in which the site is being used.

1. **Events**. Use of Cloudworks for conferences, workshops, and seminars was one of the first patterns of user behaviour to emerge on the site. The site provides a new type of mediation space to support interactions and communications before, during, and after events. The discussion space associated with clouds provides a forum for users to discuss issues and to collectively liveblog. The ability to add links, references, and embedded content fosters collective intelligence (Lévy, 1997) and crowdsourcing (Howe, 2006). Because events have become such a dominant pattern of behaviour on the site, we now provide a dynamic list of events (http://cloudworks.ac.uk/events/events_list), and to date 47 events are listed as forthcoming (up to December 2010) and 85 cloudscapes have been labelled as past events.
2. **Debates**. A number of cloudscapes have now been established as discussion spaces, for example, the flash debate cloudscape (see http://cloudworks.ac.uk/cloudscape/view/1896), which includes a range of topical issues such as Citizendium versus Wikipedia, Has Twitter already peaked?, and What will the university of tomorrow look like? Recently we have also been exploring how the site can be used to facilitate timed discussions, see for example Spotlight on OER (see http://cloudworks.ac.uk/cloudscape/view/2105).
3. **Open reviews**. Cloudworks provides a good environment for support of open reviews (i.e., as a space to aggregating and discussing research literature reviews). Examples include a review of the use of Web 2.0 tools in HE (see http://cloudworks.ac.uk/cloudscape/view/1895) and a review of pedagogical models (see http://cloudworks.ac.uk/index.php/cloudscape/view/2009). Research questions can be set up as clouds and used as a basis for discussion and aggregation of resources. Drafts of the evolving review can also be posted for comment.
4. **Resource aggregation**. Cloudscapes have also been established that act as aggregators around particular topics or resources. Examples include the Horizon report cloudscape (see http://cloudworks.ac.uk/1957), the online research tools cloudscape (see http://cloudworks.ac.uk/cloudscape/view/2046), and the learning design toolbox (see http://cloudworks.ac.uk/index.php/cloudscape/view/18.82). Currently, a course team at the Open University is beginning to explore how Cloudworks might be used by learners as a means of aggregating course-related resources and sharing professional practices.
5. **Courses**. The site is also being used to support student activities. For example, students on the Masters in Open and Distance Education course at the OU have been exploring the site by taking part in a cloudquest challenge (see http://cloudworks.ac.uk/index.php/cloud/view/2699), contributing H800 flash debates (see http://cloudworks.ac.uk/index.php/cloudscape/view/1937) and using the site to find relevant resources for particular teaching contexts (see http://cloudworks.ac.uk/index.php/cloudscape/view/2057).
6. **Reading circles**. A relatively new type of cloudscape to appear on the site is the reading cloudscape. For example, the 800-strong community of researchers interested in exploring students' use of technologies has set up a space to aggregate and discuss

relevant readings from the field (see http://cloudworks.ac.uk/index.php/cloudscape/view/1968).

7. **Learning design**. Part of the original aspiration for the development of the site was to act as a channel for fostering more debate of design practices. A number of cloudscapes have been established that focus on learning and teaching issues around a particular course. These include spaces for those involved in designing courses (see for example http://cloudworks.ac.uk/index.php/cloudscape/view/1919) as well as those who have a tutoring role in delivering courses (see http://cloudworks.ac.uk/index.php/cloud/view/3342).
8. **Expert elicitation and consultation**. Finally, Cloudworks works well as a space to elicit expert views on a topic or to validate and discuss research outputs. One example is a literature review and expert elicitation around the role of educational technologists (see http://cloudworks.ac.uk/cloudscape/view/1872). Currently, a major consultation process around open educational resources and their associated practices is about to be launched, following the gathering and analysis of a set of international OER case studies (see http://cloudworks.ac.uk/cloudscape/view/2085) and articulation of a set of associated open educational practice dimensions (see http://cloudworks.ac.uk/cloudscape/view/2086).

Discussion

Having provided an overview of the statistics for the site and the categories of user behaviour, in this section we will attempt to map where and to what extent the frameworks described earlier for understanding interactions, networks, and communities in online spaces are evident from the Cloudworks evaluation data.

Table 2 provides examples of where each of the frameworks maps to activities in Cloudworks. This demonstrates the benefits of each framework in terms of providing a particular lens with which to describe what is happening. However, none of these frameworks on its own is adequate to describe the full range of user behaviour and interactions we see within the site.

Table 2

Application of the Four Frameworks to Patterns of User Behaviour in Cloudworks

Framework	**Characteristics**	**Application**	**Examples**
Communities of inquiry	Social, teaching, and cognitive presence Coding schemes can be derived from these then applied to online discourses.	Application of CoI is particularly relevant for cloudscapes that support events or teaching-related sessions, or cloudscapes where individuals are seeking advice.	**Social:** "Love the Wordle thanks for that!" *http://cloudworks.ac.uk/cloud/view/2597* **Teaching:** "As a former student enrolled in H807 and H809 courses, I can understand your early feelings here in Cloudworks. No doubt that moving from a defined group in a VLE to a network of practitioners in Cloudworks requires some time and adaptability." *http://cloudworks.ac.uk/cloud/view/2700* "This course is offered at certificate level through Distance and Flexible Learning (DFL)." *http://cloudworks.ac.uk/cloud/view/3855* **Cognitive:** Debate between two users about learners *http://cloudworks.ac.uk/cloud/view/4152* "This has been an interesting and valuable exercise. I intend to share this with my course writer." *http://cloudworks.ac.uk/cloud/view/3859*

Communities of practice	Learning as community, identity, meaning, and practice	Relevant for cloudscapes associated with an established group or community Evidence of evolving trajectories across communities and legitimate participation Explanation of boundary crossing	Cross-fertilisation of ideas from design thinking research domain to learning design: "It is an interesting idea to apply the notion of design thinking to the area of sharing and developing learning designs." *http://cloudworks.ac.uk/cloud/view/2606* Special interest group on mobile learning at the OU *http://cloudworks.ac.uk/cloudscape/view/1889* Series of sessions for OU staff interested in technology – IET technology coffee mornings *http://cloudworks.ac.uk/cloudscape/view/2107*
Activity theory	Subject-object mediated by mediating artefacts to achieve an outcome in the context of rules, regulations, community, and division of labour	Useful to provide a rich, descriptive, contextually located account of a set of interactions and user behaviour	OU Annual Learning and Teaching Conference **Subject:** Participants involved in the conference **Object:** The conference **Outcome:** Delegates participating in a two-day virtual conference held in Cloudworks with live sessions in Eluminate **Mediating artefacts:** Cloudworks, Eluminate, Twitter **Roles:** conference organisers, session facilitators, live bloggers, Eluminate presenters, Cloudworks contributors, and conference attendees **Rules:** two-day event, real and virtual, guidelines for interactions **Community:** OU staff and broader community interested in using technology in education **Division of labour:** organisers, presenters, delegates *http://cloudworks.ac.uk/cloudscape/view/2012*

Actor-network theory	Actor-network of nodes and connections made up of both human and non-human actants	Enables the focus to be on the connectivity across and beyond the site, showing how Cloudworks is part of the wider social networking ecology	Is Twitter killing blogging? This cloud demonstrates how Cloudworks can complement and work in synergy with other social networking tools. In this instance, a tweet started in Twitter was picked up in Cloudworks, which then sparked a detailed debate (49 comments) and set of crowdsourcing activities (20 links and 6 references). In turn, this prompted users to post further reflections on their own blog spaces. *http://cloudworks.ac.uk/cloud/view/2266*

In terms of Dron and Anderson's classifications, there is evidence of all three types in Cloudworks, although the majority of interactions are either networks or collectives, as group activities are already relatively well provided for by existing tools, it could be argued. Nonetheless, some of the learner cohorts and workshop cloudscapes could be classified as groups or at least straddle the network/collective categories. The many types of events show patterns of behaviour associated with both networks and collectives. This can be attributed in part to the fact that the structure of clouds is designed to promote both discussion and collective aggregation.

Conclusion

This paper has addressed a number of themes. Firstly, it describes an innovative new social networking site, Cloudworks, which has been designed to support discussion and sharing of learning and teaching ideas. Cloudworks provides a good example of emergent technologies, and it provides a good opportunity for exploring some of the methodological issues that arise in the use and understanding of new social mediating spaces. Secondly, the paper describes how we have adopted a design-based research approach to the design and evaluation of the site. Finally, the paper explores how a range of frameworks for understanding networked learning might be applied to understanding Cloudworks.

The paper considers one of the key challenges in researching new learning contexts through socially mediated environments, namely articulation and understanding of the nature of the interactions among users within these environments and between the users and the tools that form part of the environment. Four frameworks have been described and discussed in terms of the light they shed on patterns of user behaviour in one social networking site for academic practice, Cloudworks. The paper has demonstrated that these frameworks are indeed useful but only offer a partial solution. None of the frameworks provides a comprehensive holistic description. We plan to continue to explore different theoretical perspectives and frameworks in order to try to find an approach that provides this more holistic solution. As described earlier, Galley has developed a set of community indicators, which we are currently using to analyse some case study data on the site. We are also interested in exploring to what extent the notions of connectivism developed by

Siemens (Siemens, 2005b) and later critiqued by Downes (Downes, 2007) might be useful. In particular we are interested in exploring how the eight principles of connectivism (Siemens, 2005b) might be used both as a foundation for developing an analytic framework for understanding online interactions and as good practice principles. Crucial is the notion that connectivism emphasises the fact that knowledge is distributed and that learning is the process of growing/pruning those networks and connections in a dynamic and evolving way over time. We believe sites like Cloudworks can facilitate this process and provide learners with new connections and access to a distributed intelligence.

Certainly it is possible to see synergies with the four frameworks described in this paper; for example, two of the principles (1 and 5) related to the nature of interactions among users online mirror aspects of CoI, CoP, and Dron and Anderson's categories. However, perhaps not surprisingly, connectivism seems to have a particularly strong synergy with ANT (2, 3, 4, 5, 6, 7).

However, it is worth reiterating that one of the main problems with social networking sites is achieving critical mass: building a substantive user base that is self-sustaining over time. This paper has discussed the ways in which we have fostered various social interventions on the site in an attempt to do this. Comparisons of the contributions by team members and non-team members over time shows evidence of an ongoing shift toward non-team member contributions, which is encouraging; however, much of the site activity clusters around specific events, such as conferences and workshops. A challenge in the coming year will be to grow the number of core contributors and attempt to foster other types of activities, such as the flash debates, open reviews, and reading circles. We anticipate needing to remain active as a core team but hope that a growing body of Cloudworks champions will emerge as users see the benefits of the site and begin to use it in their daily practices.

In conclusion, focusing on Cloudworks as a case study in relation to existing and potential frameworks has provided a vehicle for considering some of the issues around understanding online interactions. What is evident is that as yet we do not have either the right metrics or an overarching framework to adequately describe the patterns of user behaviour we are seeing in today's online environments. The distinctive feature of these new environments in comparison to previous technologies is the importance and influence of the network in shaping user interactions and activities. Hence, further work is needed to explore how ideas like ANT, connectivism, and other recent theoretical perspectives on networking might be used to develop a more unifying and practical framework for describing and understanding these online spaces.

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Dialogue and Connectivism: A New Approach to Understanding and Promoting Dialogue-Rich Networked Learning

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Abstract

Connectivism offers a theory of learning for the digital age that is usually understood as contrasting with traditional behaviourist, cognitivist, and constructivist approaches. This article will provide an original and significant development of this theory through arguing and demonstrating how it can benefit from social constructivist perspectives and a focus on dialogue. Similarly, I argue that we need to ask whether networked social media is, essentially, a *new landscape for dialogue* and therefore should be conceived and investigated based on this premise, through considering dialogue as the primary means to develop and exploit connections for learning. A key lever in this argument is the increasingly important requirement for greater criticality on the Internet in relation to our assessment and development of connections with people and resources. The open, participative, and social Web actually requires a greater emphasis on higher order cognitive and social competencies that are realised predominantly through dialogue and discourse. Or, as Siemens (2005) implies in his call to rethink the fundamental precepts of learning, we need to shift our focus to promoting core evaluative skills for flexible learning that will, for example, allow us to actuate the knowledge we need at the point that we need it. A corollary of this is the need to reorient educational experiences to ensure that we develop in our learners the ability "to think, reason, and analyse." In considering how we can achieve these aims this article will review the principles of connectivism from a dialogue perspective; propose some social constructivist approaches based on *dialectic* and *dialogic* dimensions of dialogue, which can act as levers in realising connectivist learning dialogue; demonstrate how dialogue games can link the discussed theories to the design and performance of networked dialogue processes; and consider the broader implications of this work for designing and delivering sociotechnical learning.

Keywords: Theory; dialogue; design; networked learning; pedagogy; dialogue games; computer mediated communication

Introduction: Connectivism and Learning in the Digital Age

The relatively recent theoretical accounts of connectivism (Siemens, 2005, 2006) and connective knowledge (Downes, 2006) as ways to understand and explore learning in the networked digital age are timely and particularly useful, both in what they offer and what they question. These positions are not without their critics, Verhagen (2006) for example, but what is particularly exciting and important about them is that they have started a serious discourse, and hopefully discipline-wide reflection, about *what learning is in the digital age*, the inescapable and unavoidable role of networked technologies as mediating artifacts for learning, and how we should design and support learning for the digitally literate learner in the networked landscape. These approaches foreground the role of network technologies, the connections within these networks, and how these influence an evolving and relative perspective on knowledge. Interestingly, until now, these emphases have not considered the role of dialogue. However, dialogue is the primary mechanism for maintaining connections and developing knowledge through them. This suggests a pivotal role for *dialogue interaction* in meaning making and learning within networks and similar open enterprises, such as personal learning environments (Attwell, 2007) or the Web in general. In reflecting upon this state of affairs this article addresses the following question: Is networked social media ostensibly a new and profound *dialogue landscape* and therefore should it be investigated in these terms? In certain ways I extend some initial thoughts, justifications, and directions that have been proposed by Siemens (2005, 2006) and Downes (2006), but take these a step further through a deliberate focus on digital dialogue as a lens through which we can better understand connectivism and design future networked learning that embraces its potentials.

Siemens (2005) states the following principles of connectivism, which are also currently available through Siemens' writings in Wikipedia.

1. Learning and knowledge rest in diversity of opinions.
2. Learning is a process of connecting specialised nodes or information sources.
3. Learning may reside in non-human appliances.
4. Capacity to know more is more critical than what is currently known.
5. Nurturing and maintaining connections is needed to facilitate continual learning.
6. Ability to see connections between fields, ideas, and concepts is a core skill.
7. Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.
8. 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.

Below, we consider these from a digital dialogue perspective that in some ways is in harmony with Downes' (2006) position that

> These trends combine to form what is sometimes called "e-learning 2.0" – an approach to learning that is based on conversation and interaction, on sharing, creation and participation, on learning not as a separate activity, but rather, as embedded in meaningful activity such as games and workflows. (p. 1)

But, in accepting this emphasis on "conversation and interaction," I argue that we need to drill down a level deeper as these are very wide-ranging and somewhat diffuse concepts. I hold that for learning we also need to ask the following: What sort of dialogue features, forms, or genres are implicated in the realisation of these principles and therefore will support networked learning?

Are New Dialogues the Most Prominent Feature of a Networked Social Media Landscape?

If we consider the operationalisation of these connectivist principles from a dialogue perspective we find that they frequently implicate ongoing evaluative processes as having prominence over prestructured and content-centric features of dialogue. So, for example, processes such as critical inquiry, reflection, and negotiation are considered more important than informing about or acquiring static knowledge. Specifically, referring to the particular principles, referred to in brackets where appropriate in the following sections, we can say the following. Diverse opinions (1) will be typically expressed through discourses and clarified, contested, and refined through critical dialogue. The connection of specialised and contextualised information sources (2) will involve the assessment of discourses, reflections about them, and recognition of meaning and value. The principle that "Learning may reside in non-human appliances" (3) seems to play out in two ways from a dialogue perspective, although the word "reside" perhaps needs additional qualification. Firstly, some types of intelligent applications, such as those that include machine learning, user modeling, or semantic techniques, typically learn, or colearn, with humans. Other technologies that don't necessarily learn themselves but are explicitly designed to promote learning in humans, such as intelligent tutors and learning simulations or games, can be said to have the capacity for learning within them. To realise a capacity to know more (4) will benefit from reflective and inquiry dialogue to maintain and evolve a community of inquiry and function critically within these spaces. Similarly, nurturing and maintaining connections (5) with people can correspond to opening up and maintaining what Wegerif (2007) calls "dialogic spaces" that emphasise "the interanimation of real voices" within learning relationships. These may then support learning through dialectical and *knowledge-building* dialogues of the type proposed by Scardamalia and Bereiter (2003). "Seeing connections" (6) is likely to involve dialogue processes such as reflection, clarification, and negotiation. And currency (7) will be realised through maintaining up-to-date and responsive dialogues, and we will often decide what to learn (8) through processes such as clarifying, reflective engagement, and negotiation.

I will now elaborate further on this dialogue lens based on some of the central precepts of connectivism that aren't explicitly stated in these principles but have been emphasised elsewhere by Siemens (2005, 2006). Thinking in networks will usually mean thinking through collaborative dialogue. Most meaningful learning and active engagement will be realised and maintained by similarly meaningful dialogue processes. We will often perform sense making through continuous discourses that coconstruct and negotiate meaning. Language and dialogue are the key underpinnings of social behaviour and learning. It is virtually impossible to imagine social processes that are divorced from dialogue processes. Also, the notion that sociality is constantly created and recreated maps to the emergence and evolution of dialogic spaces that support the development of relationships and the coordination of joint activities. Along these lines it is important to remember that our networked social behaviour did not begin with social media, but is instead coevolving with these technologies, which arguably provide social opportunities that are more open, and are used more often, than was previously possible with the traditional methods of communication, dialogue, and discourse.

Summarising, the operationalisation of these principles of connectivism seems closely interwoven with ways to characterise the richness of the evolving dialogue processes linked to new digital technologies and practices. Three related questions in this respect, which are the platform for the original contribution of this article, are

1. How can we *better understand the dialogue processes* that are implicated by connectivist learning in a networked world?
2. What are the *dialogue features* of quality connections for networked learning?
3. How do we, through *design*, promote and catalyse the development and operation of quality connections?

In addressing these questions it is also useful to consider that although the form and means of realisation of learning dialogue are changing through the increased prevalence of highly participative and discourse-intensive social software, or Web 2.0 technologies, some underpinning pragmatic level, or deep and social, discourse processes are arguably more stable and still at play. For example, we will always use dialogue, as our most intuitive semiotic system, to articulate and express what we think, share our thoughts and ideas with others, and collaboratively create meaning and understanding to make joint inquiries or to solve common problems. We may be performing these practices in more immediate, participative, or multimodal ways, but the deep psycho-social imperatives are more impervious to change and will benefit from a deeper understanding of social constructivist ideas that emphasise the primacy of dialogue in learning. In showing this I will explore and extend a recent way to characterise and understand digital learning dialogue that was proposed by Ravenscroft, Wegerif, and Hartley (2007), based on exploring Vygotskian *dialectic* and Bahktinian *dialogic* ideas, before considering how these can be incorporated within a dialogue-rich and connectivist approach to learning and its design.

Elaborating the Dialogue Perspective: Social Constructivist Theoretical Levers

The following section considers a Vygotskian and dialectic account of learning dialogue, followed by a Bahktinian and dialogic account, before synthesising both within the frame of contemporary contexts for connectivist learning. This section restates and extends the previous work that was reported in Ravenscroft, Wegerif, and Hartley (2007) and Ravenscroft, Sagar, Baur, and Oriogun (2009).

This theoretical exploration is interesting because at an initial level of analysis social constructivism and connectivism are quite different. The former foregrounds the psychology of human development from a sociocultural perspective that includes interpersonal processes that lead to the development of higher mental processes. One primary way in which this is engineered is through setting up and participating in a zone of proximal development (ZPD) that connects a learner with a more learned other (Vygotsky, 1978). It also highlights the primacy of language and dialogue within this process, where the *internalization* of external dialogue processes leading to the formation of internal psychic tools that support reasoning, reflection, and the development of higher mental processes is central. And, not surprisingly, given that this theory was developed in the early twentieth century, there is no consideration of how dialogue-rich information technology influences this process. But this is precisely where there is a harmonious join because connectivism, with its deliberate focus on the here-and-now reality of how digital networks support new forms of connections, social relations, and dialogue, provides a sociotechnical frame or set of creative constraints within which contemporary social constructivist activities occur. The sections below elaborate on this through further refining social constructivism into dialectic and dialogic before showing how these processes can be structured by connectivist constraints within networked learning contexts through dialogue games that are mediated by a tool called InterLoc (Ravenscroft, McAlister, & Sagar, in press).

Dialectic, Learning, and Connectivism

In considering dialectic dialogue processes, Ravenscroft, Wegerif, and Hartley (2007) argued the following:

> The dialectic that was used by Socrates (470–399 BC) during what has become known as “the Socratic method” is one of the earliest recorded educational approaches. This has remained an inspiration to contemporary approaches to learning, such as computer-based *tutorial learning* proposed by Bork (2001), that he offers as the most important learning model for the twenty-first century. The essence of the method is that through careful questioning by the teacher, students can come to realize the truth of a situation without being told it directly. For Socrates argument and learning was embedded in these real dialogues.

> Hegel (1770–1831) turned dialectic into a more abstract notion of a dynamic logic proceeding from thesis to antithesis and then synthesis. Hegel's (1975) approach rested on a coherence theory of truth, where the truth relies not on a single proposition but a whole system of propositions, and only within this complete system can contradictions be recognised and falsity removed. Similarly, the process of synthesis preserves the rational and removes the irrational but then also provides another thesis that can become the subject of the same triadic process, and so on. So for Hegel, although "The true is the whole", this is an evolving whole that develops through contradiction. (p. 40)

Through applying Hegel's dialectic Marx argued that culture and consciousness arise as tools in the dialectic interaction between humans and nature. Vygotsky took this as a model of how an individual consciousness is formed through the internalisation of tools. So Vygotsky's (1978) theory of the development of higher mental processes can remain a foundation and inspiration for approaches to networked technology enhanced learning (hereafter TEL) that emphasise collaborative, argumentative, and reflective discourses, along the lines that have been emphasised by Mercer (2000), Ravenscroft (2000, 2004) and Wertsch (1991).

This dialectic position maps to connectivism in a number of significant and related ways that are given below where essentially these mappings concur with how to deal with a new "provisionality" associated with twenty-first-century knowledge practices. In adding to these accounts above, we now also need to take full account of the mediational power offered by new and evolving digital tools, which is another anchor in connectivist thinking.

The mappings are mostly related to the *energetic process* and *form* of dialogue. Firstly, dialectic is a suitable process for refining knowledge and realising learning from a diversity of opinions (1), and similarly, supporting the capacity to always know more (4). Secondly, implicit in dialectic processes is the ability to foreground and emphasise new connections (6) through the consideration of new or alternative positions and viewpoints of others. Thirdly, the way in which dialectic implies this constant evolution of knowledge, for example through the Hegelian triadic process, should foster currency (7). Fourthly, the decisions about what to learn in a shifting reality (8) can be optimized through ongoing and frequent critical and collaborative dialogue. In brief, the constructive criticality, combined with the energy and edge of dialectic dialogue processes, can act as an engine for connectivist and networked learning.

Dialogic, Learning, and Connectivism

In considering dialogic dialogue processes, Ravenscroft, Wegerif, and Hartley (2007) argued the following:

> Bakhtin (1986), a contempory of Vygotsky, went back to the Greeks to argue that dialectic had become over formalized and

> we needed to return to real dialogues. He said dialectic is a dynamic form of logic leading all apparent differences to be subsumed into identity in the form of a more complexly integrated synthesis. Bakhtin argued that logic itself has no meaning, it is only the clash of different voices that gives meaning. He opposed what he called 'Hegel's monological dialectic' with his notion of dialogic that referred to the interanimation of real voices where there is no necessary 'overcoming' or 'synthesis' (Wegerif, 1999). Following Wertsch (1991) the sociocultural approach has tended not to recognize this and instead has combined together two notions of mediation, Vygotskys account of mediation by tools including words as sign-tools (dialectic) and Bakhtin's account of mediation by the voices and perspectives of others (dialogic). While mediation by tools is not incompatible with mediation by the perspective of the other person and both happen in education, it is important to point out that these are very different kinds of mediation, which can be conceived as different dimensions, or features, of the dialogue process. For each participant in a dialogue, the voice of the other is an outside perspective that includes them within it. The boundary between subjects is not therefore a demarcation line, or an external link between self and other, but an inclusive 'space' within which self and other mutually construct and reconstruct each other. (pp. 43–44)

Wegerif (2007) has argued very strongly for this dialogic approach to learning, where he considers that the main mechanism for learning is taking the perspective of another in a dialogue, where the dialogue is an end to be valued in itself as perhaps the most important goal of education. Recently, Wegerif (2007) has argued powerfully for this perspective to "expand the spaces of learning" through digital technologies and emphasised that it's not just the use of explicit reasoning but the ability to change one's mind and see things from a new perspective that is essential for learning. So, as with dialectic, there is the clear call to foreground the proactive role of social technologies in networked learning.

This dialogic position also maps to connectivism and networked learning in a number of significant ways, related to the conditions, context, and intersubjective orientations (Bahktin, 1986) that are appropriate for cothinking and learning. Firstly, it embraces the diversity of opinions (1) whilst recognising that these will not necessarily be, or need to be, resolved through logic. Instead it holds that the capacity to keep real, collaborative, and meaningful dialogue "in play" and learn through genuinely considering the perspective of others within inclusive spaces (2) is arguably more important than being driven by an undercurrent logic. Secondly, implicit in this perspective is the capacity to always know more (4) as operating in a dialogic space means that we will be constantly exposed to new or conflicting ideas that we are encouraged to explore and understand, rather than reject or attack in favour of preexisting personal beliefs or ideas.

Thirdly, cultivating and maintaining these dialogic spaces corresponds to nurturing and maintaining connections that facilitate learning (5). Fourthly, if learners operate in this dialogic way in learning networks they will inevitably be open to seeing and understanding new connections (6) and staying up to date through being in continual learning relationships (7), as well as having the opportunity to make decisions (8) about what it is they want to learn or think is important and relevant to learn.

Dialectic or Dialogic? Relative Dimensions for Networked Learning Dialogue

The relationship between these two characterisations of dialogue, and the implications for learning, was also explored by Ravenscroft, Wegerif, and Hartley (2007). A key question they asked was whether these two characterisations, or genres, worked together or in opposition. Previous work of Ravenscroft and his colleagues in designing dialogue games for conceptual change in science (e.g., Ravenscroft & Pilkington, 2000; Ravenscroft & Matheson, 2002) has shown that an argumentative and dialectical approach was needed for a student and tutor to achieve a synthesis around a correct conceptual understanding of the physics of motion. In contrast, Wegerif (2007) has argued and demonstrated that in some circumstances, especially when dealing with younger children and those with emotional and behavioural problems, a dialogic approach, with its emphasis on "taking the perspective of another," is more important than progression towards some sort of synthesis around a common understanding. So considering their previous work collectively, they argued that dialectic and dialogic are two relative dimensions that are not in opposition as they focus on different yet equally important features of the dialogue process relevant to learning. Dialectic emphasises the epistemic and cognitive dimensions of learning that can be realised through identifiable forms of dialogue processes that occur when an appropriate dialogic state is established. Dialogic emphasises emotional and interpersonal dimensions or the sorts of "relationships" and "intersubjective orientations" (Habermas, 1991) that enable the spaces where learning can happen. These represent a complementary emphasis, which Ravenscroft, Wegerif, and Hartley summed up by saying:

> The desire to reason to progress towards a rational synthesis does not have to override the need to understand others, and likewise, the desire to understand others does not have to override the often pragmatic need to reach a rational consensus that links to purposeful action in a context. The two will always interplay and vary in emphasis based on what is wanted from a learning situation. (2007, p. 46)

And to further emphasise these points, they held that this position paraphrased the thinking of Kant:

> dialectic without dialogic is blind (as in machine cognition), dialogic relations without dialectic is empty of content (as in the

> mother child couple): it is through their union that new shared understandings can arise. (p. 47)

So in terms of contributing to our understanding and realisation of connectivist dialogues in learning networks, both of these perspectives are, arguably, equally valuable. And similarly, we may need both approaches to operate in a complementary way if we want "real" learning to occur. Whereas dialectic is an engine that can energise and shape the form and process for connectivist and networked learning, dialogic is the sophisticated housing structure which sets up the appropriate relationships, epistemological orientations, and general conditions for learning to take place.

Connectivism and Contemporary Contexts for Learning

Further parallels with key aspects of connectivism related to dialectic and dialogic were also made in a later article by Ravenscroft et al. (2009), who said,

> . . . through social and more open technologies we are creating new spaces and contexts which have the potential for dialectic and dialogic learning through new and developing digital literacies. These contexts can often be conceived 'democratic spaces' that are either generated or populated by the users, whose relationships mediate learning as much as the processes and tools that are in play. These contexts are clearly creating new forms of intersubjective orientations where learning can happen, that are shaped through open participation, collaboration, multimodal language, the provisionality of representations and could potentially contribute, generally, to a more "democratic epistemology." (p. 418)

These researchers also drew together these interconnected notions about connectivism, dialogue, and collaborative thinking by comparing it to a key proposition proposed by Friere (2001), who said,

> To think correctly implies the existence of subjects whose thinking is mediated by objects that provoke and modify the thinking subject. Thinking correctly is, in other words, not an isolated act or something to draw in isolation but an act of communication… For this reason, a correct way of thinking is dialogical not polemical. (pp. 42–43)

This articulation aligns well with Siemens' notion of "thinking in networks," but adds an additional dialogue dimension related to the idea that communication and cognition are actually inseparable and essentially part of a greater social imperative. This also aligns with the point

made by Ravenscroft (2004) in a critique of a pure community of practice (CoP) approach to learning:

> When we consider the pedigree and support for socio-cognitive approaches . . . we cannot accept the claim that "Learning is a process that takes place within a participation framework, not an individual mind" without significant qualification. Surely, *learning is a process that takes place within a participation framework and an individual mind*. (p. 8)

This position is further strengthened if we don't ask where does the knowledge lie and instead ask how is knowledge beneficially refined, developed, and transformed through technology-mediated practices? This allows us to escape the possibly false dichotomies between individual cognition, distributed cognition, individual learning, and networked learning, etc. as we will always learn by being alone and together.

In embracing these new networked and highly social contexts and possibilities, this position also aligns with what tends to be called "egalitarian dialogue," which foregrounds the assessment of contributions in terms of the validity of the arguments presented rather than according to any power positions of those who advocate them.

I argue that all the perspectives, or levels, for understanding the dialogue process that are discussed above are important for connectivist and networked learning. Thus far, a lot of research has focused on the connection-forming potentials and propensities provided by open and social technologies that build upon network theory and the Internet architecture. This article provides an additional, original, and nuanced perspective on this theoretical and practical situation that looks at the prospects for greater understanding and better design of the learning dialogue processes that operate over social networks.

Tools, Dialogue Genres, Knowledge Building, and Networked Learning

What do the ways to better understand digital dialogue that I have argued for above contribute to more directly designing and promoting networked learning and the related and well-founded approach of *knowledge building* as it is defined by Scardamalia and Bereiter (2003)? Three related implications are that understanding these ideas should allow us to consider the nature and form, or *genre*, of desired dialogue processes and better problematize a learning and knowledge-building situation; enable the selection or combination of tools that will optimally mediate practices that address our learning and knowledge-building ambitions and requirements within given contexts; and, where existing tools are not available, be a foundation for tool design. Too often in practice these aims are erroneously conflated, producing mismatches between the affordances of tools and the educational expectations of them in learning situations. The TEL literature, or research that doesn't make it to literature, is replete with examples of this. Herring (1999) and McAlister, Ravenscroft, and Scanlon (2004) clearly showed the shortcomings of instant messaging and chat in supporting reasoned discussion that could lead to knowledge

building, and a recent journal special issue on "Social Software, Web 2.0 and Learning" (Ravenscroft, 2009) showed that attempted social media learning solutions often did not harmonise with or understand the actual learning-teaching problem they were meant to address. In applying this argument I now introduce a theory-driven approach to design that addresses the specific problem of promoting critical thinking and reasoned dialogue to support knowledge building on the Internet. This research arose out of the UK Open University, which, after considerable efforts to exploit synchronous chat and asynchronous forums for critical discourse amongst distance learners, realised that it needed to explicitly design for critical discussion, reasoning, and related knowledge building rather than expecting it would occur. This was achieved through research incorporating an anatomy (or ontology) and explicit process for collaborative argumentation, derived from the dialectic and dialogic ideas that were proposed above. Note that this approach does not override using other dialogue technologies where they are more appropriate. Put simply, I would propose using chat or microblogging to hold immediate informational exchanges, conferencing and blogging for reflective commenting, and digital dialogue games for "live" and collaborative thinking and knowledge building on the Internet.

Dialogue Games: From Theory to Designing for Dialogue Processes

Whilst the theoretical work above helps us to better understand connectivist and networked learning dialogue, if we want to ensure that we promote it we need additional concepts that directly link theoretically informed accounts to the design of dialogue-rich learning applications and experiences. One such theoretically strong design concept is dialogue games that incorporate other design-oriented theories such as speech acts (Searle, 1969).

Dialogue games are a well-established paradigm for designing learning dialogue (e.g., Ravenscroft, 2007) and argumentative dialogue in general (e.g., Moore, Yuan, Reed, Ravenscroft, & Maudat, 2009) that synthesise work from the philosophy of language (e.g., Wittgenstein, 1953; Mackenzie, 1979; Walton, 1984), computational linguistics (e.g., Levin & Moore, 1977), and design-based studies of learning dialogue (see Ravenscroft, 2007 for a review). The latter approach is driven by the Vygotskyan and Bahktinian notions that have informed the contemporary articulation of *dialectic* and *dialogic* dimensions of learning dialogue that were mapped to the connectivist principles and given above. This work has been reported extensively in previous articles, which cover the applied design based research approach of deep learning design (Ravenscroft & Boyle, 2010), the history of the development of the dialogue game framework (see Ravenscroft, 2007 for a review) and the methodological approaches and findings related to the evaluation of the games and the tools that realize them (Ravenscroft & McAlister, 2008). Some relevant parts from Ravenscroft, McAlister, and Sagar (in press) are restated and extended below. This dialogue game work has recently been complemented and realised through applying new design-oriented and conceptual principles of "ambient pedagogy" and "experience design" (Ravenscroft et al., 2009) to adapt the dialogue game approach directly to the social media landscape. In succinct terms, ambient pedagogy holds that the structure or scaffolding supporting the learning interaction is behind the scenes and yet also implicit in the digital practice that is supported; and "experience design" emphasises that the learning occurs through the production of an experiential context and ecosystem, or space that favours learning, in contrast to

foregrounding the management of instruction and explicit pedagogical design. This elaborated dialogue game approach is used to address relatively generic learning problems and opportunities related to the need for critical and reasoned dialogue, often linked to thoughtful writing. It has recently been deployed through the InterLoc tool and evaluated across five UK higher education institutions with over 350 students and 10 tutors (Ravenscroft, McAlister, & Sagar, in press). The results of these evaluations showed that the approach was highly valued by tutors and students, was effective in promoting critical thinking and reasoned discourse, and generally supported much deeper engagement between peers than is typical with other dialogue technologies.

Essentially, these social games realise engaging and structured rule-based interactions within networked spaces, which are performed using predefined dialogue features (such as dialogue moves, locution openers and a model of turn taking) that are specifically designed to foster thinking and learning in ways that are popular with learners (Ravenscroft, McAlister, & Sagar, in press). All contributions or replies are made using move categories (*inform, question, challenge*, etc.) and further scaffolded through using specific locution openers (*I think . . ., I disagree because . . ., Let me elaborate . . .* etc.) that have to be used to perform the dialogue. Similarly, rules about the legitimate and logical responding openers, based on the specific openers that are replied to, are offered selectively, but these can be overridden where necessary. The model of turn taking is incorporated to ensure that the dialogues support "listening" to others' contributions, fairly balanced patterns of contribution, and, generally, the sort of coherent sequencing that results in reasoned discourses.

A key point about these dialogue games realised through InterLoc is that all the features above are easily configurable, so dialogue moves, locution openers, and rules of interaction can be selected or developed to promote ostensibly dialectical dialogue processes, dialogic dialogue, or complementary combinations of both. The latter has been found to be the most popular and effective configuration within a game called the Critical Discussion and Reasoning Dialogue Game (CDR-DG). The following section demonstrates how this dialogue game realises these dialectic and dialogic processes that correspond to connectivist networked learning and other key aspects of connectivism.

Networked Learning Dialogues through InterLoc: Realising Connectivist, Dialogic, and Dialectic Dimensions

This section provides a concise account of how the dialogue games and InterLoc operate for the purposes of this paper, with its focus on the theory and application of connectivism and dialogue-rich networked learning. A more comprehensive and detailed account is given in Ravenscroft, McAlister, and Sagar (in press).

Practically speaking, the current dialogue game technology, InterLoc5 (Ravenscroft, McAlister, & Sagar, in press), embodies the pressing need to reconcile learners and knowledge workers developing digital literacies and practices with the well-established requirements for reasoned and purposeful learning dialogues, such as those supporting critical and creative thinking. It realises social games that are performed amongst small groups of four to six players that can be easily

scaled and replicated across many simultaneous groups. Through orchestrating interaction and learning through dialogue games we can connect anyone who can access the Web and include any resources that are available on the Internet.

The texts that result (see Figure 1) are more formal than records of unstructured chat or dialogue that is typical in conferencing software, and yet are less formal – in terms of textual representation – than a typical wiki or blog.

These types of digital dialogue records are significant in that they capture "live collaborative thinking." These can provide unique intermediary representations between collaborative thinking and thoughtful writing. In a sense, the current dialogue game approach is a way of generating and capturing thinking on the Web in ways that realise and satisfy accepted ambitions for learning that also sits with more informal and media-driven digital practices with social software.

Playing the Dialogue Game

The interface in Figure 1 shows how each player performs the dialogue game. This was taken from an exercise performed by postgraduate students at a UK university who were critically discussing the National Curriculum (or NC) for Science (which is also reported in more detail in Ravenscroft, McAlister, and Sagar, in press). They can contribute to the current state of the developing dialogue through selecting either "contribute" or "reply" to a specific previous contribution. "Contributing" to the dialogue places a message at the bottom of the display while "reply" indents responses below the specific contribution that is replied to (preserving a thread). This model contains affordances that achieve a balance of "keeping the dialogue moving forward" whilst allowing reflective asides and specific responses to previous contributions. So players need to distinguish whether they are "contributing" to the developing dialogue (using the large reply bar at the bottom), typically responding to the latest state of the dialogue or replying to a specific previous contribution (by selecting "reply" next to each contribution). All contributions or replies are made using the predefined move categories (*inform, question, challenge*, etc.) and the specific locution openers *(I think . . ., I disagree because . . ., Let me elaborate . . .* etc.). Similarly, rules about the legitimate and logical responding openers, based on the specific openers that are replied to are offered selectively. So in this example (in Figure 1) the responding player (george) is presented with logically legitimate responses to *I disagree because . . .*, such as *Is there another way of looking at it?, Why do you think that?*, etc., although he is not restricted to this preferred response set and can instead select *More* to see the full range of openers. So a structured and yet flexible form of scaffolding is provided.

This brief excerpt, and the context in which it was conducted, is able to demonstrate the harmonisation of dialogic and dialectic features along connectivist lines and also highlight some of the key principles of connectivism.

Beginning with the principles, firstly, the rationale behind dialogue games and InterLoc is that people learn and collectively advance knowledge and understanding through argument and critical inquiry. Implicit in this approach is an acceptance that diversity of opinion (1) is the

"intercognitive engine" that drives the argumentation process. Secondly, the learning design that InterLoc realizes deliberately connects particular people and particular resources, which are the "specialised nodes or information sources" (2). The design of the dialogue games and InterLoc, which comprise a "non-human appliance," ensures that collaborative argumentation occurs in ways that correspond to learning (3) and the collaborative development of understanding. Also implicit in the dialogue game rationale is that, through legitimate and continued argument, we can continually develop and improve our understanding of a domain, which maps to the principle that it is more important and critical to know more than is currently known (4). Principles 5, 7, and 8 are less evident in InterLoc's design and practices. But also central to dialogue games is that, through inquiry style interchanges, we have a greater ability to see and confirm connections between ideas and concepts (6), and also to qualify and refine the semantics of these connections and relations through more critical and argumentative exchanges.

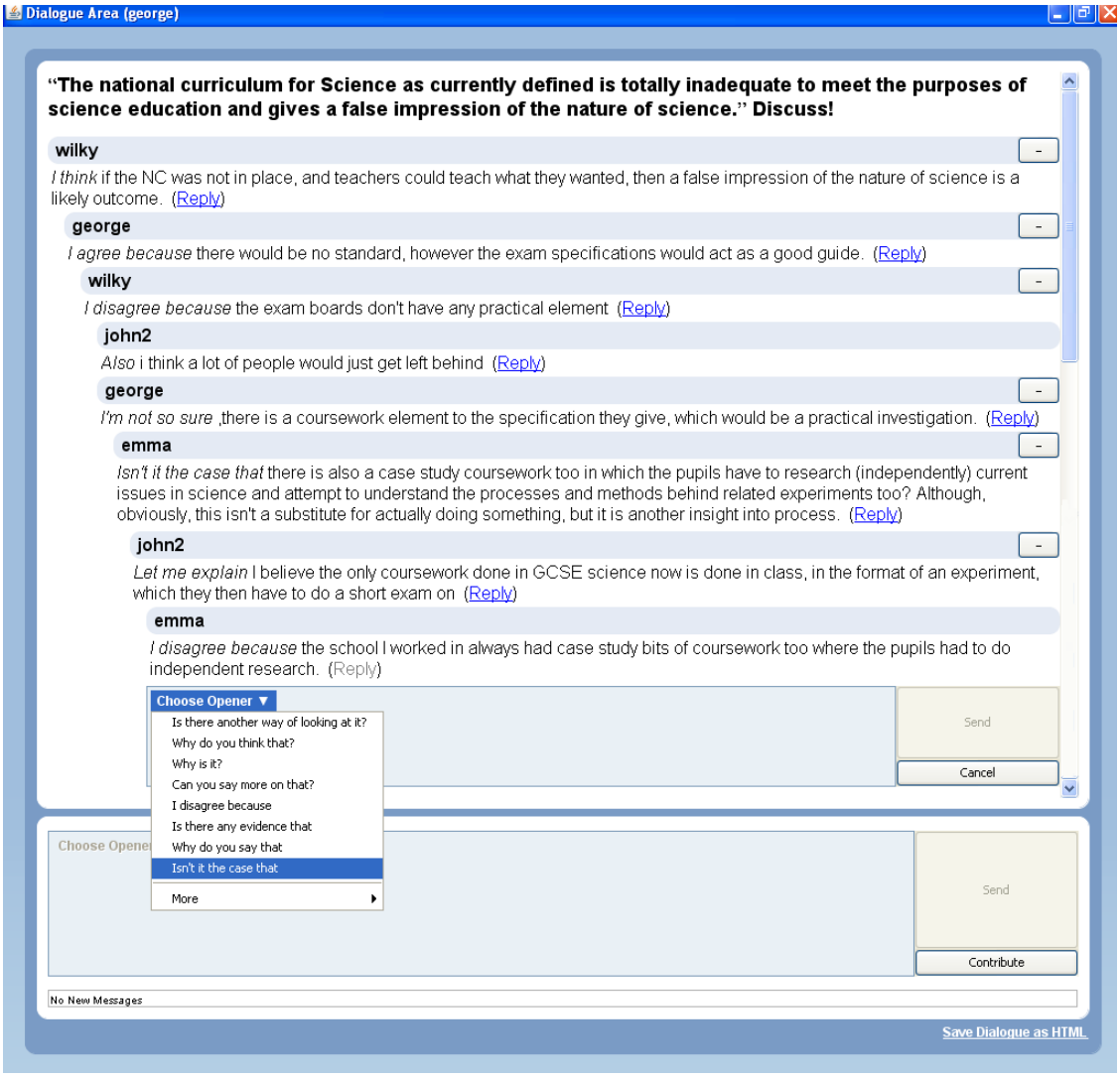

Figure 1. A critical dialogue demonstrating how connectivist, dialectic, and dialogic features are realised through InterLoc.

If we now focus on how dialectic and dialogic dimensions harmonise with connectivism more generally, firstly, the setting of an open question (bolded at the top of the screen), with a number of potential positions, within a collaborative "group space" where all players share the symmetric role (of player) and the same dialogue features – creates a dialogic space. This sources and stimulates collaborative inquiry and argument and a readiness to colearn what is not yet known. Similarly, this sort of connected learning experience could not be realised without the design of this nuanced network technology (InterLoc) to mediate the colearning amongst the participants deliberately through exploring, challenging, and reconciling diverse and differing opinions.

In turning our attention to the openers that are used and offered in the screenshot of this interface we can see this balance of dialogic and dialectic dimensions. Although I fully accept that the subtleties of interpretation will be dictated through the play of dialogue over series of interchanges within a particular context, following Wittgensteinian (1953) notions of "meaning as use," this level of analysis below helps to explain my position for the purpose of this paper. Replying to another's assertion (about the adequacy of the National Curriculum in the UK) with *I agree because . . ., Also . . ., Can you say more on that . . .* represents a mostly dialogic interchange; whereas, responding to the same or similar assertion with *I disagree because . . ., Is there any evidence that . . ., Why is it . . .* represents a challenging and dialectic interchange. Also, some openers are probably at the borderline of dialogic and dialectic, somewhere between requests for elaboration and challenges. These are openers such as *Isn't it the case that . . ., I'm not so sure . . ., Is there another way of looking at it . . ., etc.*

As Ravenscroft, McAlister, and Sagar (in press) point out, in this relatively brief interchange we can see how InterLoc supported reasoned agreement, reasoned disagreement, and then the further elaboration and clarification of concepts (related to the role or practical work in the National Curriculum). Summarising the shown conversation, where the individuals have been anonymised through being given "dummy" names, wilky initiates it using an assertion move, *I think . . .*, to offer a position for the role of the NC, to guide (or deliberately restrict) what can be taught about the nature of science – a position that george agrees with, using *I agree because . . . .* However, wilky then challenges george, using *I disagree because . . .*, to point out that examination boards don't actually have a "practical element," and john2 points out, using *Also . . .*, to make a related point that otherwise people would get left behind. This introduction of the notion of a "practical element" stimulates george, who uses *I'm not sure . . .*, to point out that maybe there is a practical element in the form of coursework. This then stimulates emma to offer a qualifying question, in the form of *Isn't it the case that . . .*, to offer a more sophisticated position that includes notions of independent study and how this relates to experimental work. This, in turn, stimulates john2 to clarify his position, using *Let me explain . . . .* But emma then challenges john2's clarified position, using *I disagree because . . .*, to offer a different relationship between coursework and independent study. And finally, this excerpt ends with george about to offer a further qualifying question through selecting *Isn't it the case that . . . .*

So even this brief excerpt, taken from an authentic implementation, demonstrates

- the sort of question (bolded at the top of screen in Figure 1) that seeds the dialogue game and fosters a dialogic space;
- how four participants all contribute to the dialogue, exploring and reconciling different opinions, to perform a well-balanced critical inquiry;
- A good range of moves and openers, including assertions (*I think, I agree because, also, let me explain*), challenges (*I disagree because*), and a question (*Isn't it the case that?)* being used to perform a dialogic and dialectic dialogue;
- how the dialogue game allows the players to quickly identify, consider the importance of, and elaborate their understanding of a key concept, the role of practical or experimental work; and
- how each participant, at this stage of the game, is articulating his or her own and different understanding of how this concept (of practical or experimental work) connects and relates to other aspects of coursework and independent research.

This conversation then goes on to appreciate how the NC is actually open to interpretation in these respects and that coursework now has to consider issues such as plagiarism.

The Digital Dialogue Game Project Evaluation Report (at www.interloc.org.uk) and a number of previous papers (McAlister, Ravenscroft, & Scanlon, 2004; Ravenscroft & McAlister, 2006) give a considerable number of longer and more varied dialogue game interactions along with their analysis and evaluation, including comparisons with equivalent chat exercises (Ravenscroft & McAlister, 2008). The extract used here is deliberately straightforward and illustrative for the purposes of this paper, but it still provides insights about what the dialogue game approach gives us as without InterLoc these sort of networked dialogues are likely to be less well balanced (with some individuals dominating), less deep and detailed, open to more misunderstandings, and generally more poorly reasoned, involving the simple trading of opinions instead of reasoned engagement. Note also that the way in which the openers and interaction design afford participation means that we rarely experience some participants being overly silent during the games (Ravenscroft, McAlister, & Sagar, in press).

Future Connectivist Dialogues: Reconciling Openness and Orchestration

One of the reasons why this dialogue game and InterLoc approach works well (Ravenscroft, McAlister and Sagar, in press) is that it has a practical balance of orchestration and openness. And this raises questions about how, or whether, we can move to a more open paradigm. With the current design, a learning manager role (usually a tutor) typically selects the opening question, related resources, and type of dialogue game and also schedules a synchronous interaction and decides whether or how to assess the outcome. So what if we wanted to further personalise and open up this experience through making the role of the tutor or learning manager either optional or unnecessary? Recent work has done this (see Ravenscroft, Braun and Nelkner, 2010; Ravenscroft et al. 2011) and produced a variation of InterLoc that was loosely coupled with a

social bookmarking and collaborative ontology tool (SOBOLEO) as part of a large-scale European project called MATURE. This supports more responsive and asynchronous dialogue interaction. In this situation the players proposed the question or topic and announce the dialogue game, which can then be joined by anyone in a registered community of practice (CoP). So far, this application has undergone a small-scale formative evaluation that has suggested ways to realise engaging and reasoned dialogues that are also commensurate with the expectations for personal learning environments (PLEs). The central idea is to make the need and means for orchestration explicit, and yet put this under greater learner control. To do this, future developments will realise more visible and open orchestration through tagging resources with dialogue game "invites," semantically processing interactions to identify and propose suitable interlocutors, and generally, linking the dialogue games to related digital learning activities. The latter could be design activities that naturally afford critical and creative discussion amongst groups who are collectively creating a shared artifact. Similarly, future developments will more clearly signal and manage expectations, so users are aware that dialogue games are deliberately reflective and their duration is relatively long term (e.g., from thirty minutes to an hour) and require concentration when compared with instant messaging or microblogging, for example. In other words, we need to accept that thinking and learning together in reflective and reasoned ways requires a commitment that is commensurate with the ambitions for this sort of interaction.

Bearing these experiences in mind, it is important to understand that although social networked systems might be emergent and self-regulating, some form of coordination or orchestration is usually required to support the sort of meaning making that corresponds to learning. To support continual learning requires some level of control of the sort of sense making and meaning making that Siemens (2006) refers to, which can arguably be achieved through reproducible dialogue patterns that catalyse certain learning processes. The implication of this is that we can "design" dialogues to favour certain types of discourse over others, where in our case we want to favour those that are most likely to lead to critical learning within networked and open spaces.

Conclusions

This article has proposed an original development of theory for networked learning through questioning and elaborating connectivism based on social constructivist thinking and an emphasis on dialogue. It has also argued why this is important and proposed how a "dialogue-rich view" of connectivism can be applied to the design and use of networked learning tools, and demonstrated this through one particular tool called InterLoc. Embracing connectivism means that we need to consider new design metaphors for future learning that place the person, their social behaviour, and their community at the centre of the design process and the resulting networked technologies. And whilst future learning landscapes will be characterised by the greater penetration of the Web within our everyday lives, fundamentally we must remember that we will still be, mostly, people socially interacting with other people. And this interaction will, in turn, be supported primarily through new dialogue and discourse. So this article argues for greater attention upon, and the pedagogical shaping of, the learning dialogue process within networked learning spaces through adopting contemporary approaches to learning design (e.g., Ravenscroft & Boyle, 2010; Ravenscroft et al., 2011). And I argue that without a reworking of attested dialogue theory into

more open and ambient pedagogies we will be less successful in converting mega-social interaction into mega-meaning making and learning. But perhaps the main point, or question, is even more fundamental and profound as whilst we pursue new forms of meaning making and communicative practice in the digital domain, through embracing the exciting possibilities offered by emerging web technologies, shouldn't our endeavours still fully appreciate the role of language and dialogue as our oldest and arguably still most powerful semiotic system?

"In the beginning was the word . . ." – John 1:1.

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Proposing an Integrated Research Framework for Connectivism: Utilising Theoretical Synergies

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Abstract

Connectivism is receiving acknowledgement as a fresh way of conceptualising learning in the digital age. Thus, as a relatively new instructional framework, it is imperative that research on its applicability and effectiveness in a variety of educational contexts is advanced. In particular, a high premium should be placed on context-specific research that is aimed not only at developing general principles but also at improving practice in local settings. Thus, developmental research approaches become imperative and as such it becomes increasingly necessary to have models that would assist scholars to understand the learning ecologies of connectivism. This paper therefore proposes a research framework for connectivism that integrates approaches commonly used in online learning environments. The paper integrates the theories of online communities of practice, design-based research, and activity theory to construct a research framework that is characterised by a synergistic relationship between them. It demonstrates the viability of the model by using an example of how it was operationalised in one research project. The framework, whose potential strength derives from integrating already established theoretical constructs, is presented as a proposal with the intention that it will be critiqued, tried, and improved upon where necessary and ultimately become part of the menu of other tools that serve connectivism research.

Keywords: Online communities of practice; design-based research; activity theory; connectivism; developmental research; research framework; Botswana

Introduction

The discourse on connectivism has gradually grown since it was articulated by Siemens (2005) and Downes (2005). In particular, the issue of whether connectivism has a theory status has dominated the discussion (Kerr, 2007; Kop & Hill, 2008). Regardless of whether it is a theory or not there is acknowledgement that it is a fresh way of conceptualising learning in the digital age. Thus as a relatively new instructional framework, it is imperative that research on its applicability

and effectiveness in a variety of educational contexts is advanced. While global principles of connectivism are desirable and need to be continually developed and refined, a high premium should also be placed on context-specific research that is aimed not only at developing general principles but also at improving practice in local settings. Thus, developmental research approaches become imperative and as such it becomes increasingly necessary to have models that assist scholars to understand the learning ecologies of connectivism.

This paper therefore proposes a research framework for connectivism that integrates approaches commonly used in online learning environments. It presents an approach that it is hoped will advance the research agenda of connectivism. To this end, the paper will outline the features of connectivism and articulate how it can be realised through online means particularly through the use of communities of practice. It will then discuss design-based research as an approach that can be used to investigate connectivism in specific settings. An argument will be made for activity theory as an appropriate analysis tool for design-based research. Then the paper will integrate these theories to construct a research framework that is characterised by a synergistic relationship between them. It will demonstrate the viability of the model by using an example of how it was operationalised in one research project.

Features of Connectivism

Before venturing into the articulation of the proposed epistemological framework, it is important for purposes of this discussion to characterise connectivism in terms of its key pedagogical features. These key features, as gleaned from the literature (e.g., Siemens, 2005; Downes, 2005; Kop & Hill, 2008), are as follows.

1. The central idea in connectivism is that of learners connecting to a learning community and benefiting from it while also feeding it with information. The learning community is a group of people learning together through continuous dialogue because of their similar interests.
2. The community is viewed as a node which is part of a wider network of nodes. The networks, which are diverse but connected, support autonomous, diverse, and creative knowledge development.
3. Knowledge is viewed as not only residing in the mind of an individual nor in one location but as being distributed across an information network or multiple individuals. Thus learning and knowledge creation are dependent on a diversity of views and opinions and on access to different information streams or hubs.
4. Information is constantly changing and there is a need to continuously evaluate the validity and accuracy of knowledge in light of the new information.
5. There is an inter-disciplinary connection in the knowledge creation processes particularly in the Internet environment with its dispersed nature of information.

It is important to underline that while connectivism is not limited to the online environment, the versatility of this medium enhances the realisation of the features outlined above. Thus the online environment is a critical vehicle in the growth and facilitation of connectivism.

A perusal of the above features of connectivism reveal that connectivist learning environments are inherently complex not only because they are characterised by networks of individuals, groups, and even disciplines, but also due to their dynamic nature and the fact that they require a continuous (or at least continual) engagement by learners. Consequently, an integration of theories such as communities of practice, design-based research, and activity theory for epistemological purposes is needed to adequately capture an understanding of the multifaceted nature of these learning environments. These theories, as shall be discussed below, play unique yet complementary and overlapping roles in the course of knowledge creation, hence a need for an explicit framework integrating them.

Manifesting Connectivism: Online Communities of Practice

The previous section outlined that connectivism is about connecting to communities and to the wide plethora of available resources in any given setting particularly using the networking capabilities of information and communications technologies (ICTs). Thus, the concept of online communities of practice becomes relevant as a way of manifesting connectivism. Online communities of practice as an instructional approach are being used increasingly in the education and training arena as a way of facilitating meaningful and connected learning. This is a corollary to the opportunities that ICTs offer for people to link up and communicate in ways that were not possible in the past. Communities of practice have been defined by Wenger (1998) as naturally occurring phenomena emerging wherever groups of people in pursuit of a common goal or interests are bound by a common need for knowledge. Thus they are usually characterised by

- mutual engagement of the participants that allows them to jointly participate in activities and dialogue; co-participation is key to defining community;
- joint enterprise which results from shared expertise and negotiated meaning, which primarily defines practice; and
- shared repertoire of communal resources that the community uses to carry out its practice and these include routines, tools, actions, words, and symbols.

These characteristics are indeed resonant with the features of connectivism as discussed earlier. In terms of theoretical underpinnings, the concept of communities of practice is informed at a general level by constructivist perspectives of learning especially those that advance the social nature of learning. However, at a very specific level, the social constructivist theories of situated cognition and distributed cognition are fundamental to this concept.

Communities of practice are known to facilitate learning from a number of perspectives. In terms of Piaget's work, which concentrated on cognitive work, communities of practice have the potential to foster equilibration; regarding Vygotsky's emphasis on the influence of culture and social surroundings on learning, they can be used to foster cognitive scaffolding in terms of supporting the learner to bridge the zone of proximal development gap.

Situated cognition, as discussed by Lave and Wenger (1991) and Brown et al. (1989), is central to the notion of communities of practice. The central idea in situated cognition is that learning is inherently social and is shaped by interactions among people, the tools they use, the activity they engage in, and their sociocultural environment (Hansham, 2001). Knowledge is seen as inseparable from the occasions and activities of which it is a product (Brown et al., 1989). In other words, cognition and context are inseparable entities. With regard to how situated cognition relates to communities of practice, Gasson (1997) has this to say: "…situated cognition deals with how individuals learn to participate within communities of practice and how their development is shaped by the activities in which they engage…" (p. 227). Therefore Hung and Chen (2001) submit that, "…learning from a 'communities of practice' perspective is [also] congruent with recent notions of situated cognition…" (p. 4), where context is fundamentally interwoven with cognition and learning.

Equally important, and perhaps of more relevance to connectivism, is the idea of distributed cognition whose underlying assumptions is that no one person or device is in possession of all the information needed to complete a task or solve a problem (Hutchins, 1996; Winn, 2002). The idea, therefore, views knowledge as being spread across a group of people and the tools they use (Stahl, 2005; cf. Hutchins, 1996). In other words, "…knowledge is distributed among a community of people and devices" (Winn, 2002, p. 341). This idea has already been stated as one of the key features of connectivism in the previous section. According to Hutchins (1996), as cited by Bell and Winn (2000), distributed cognition recognises

- that communication forms the basis of distributed cognition and that knowledge has to be shared in order for it to be useful;
- that shared information is pooled information and it can be used by the best equipped person for the good of the whole team;
- that the components of a distributed system must rely on each other to get the job done.

These elements put emphases on communication and information sharing and on utilisation for learning and productive purposes; this is essentially the hallmark of connectivism. Highly interactive and networked learning environments, such as communities of practice, offer opportunities for these elements of distributed cognition to be realised (Bell & Winn, 2000).

In sum, the argument of this section is that online communities of practice are necessarily a manifestation of connectivism. Therefore the formation and functioning of communities of practice, whether naturally or by design, allows connectivism to take its course. But how can we investigate the different aspects of connectivism? The next section is an attempt to explore this question.

Investigating Connectivism: Design-Based Research

The argument in this section will be advanced on the basis of the observation previously made that online communities of practice are a manifestation of connectivism. Therefore an

examination of the methodological pattern of research on online communities of practice will necessarily give ideas of how connectivism might be investigated.

An examination of the literature on online communities of practice in education (e.g., Schwen & Hara, 2004; Kirschner & Wopereis, 2003; Vazquez-Abad et al., 2004) reveals how studies of this nature are usually carried out. Job-Sluder and Barab (2004) place this literature into two categories. The first category consists of case studies focusing on existing social networks that already have well defined histories, norms, identities, and so forth. The second one is of case studies of attempts to build infrastructure for online communities within a given educational setting and studying the results of that design. While both categories are relevant for our purposes, the latter would be of particular interest in this paper as such case studies offer an all-encompassing opportunity to study the whole life cycle of an online community. This category of studies is characterised by designed interventions in the form of a sociotechnical environment that facilitates interaction. The design of these interventions usually undergoes multiple revisions as it is continually tested in real practice. Strictly speaking, because of the iterative and interventionist nature of these studies, they are more than just case studies. While case studies are characterised by in-depth studies (usually using multiple data collection procedures) of an individual unit (e.g., a student, a class, an organisation) and seek to engage with and report the complexity of social activity (Burns, 2000; Krathwohl, 1998), they do not usually involve any iterative design interventions. The emphasis on iterative design interventions is a unique feature of research on technology-based learning environments. This research methodology is known as design-based research (DBR).

DBR, otherwise referred to as design research (e.g., in Collins et al., 2004; Bereiter, 2002) or design experimentation (e.g., in Gorard et al., 2004), has its origins traced back to the work of Brown (1992) and Collins (1992) in which they each carried out what they termed as design experiments or experimentation. These design experiments were done as a way of carrying out formative research to test and refine theory-based educational designs (Collins et al.; Bell & Winn, 2000). It emerged mainly from the need for new and complex methodologies that could capture the systemic nature of educational activities such as learning, teaching, and assessment (Brown). DBR involves intentional design coupled to empirical (observational) research and to theorising about what takes place in authentic contexts where the designed objects come to be used (Joseph, 2004; Bell, 2004). Theory-informed interventions in the form of technological artefacts as well as less concrete innovations like activity structures or particular curricula are tested in particular situations and thus reveal how, when, and why they work in practice.

The decision to conduct DBR usually comes about as a result of identifying a real-life educational problem and coming up with a theory-informed design intervention that seeks to address such a need. The design "…embodies testable conjectures about both significant shifts in learners reasoning and the specific means of supporting those shifts" (Cobb et al., 2003, p. 11). These design experiments are essentially characterised by improving the initial design through a series of iterations consisting of testing and revision of conjectures during the various phases of the intervention. The ongoing analysis requires direct engagement with the enactment process of the

design intervention through observation, collaboration, and comprehensive record-keeping from the multiple sources of data.

Once the design is refined and seems fit for purpose or otherwise, a retrospective analysis is carried out. This analysis looks at the extensive longitudinal data and gives an historical review that attempts to identify an emergent pattern (Cobb et al., 2003). It looks at concerns related to the adoption (and adaptation) of the intervention by a broader audience. Barab and Squire (2004) say that cases undergo multiple transformations and that the sequence of events and their situational consequences need to be discussed in ways that are globally relevant while capturing the dynamism of the phenomena locally. Therefore, the value of design-based research is that it attempts to meet local needs while also advancing a theoretical agenda (Barab & Squire, 2003).

Thus, DBR has emerged as a methodology for carrying out research on technology-based learning environments. The technological interventions that are usually designed are diverse in nature, and they include online communities of practice.

As advanced earlier, in examining studies on online communities of practice the methodological pattern that seems to consistently emerge is that of DBR. For this reason, Bell and Winn (2000) identify

> …a natural synergy between the distributed cognition perspective, for example communities of practice, and the design experiment approach to innovation in that they are both focused on understanding the cognitive interaction between components of a complex system in naturalistic settings. (p. 135)

This is particularly so with regard to designing online environments which sustain or facilitate community interaction. A consistency between the features of DBR and literature on designing online communities includes the suggestions by Barab et al. (2004) as follows:

- A co-participatory and co-evolutionary design approach with the users is essential; and
- There is a preference for minimalist design as opposed to over-designed spaces, which ensures that users are not confused and also means improvements can be incrementally added using feedback from users; in this way, they suggest that a tentative platform should be designed and then the virtual community will evolve according to the needs and agendas of its members.

Thus, on the basis of the arguments advanced in the previous section, the synergy that exists between DBR and communities of practice can be extended to connectivism.

As already explained, conducting DBR involves cycles of enactment and at each stage seeks to understand the learning ecology of the authentic contexts where the designed objects are used. Therefore with every cycle, a thorough analysis is needed so that more refined conjectures can be made about subsequent stages. Moreover a retrospective analysis is required to establish patterns,

principles, and even theories. These processes require an analysis tool that can capture both the dynamism and the complexity of the learning ecology. Activity theory is one such framework, and it is discussed in the next section as a viable tool for analysing connectivism.

Analysing Connectivism at Work: Activity Theory

This section introduces activity theory (AT) and analyses it in terms of its assumptions. It also explores some of the literature where it has been used to study online learning settings. It concludes by making a justification for its use in design-based research.

AT, as we know it today, largely builds upon the work of Vygotsky (1978). It is premised upon the belief that there is a dynamic interrelationship between consciousness (the mind) and activity, and on the fact that they co-exist and are mutually supportive (Jonassen & Rohrer-Murphy, 1999). This theory conceptualises learning as an activity system involving a subject (the learner), the object of the activity, and the tools that are used in the activity. According to AT, human learning is fundamentally grounded in activity (Hewitt, 2004). Thus in studying an activity system, the unit of analysis is the activity, which is described by Issroff and Scanlon (2002) as a "…form of doing directed to an object…" (p. 78). The basic activity system is diagrammatically represented by the small top triangle of Figure 1 where the subject(s) seek to transform an object into an outcome using either physical or mental tools. This transformation of an object into an outcome, according to Hung and Wong (2000, cited in Hung & Chen, 2002), motivates the existence of an activity.

Engeström (1987), convinced that activities do not exist in isolation, introduced the aspect of community to the activity system. Activities are socially and contextually bound so that an activity system can only be described in the context of the *community* in which it operates (Jonassen & Rohrer-Murphy, 1999). The community negotiates the *rules* and develops the customs that describe how it functions and what it believes. Individuals or groups of individuals in these communities play different roles towards the object, that is, there is *division of labour*. This aspect of the expanded version of the activity system is represented by the bottom part of the larger triangle of Figure 1.

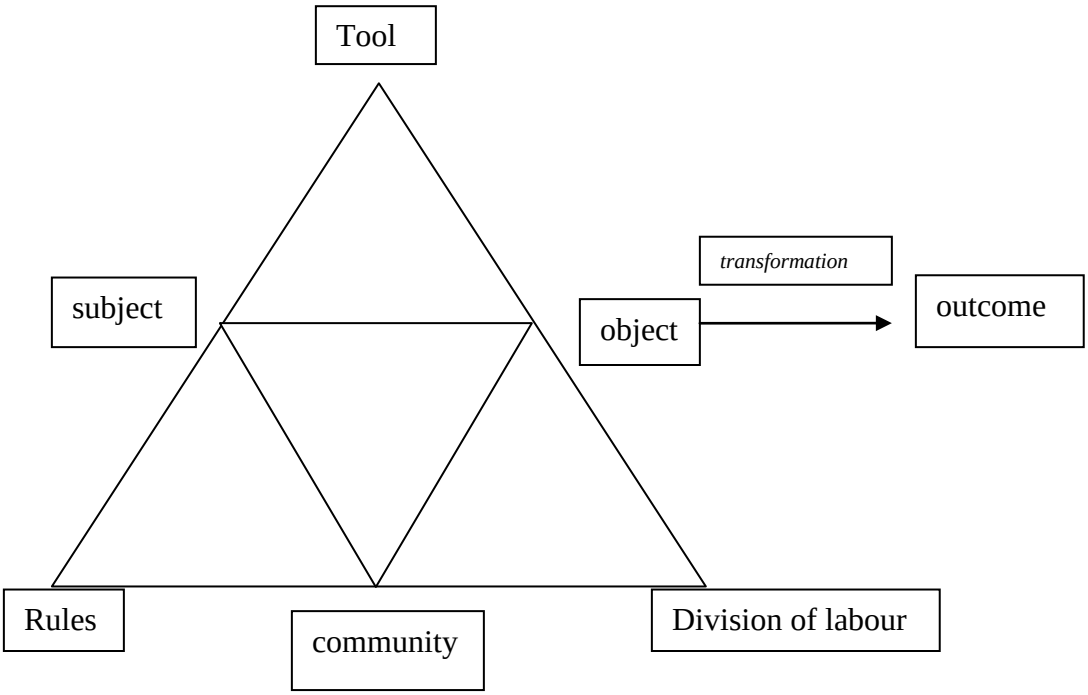

Figure 1. Standard representation of the activity theory framework.

AT operates under certain assumptions (Jonassen, 2000; Jonassen & Rohrer-Murphy, 1999) or principles (Kaptelinin, 1996) as follows.

Unity of Consciousness and Activity

This assumption is considered the most basic principle of AT. The assumption explains the integration between consciousness and activity (Kaptelinin, 1996). That is, rather than separating learning (conscious processing) and activity (mental and physical interaction with the environment or objective reality), AT views them as coexisting and mutually supportive (Jonassen, 2000). A similarity with situated cognition is noted. Therefore, learning is viewed as a transformational process that results from the reciprocal feedback between consciousness and activity. As individuals act they gain understanding and this understanding further improves their actions and so on.

Intentionality

Underlying this assumption is the fact that learning and doing, which are inseparable according to the previous assumption, are initiated by intention. That is, AT "focuses on the purposeful actions that are realised through conscious intentions" (Jonassen, 2000, p. 106). These intentions are directed at objects of activity with the motive being to transform those objects into outcomes. Intentions, therefore, are activity specific and context bound, and they emerge as a result of contradictions that individuals perceive in their environment between what is and what needs to be. This assumption is important because intentionality leads to meaningful learning and in the context of connectivism it is useful to know why individuals connect to communities.

Contradictions

Activity theory recognises the fact that activity systems are not stable and harmonious systems (Yamagata-Lynch, 2003; Cole & Engeström, 1993). The systems are characterised by internal contradictions, which are caused by tensions between their components. That is, when the conditions of one component are in contrast to the working of another a tension emerges that may cause subjects or learners to face contradictory situations that hamper the attainment of an object. Other contradictions may be external in nature where one activity system constrains the functioning of another (Jonassen & Rohrer-Murphy, 1999; Barab et al., 2002; Yamagata-Lynch, 2003). These perturbations or contradictions are what cause activity systems to change and develop (Jonassen, 2000; Barab et al., 2002). That is, activity systems are always adapting towards resolving these contradictions and becoming more stable. One feature of connectivism is that it recognizes the ever-changing nature of information and the need to adapt accordingly in order to resolve the disharmony introduced by such change.

Mediated action

In this assumption it is argued that human activity is mediated by tools or artefacts. These artefacts can be physical, such as computers, or symbolic, such as models, signs, or theories. Thus mediated action is defined by the interplay between agent (subject) and the mediating tool. That is, there is a reciprocal effect between subject and the mediating tool in the carrying out of an action. In this way, while tools can change and shape the nature of human activity, they are, in turn, also affected by it. This assumption has aspects of distributed cognition, which is a key feature to communities of practice and connectivism.

Historicity

According to this assumption, activity is historically and culturally developed (Jonassen, 2000). Therefore, in order to understand the dynamics surrounding an activity, an awareness of how the dynamics have evolved over time is essential. Kaptelinin (1996) calls this assumption "the principle of development" and asserts that to understand a phenomenon means to know how it developed into its current form.

These principles demonstrate that AT has immense power in studying the dynamic interdependence of the individual, social, and cultural influences on human praxis. Thus AT has been suggested as a useful framework for examining ICT-supported learning environments (Nardi, 1996; Kaptelinin, 1996; Hewitt, 2004; Collis & Margayan, 2004; Issroff & Scanlon, 2002). Recently AT has been used widely in this respect. An examination of studies utilising AT reveal that researchers use it flexibly and select and apply principles that best suit their purposes. In other words, a researcher may choose one or more of the principles in their analysis of activity depending on their research intentions.

Waycott et al. (2005) predominantly utilised the principle of mediated action in their study. They used AT to analyse distance learners and mobile workers who where using portable digital assistants (PDAs) for their learning and work activities respectively. They observed a two-way process between the users and their PDAs in which the learners/workers adapted their practice to

the PDAs and in turn their learning and work practices were being shaped by these devices. This finding is consistent with the principle that, "[tools] change the process and they are changed by the process" (Jonassen & Rohrer-Murphy, 1999, p. 67). A study by Issroff and Scanlon (2002) is also of interest in this regard.

On another front, a study by Yamagata-Lynch (2003), which examined a professional development programme for integrating technology into school using AT, was underpinned by the principle of historicity. The focus of this particular study was to gain an historical understanding of the developments in the interaction between participant teachers and the professional development programme over a period of time. The study traced the different stages that the teachers went through and identified four activity systems in the school setting over period of time. Schlager and Fusco (2004), on the other hand, in the context of teacher professional development (TPD) explore the relationship between the activities of teachers involved in TPD initiatives and that of the rest of the school communities where those teachers work. They observe that the two activities can either align or misalign depending on the extent of overlap of professional development project and prior activities in the school. This study essentially investigated the extent of the contradictions between the two related activities and how such tension could be resolved.

A study by Collis and Margaryan (2004) appears to have integrated all of the principles of AT in its attempt to seek understanding of learning in a corporate setting. The authors contend that individual learning in corporate settings is viewed as an expansion of social and intellectual involvement, over time, with other people and the tools available in their culture. They report on how they used activity theory as a framework for design of instruction involving computer-supported collaborative learning and work-based activities in a multinational corporation, thus integrating the strengths of formal and informal learning. In their Health Risk Assessment course for workers in this corporation, the workplace situations specific to each learner became the learning tasks (objects) motivating participation in the learning activity. Work peers, experts in the organisation, managers, and supervisors acted as partners in this activity and provided the necessary support to the learners. The paper concludes by noting that while activity theory-guided design to learning helped in structuring new forms of learning, much still needed to change in the "social climate of the workplace (the community, the rules, and the division of labour) before the potential of the approach will be realised in widespread practice in corporate settings" (p. 50). In this particular study there was clear evidence of how the principles of unity of consciousness and context, intentionality, mediated action, contradictions, and even historicity were used to frame this study.

The above literature reveals a wide range of potentialities of activity theory in analysing complex and diverse learning situations. For this reason AT can be suitably used to analyse the enactment of online interventions, such as communities of practice. Since online communities of practice are largely informed by the ideas of situated and distributed cognition, AT seems to be an appropriate analysis tool as it attends to the social and contextual aspects of learning (Jonassen & Rohrer-Murphy, 1999; Barab et al., 2002; Yamagata-Lynch, 2003). This character of AT also dovetails very well with DBR's focus of systemically examining learning in naturalistic settings,

particularly how online interventions are influenced by the contexts in which they are enacted and vice versa.

A Framework of Synergies

The discussion in the preceding sections has demonstrated the synergies that exist between online communities of practice, design-based research, and activity theory. The three constructs attend to issues of context, complexity, and culture in very fundamental ways and can thus be integrated to form a framework through which introduction and implementation of ICTs in education could be examined effectively. This discussion has therefore formed a basis for a proposal to integrate the three ideas or theories to act as theoretical foundation, methodology, and analytic tool respectively in the study of connectivism. Thus, a *framework of synergies*, which integrates these three perspectives, is hereby proposed to guide developmental research, primarily, in connectivism. Figure 2 is a diagrammatic conceptualisation of the framework.

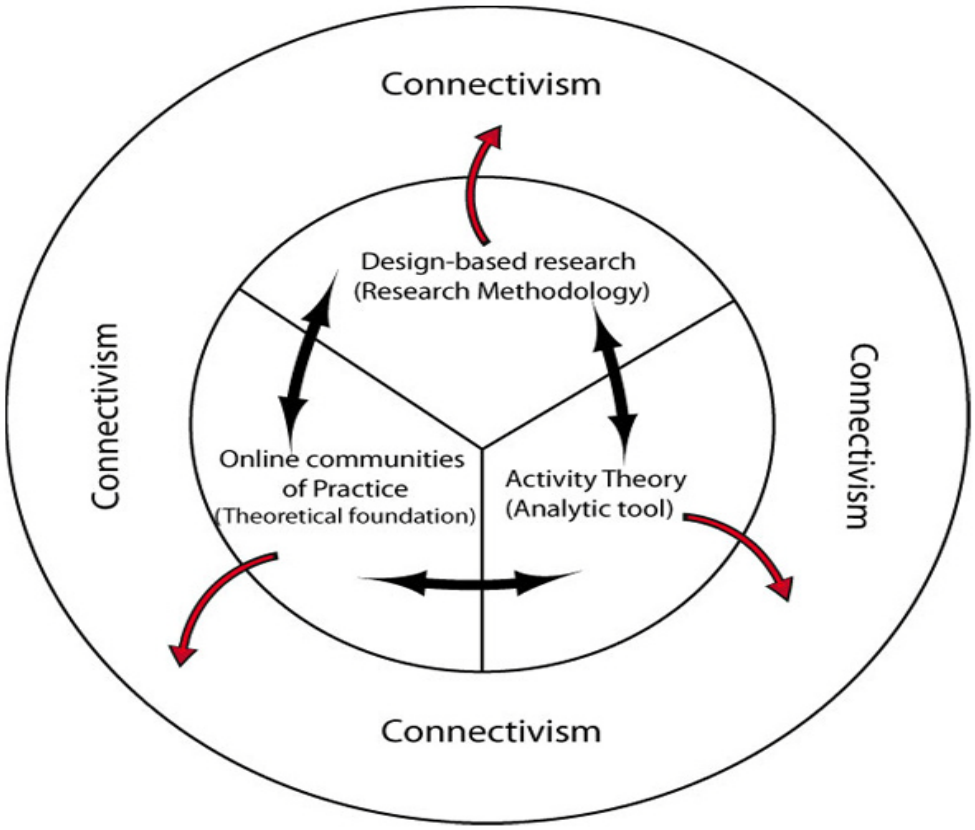

Figure 2. A proposed framework of synergies for conducting developmental research in connectivism.

The compartmentalised inner circle in the diagram shows that each of the three perspectives has a two-way relationship with the others as illustrated by the two-way arrows. They feed into each other for a better understanding of phenomena. A corollary to the functional synergistic

relationship between these three constructs is the growth of understanding of connectivist learning environments in terms of their ecology, hence the arrows feeding into the bigger circle. The framework is dynamic in that it allows a continuous, cyclical, and iterative process of research which may, in principle, start anywhere as evident from the inner circle. It is envisaged that the framework will have high flexibility so that it can be used for studies of different magnitudes: from small-scale research projects to systemic reform initiatives. As earlier argued, such an explicit eclectic framework is necessary if we are to properly conceptualise developmental research that focuses on investigating the complexity of variables and achieve a richer understanding of ecologies of learning in the context of connectivism.

Enacting the Framework: An Example

Enacting this framework is conceptualised as a process that requires creativity and the researcher's latitude depending on the aspects of connectivism being investigated. It is important to underscore that this framework is particularly aimed at developmental research and as such its enactment would be interventionist in nature. The purpose of this section is to demonstrate, with the help of an example of a study from which the idea of an integrated framework emerged, how the framework might be typically enacted. It has to be noted that the example study, which is presented in detail in Boitshwarelo (2007a), was not necessarily conceptualised as a connectivism study. Instead, the study subserviently advanced the course of connectivism because its agenda was about connecting people to one another for professional development purposes. Thus using this example, the general stages that characterise the enactment of this framework are described below.

Understanding the educational situation and conceptualising an intervention.

Just like any developmental research endeavour an analysis of the educational situation would reveal the specific need, challenges, or disconnects that exist in a particular learning environment. This understanding helps in the conceptualisation of an appropriate intervention. Connectivism by its very nature is about connecting people for learning purposes and reducing isolation between stakeholders involved in the learning processes. Therefore the nature of connectivist interventions would be such that they predominantly foster development of learning communities.

In the case of the illustrative study, the setting was a biology teachers' professional development programme run by the University of Botswana through traditional face-to-face workshops at a central venue like Education Centres belonging to the Ministry of Education. The programme, which was sponsored by the Ministry of Education through its Department of Teacher Training and Development (DTT&D), is run once a year during one of the school holidays. The shortcoming of this programme was that once the teachers who are selected by their schools from all over the country to attend these two- or three-day workshops go back to their respective schools they lack support to implement the skills they have acquired. Because of distance and other constraints the teachers are not able to connect to their colleagues with whom they attended

the workshop. It was also discovered that it is not easy for teachers to keep in constant touch with the resource people at the university for continued expert coaching. Given this analysis of the learning situation, it was conceptualised that an extension of this programme through continued online interaction of teachers with both each other and resource people would enhance the implementation of skills that they would have acquired in the workshops. Thus, an intervention that would facilitate an online community of practice among the teachers and their resource person was conceived. Alongside this developmental endeavour, the study was also meant to determine the potential that online learning environments have in facilitating communities of practice among teachers in various schools in Botswana.

Developing and implementing the online community learning environment.

Having conceptualised that a connective learning environment in the form of an online community was necessary, the process of developing it, testing it, and implementing it with the target audience was then actualised. Therefore in the example study, consistent with the principles of DBR, an online intervention founded on the theories of situated cognition and distributed learning was designed and developed to facilitate a community of practice among some of these teachers who attended the workshop.

The online intervention, which was in the form of a sociotechnical learning space, was developed and hosted on WebCT at the University of Botswana. This learning space, which was called Biology Teachers Online (BTO), was developed with the assistance of the Educational Technology Unit at the University of Botswana, following a design statement. The design statement acted as the original blueprint of BTO and included specifications related to design metaphors and media elements as well as instructional approach. In the course of developing BTO, a series of refinements in terms of graphics and other design elements were made before it could be ready for implementation. This involved ongoing interaction with staff of the Educational Technology Unit because of their understanding of the WebCT environment and educational technology use in general. In addition to the physical design, the pedagogical elements of the BTO environment, such as the instructional approach and the selection of content for the resource section, were iteratively developed in consultation with one of the resource people.

The BTO was introduced at the workshop to the teachers, and subsequently further review was made in terms of the nature of the online task for the teachers involved and of the schedule of activities in the online environment. Only 10 teachers out of the over 20 teachers who attended the workshop had volunteered to participate in this intervention. Their primary task was to collaboratively review the worksheets that had been developed at the workshop. These worksheets had been developed to assist teachers in teaching process skills to their biology classes. Therefore as they went back to their schools they were expected to do two things: to interact with their teaching peers and get them to provide their diversity of views and suggest improvements and to assess whether the worksheets could be implemented in their own classrooms. Information emanating from these school-based exercises would then form a basis

for the online discussions. Thus, the online community, BTO, was *connected* to the school communities of the respective individual members as well as to the trainer at the university. Therefore, while the task of collaboratively improving the worksheets was for the BTO community it was meant to benefit from other *nodes* particularly the teacher community in the schools and the classroom environments of the respective members of the BTO. The implementation exercise ran for over two months with the expectation that at the end of that period there would be a tangible product in the form of implementable worksheets.

As evident from the narrative above, the development and implementation of BTO was informed by principles of DBR, particularly the collaborative and iterative nature of the process of refining the intervention.

Evaluating the connectivist learning environment and analysing the outcomes through AT.

During the development and implementation of the online community intervention, an ongoing analysis and evaluation is conducted so that appropriate reviews can be made to meet the objectives of the innovation. However, once the online community has run its course or its intended duration in terms of the research agenda, a summative evaluation and retrospective analysis is carried out to establish the success and/or outcomes, identify emergent patterns, and gain an historical understanding of the intervention. AT plays a key role in this respect. As demonstrated earlier, AT has a number of potentialities in the sense that it can analyse activity systems from different angles depending on the nature of the study. In specific reference to connectivism it is perhaps advisable to view the various nodes as activity systems that influence each other in one way or another. Thus, in analysing the processes and outcomes of learning activities, attention should be given to the relationships both within and between activity systems and how things evolve over time.

In the case study presented here, the success in terms of participation within BTO was minimal and a further probing of why this was so was done. This probing pointed to systemic factors as a reason for low participation. Therefore AT was used to identify and clarify these systemic constraints. In particular, the AT analysis sought to identify the nature and extent of the contradictions or tensions that constrained the success of the online community of practice. Specifically, it looked at how activity systems that were directly related to the intervention shaped its enactment and outcome. In that respect, activity systems that represented three stakeholder organisations in the programme were identified. These stakeholder organisations included the department running the in-service training programme at the University of Botswana, the Ministry of Education (particularly DTT&D), and the schools from which the teachers came; these represented activity systems.

A key activity system or node, however, was the schools where the teachers work: a tension between this activity system and the "BTO activity system" was that "...the socio-cultural, organisational and technical environment [of schools] is not conducive for ongoing, collaborative and contextual learning endeavours" (Boitshwarelo, 2007a, p. 225). This included the way the

ICT resources are managed, which was not friendly for teachers who wanted to access resources for professional development purposes, and the lack of a culture of peer collaboration and innovative teaching practice amongst teachers in schools. A detailed analysis of this activity system can also be found in Boitshwarelo (2007b, 2009).

The school activity system was, in turn, influenced by the Ministry of Education activity system which deals with mostly policy issues. The Ministry generally facilitates and/or sponsors in-service training that is centralised in nature and conducted mostly in education centres, away from schools. Therefore resources (e.g., ICTs) meant for training are concentrated in these education centres, and ICT facilities in schools are primarily meant for teaching purposes and administration but not for teachers to access for their professional development. Therefore electronic networking among teachers is constrained by, among other things, lack of ICT resources in schools. In terms of the university, the culture of the department providing the in-service training seemed to be in misalignment with the intentions of the BTO activity system in the sense that the concept of online communities didn't really fit into the structures, processes, and practices of the department. This meant that there was little capacity to facilitate this connective process of learning.

This brief description is for illustrative purposes; a thorough analysis of the activity systems is done elsewhere (Boitshwarelo, 2007a). However, overall in this study the AT analysis unpacked and clarified issues related to not only individual teachers as learners and their immediate online community but also to other nodes across which the learning activity was distributed, including the social environment, the tools used, and the contextual affordances and constraints that were at play.

A reflection on this case study revealed that there was a high level of harmony between the three concepts towards a cohesive execution of the developmental research project leading to an extensive understanding of the learning ecologies surrounding the intervention. This is a demonstration of the functionality of the integrated framework and as earlier pointed out there is a lot of room for manoeuvre as one uses it.

Conclusion

This paper set out to propose a research framework that will aid in advancing the research agenda of connectivism, particularly developmental work. The framework, whose potential strength derives from integrating already established theoretical constructs, has been presented as a proposal for consideration by connectivism enthusiasts. The arguments upon which it is based are hopefully robust enough to warrant its viability. As a proposal the intention is that it will be critiqued, tried, and improved where necessary to add to the menu of other tools that serve connectivism research.

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