Connectivism: a theory for learning in a world of growing complexity

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Abstract: Connectivism is an emergent theory that attempts to capture and reflect the complexity of learning in a world of proliferating information. The authors review the origins and underpinnings of connectivism, situating it within more established and accepted traditional learning theory and demonstrating how it both challenges and expands our understanding of how, why and when learning occurs. They also explore what organisations should do differently, how learning design should change and how organisational performance potential can be improved using the principles of connectivism. The authors offer practical examples of how these principles are applied in workplace learning and e-learning, and suggest specific instructional design strategies and activities in line with the principles. Finally, the authors conclude with brief suggestions for future research.

Keywords: connectivism; instructional design; workplace e-learning; learning theories

Introduction

Maturation of the Information Revolution is an unrelenting force driving change, what Austrian-American economist and social theorist Joseph Schumpeter (1942) popularised as waves of “creative destruction”, through our lives, our organisations and our institutions. The impact is being felt simultaneously on multiple fronts. Daily, we struggle to make sense of the deluge of raw data being transformed from information into usable knowledge. Nearly a decade ago an American Society for Training and Development (ASTD) study reported the half-life of knowledge to be at 18 months (Westmore, 2000). More recently, an IDC white paper (Gantz et al, 2008) calculated “that the digital universe – information that is either created, captured, or replicated in digital form – was 281 exabytes [ie 281 million gigabytes] in 2007. In 2011, the amount of digital information produced in the year should equal nearly 1,800 exabytes, or 10 times that produced in 2006... The compound annual growth rate between now and 2011 is expected to be almost 60%” (p. 3). Given such projections, expanded conceptualisations and methods for understanding how individuals consume and use information will be essential. Increasingly apparent is the link between the proliferation of information and the accelerating pace of social and economic development, shrinking distance and tightening interdependencies between disparate parts of our world, deepening complexity of problems, and rising uncertainty of solutions. The ability to pursue ‘business-as-usual’ as a modus operandi is becoming ever more difficult given the rapid change and constantly growing information needs of our society.
New paradigms of learning are emerging to address the explosion of information and changing nature of knowledge creation, access and use. For example, Hase and Kenyon (2000, 2007; see also Hase’s article in this inaugural issue of Impact) propose a learning theory called heutagogy as an answer to pervasive change, uncertainty and ambiguity. Heutagogy is a paradigm that focuses learning on developing individual capability as well as on enabling and empowering others, and it relies heavily on sharing information. Unlike andragogy, which relies on teacher facilitated and self-directed learning, the self-determined learning of heutagogy shifts control of both the ‘what’ and the ‘how’ to the learner. Heutagogy aligns with a proposition tendered by futurist Alvin Toffler in *Future shock* (1970), “Tomorrow’s illiterate will not be the man who can’t read; he will be the man who has not learned how to learn” (p. 414, emphasis added). Similarly, Tom H. Brown (2006) proposes a learning theory called navigationism, based on how learners seek and use the information as a learning process. According to Brown, “In a navigationist learning paradigm, learners should be able to find, identify, manipulate and evaluate information and knowledge, to integrate this knowledge in their world of work and life, to solve problems and to communicate this knowledge to others” (p. 113). The development of skills and competencies for managing, making sense of and applying information is at the heart and core of navigationism.

An attempt to marry the ideas of heutagogy and navigationism is offered in a theory labelled connectivism (Siemens, 2004). Connectivism integrates principles explored by chaos, network, complexity and self-organisation theories into a coherent learning theory for the digital age. Not only is connectivism an opposite response to the advent of the information society and knowledge economy, it embodies the core attributes of heutagogy’s self-determined learning and navigationism’s skills and competencies. Put simply, connectivism picks up where traditional learning theories leave off in preparing learners for a world of growing complexity. Learning, according to the connectivist view, is distributed within a networked environment that is technologically and socially enhanced. Despite the attention it has enjoyed over the last few years, there is little research investigating connectivism as a feasible learning paradigm and even less that examines its relationship to workplace e-learning. Thus, the purpose of this article is to explore connectivism as a learning theory amenable to workplace and organisational contexts. Specifically, in the various sections of the article, the tenets of connectivism are reviewed and an attempt made to situate connectivism within existing learning theory, before suggesting and discussing applications to and implications for workplace learning.

**Overview of connectivism**

Although Siemens’ (2004) seminal paper, “Connectivism: a learning theory for the digital age”, appeared on the Internet prior to Downes’ (2005a) “An introduction to connective knowledge”, Downes’ theory of distributed knowledge forms the epistemological foundation for Siemens’ theory of connectivism. Connectivism describes how learning transpires in the digital age as a network-forming process. Put another way, “knowledge and cognition are distributed across networks of people and technology and learning is the process of connecting, growing, and navigating those networks” (Siemens & Tittenberger, 2009, p. 11). The metaphor for connectivism is “our mind [as] a network... an ecology” (a knowledge sharing environment) where individual points of knowledge are distributed across the entire entity, not housed fully in one centralised location or area (Siemens, 2006a). The result is that users are perpetually adapting to the dynamics of the environment and co-creating new structures of knowledge (Siemens, 2006c). Networks exhibit flexibility and responsiveness in a world driven by waves of continual change, and knowledge and learning are viewed as both processes and outcomes of this dynamic. The key principles of connectivism as described by Siemens (2006c, p. 31) are as follows:

1 Learning and knowledge require diversity of opinions to [re]present the whole... and to permit selection of best approach.
2 Learning is a network formation process of connecting specialized nodes or information sources.
3 Knowledge rests in networks.
4 Knowledge may reside in non-human appliances, and learning is enabled/facilitated by technology.
5 Capacity to know more is more critical than what is currently known.
6 Learning and knowing are constant, ongoing processes (not end states or products).
7 Ability to see connections and recognize patterns and make sense between fields, ideas, and concepts is the core skill for individuals today.
8 Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.
9 Decision-making is learning. 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.

Connectivism more accurately mirrors realities of the present era, as manifested in the connection-creating and participative emphasis of the ‘Read/Write Web’ (aka ‘Web 2.0’), which is about information creation, collaboration and sharing. At the centre of connectivism is the notion that learning is a networked phenomenon, shaped and supported by the forces of technology and socialisation:

Connectivism is focused on the process of forming and creating meaningful networks that may include technology-mediated learning, acknowledges learning that occurs when we dialogue with others... The more rapidly knowledge develops the less likely it will be that we will possess all knowledge internally. The interplay of network, context, and other entities (many which are external) results in a new approach or conception of learning. The active creation of our own learning networks is the actual learning, as it allows us to continue to learn and benefit from our network – compared to a course which has a set start and end date. (Siemens, 2006b, “What makes connectivism a theory?” para 4–5)

Siemens and Tittenberger (2009) suggest that current technology supports the tenets of connectivism through the co-creation of learning rather than merely being the logistical vehicle that delivers information:

Today’s social software tools add an additional dimension beyond transporting information. These social tools have essentially become the space, not the conduit for sensemaking. The value of connections formed exceeds the value of the particular information and knowledge flowing through a network at a particular time. Unlike the oil analogy provided, software tools exist not to transport knowledge, but have become the value point themselves. (p. 31)

Thus, the sense of connectedness to other learners may be fostered through the use of social software such as blogs, wikis, social networking sites (see for example www.elgg.org) and other Web-based applications in ways that encourage self-governed, problem-based learning processes while promoting collaboration and community building. According to Downes (2005a), connective knowledge is the emergent knowledge resulting from connections – “A property of one entity must lead to or become a property of another entity in order for them to be considered connected” (“Types of knowledge”, para 2). Whether connectivism is a new learning theory, a simple extension of existing theories (eg Vygotsky’s formulation of social constructivism, Papert’s theory of constructivism, Clark’s theory of embodied active cognition, Lave and Wenger’s typology of a community of practice) or simply a basis for or lens through which to rethink and reframe pedagogy and curriculum for a changing educational landscape has yet to be decided. Nevertheless, connectivism offers a valuable perspective as it integrates principles explored by chaos, network,
Connectivism as a learning theory

In their book on learning in adulthood, Merriam, Caffarella and Baumgartner (2007) define learning in terms of process rather than product. According to them, “Learning is a process that brings together cognitive, emotional, and environmental influences and experience for acquiring, enhancing or making changes in one’s knowledge, skills, values and worldviews” (p. 277). A learning theory, then, is an explanation of what happens when learning transpires. From the perspective of Hill (2002), learning theories are valuable for two chief reasons: they provide a vocabulary and conceptual framework for interpreting what we observe, as well as supplying an orientation to finding solutions. A universal consensus has yet to be reached on which contemporary perspectives constitute learning theories; this section situates connectivism within the recognised learning theories, explores some of the criticisms of connectivism as a learning theory, and examines the contributions of connectivism to explaining how, when and why learning occurs.

Connectivism v traditional learning theories

Following her assertion that there is no single constructivist theory of instruction, Driscoll (2000) questions “whether constructivism is actually a theory or a philosophy” (p. 395). Merriam et al (2007) count Piaget’s cognitive development theory among the traditional learning theories, while Gredler (1997) contests that this work fails to meet the technical definition of a learning theory in spite of its important implications for practice. Likewise, Verhagen (2006) challenges Siemens’ (2004) original article introducing connectivism as a learning theory, suggesting that connectivism fits better at the curriculum level at which the primary concerns are what is learnt and why, rather than serving as a foundation for comprehending how learning fundamentally occurs. Verhagen dismisses connectivism as a learning theory on the grounds that it fails to adequately “explain phenomena… [in ways that are] verifiable. … The principles are not sufficiently linked to the arguments and examples to develop an idea of how the theory could function in practice” (p. 2).

In an attempt to identify the contributions of primary learning theories, Ertmer and Newby (1993) developed a taxonomy that places behaviourist strategies en par with the ‘what’, cognitivist strategies with ‘how’ and constructivist strategies with ‘why’. Siemens (2006b) suggests that connectivism indeed embodies these formative theories, but also adds the element of co-creation of knowledge among and across multiple contexts. He uses Ertmer and Newby’s taxonomy as a basis for articulating how connectivism addresses the five definitive questions distinguishing learning theories (Table 1). In brief, these questions address how learning occurs, identify the key factor(s) influencing learning, assess the role of memory in learning, explain how transfer occurs in the learning process and identify the types of learning best explained by the respective theory.

As indicated in the table, behaviourism rests on three assumptions in its attempt to explain the learning process: observable behaviour, environment-shaping behaviour and contiguity/reinforcement (Merriam et al, 2007). Task-based learning that is reinforced by external consequences, such as learning to drive a car or to operate a new software program by trial-and-error, is the type of learning best explained by behaviourism. Such task-based learning is appropriate in stable environments under which external conditions can be controlled. In contrast, cognitivism perceives learning as primarily an internal process to the individual and its emphasis is centred on the information processing cycle where the construction of knowledge is dependent on how well the information is defined and recalled. In the words of Merriam et al (2007), cognitivism carries the notion that “[L]earning involves the
“reorganization of experiences in order to make sense of stimuli from the environment” (p. 285). With digital information projected to grow at a compound annual rate of 60% (Gantz et al., 2008, p. 3), and in light of the expediting knowledge churn and shortening half-life, the appropriateness of behaviourism and cognitivism for meeting current and future needs comes into question. Connectivism may be a more useful lens through which to view the types of learning associated with a rapidly changing information core, diverse knowledge sources and complex information environment.

Table 1: Comparison to the three dominant learning theories
(Adapted from Ireland, 2007, based on Siemens, 2006b)

<table>
<thead>
<tr>
<th>Issue/question</th>
<th>Behaviourism</th>
<th>Cognitivism</th>
<th>Constructivism</th>
<th>Connectivism</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 How does learning occur?</td>
<td>Black-box, ie observable behaviour is the main focus</td>
<td>In a structured, computational manner</td>
<td>Socially and experientially, with personal meaning created by each learner</td>
<td>Distributed within a network, social, technologically enhanced, through recognising and interpreting patterns</td>
</tr>
<tr>
<td>2 What factors influence learning?</td>
<td>Nature of reward, punishment, stimuli</td>
<td>Existing schema, previous experiences</td>
<td>Engagement, participation, social and cultural factors</td>
<td>Diversity of network</td>
</tr>
<tr>
<td>3 What is the role of memory?</td>
<td>Memory is the hard-wiring of repeated experiences – where reward and punishment are most influential</td>
<td>Encoding, storage, retrieval</td>
<td>Prior knowledge remixed to current context</td>
<td>Adaptive patterns, representative of current state, existing in networks</td>
</tr>
<tr>
<td>4 How does transfer occur?</td>
<td>Stimulus-response</td>
<td>Duplicating knowledge constructs of the ‘knower’</td>
<td>Socialisation</td>
<td>Connecting to (adding) nodes</td>
</tr>
<tr>
<td>5 What types of or approaches to learning are best explained by this theory?</td>
<td>Task-based learning</td>
<td>Reasoning, clear objectives, problem solving</td>
<td>Social, vague (ill-defined)</td>
<td>Complex learning, rapid changing core, diverse knowledge sources</td>
</tr>
</tbody>
</table>

The fourth learning theory, constructivism, views learning as a process of constructing meaning from experience. Constructivists believe that knowledge occurs as a fusion of internal mental models and observation and reflection on external experiences, thus merging the tenets of behaviourist and cognitivist perspectives. However, as Merriam et al. (2007) suggest, “constructivists differ as to the nature of reality, the role of experience, what knowledge is of interest, and whether the process of meaning-making is primarily individual or social” (p. 291). In relationship to constructivism, connectivism views learning as an external phenomenon embedded in socially and technologically enhanced distributed networks where pattern recognition and interpretation facilitate sense-making of proliferating information. The main difference is therefore temporal: while connectivism views knowledge creation as emergent and iterative, constructivism views learning as being based on prior experiences and is largely concerned with how those experiences are brought into current reality.
Criticisms of connectivism

Despite the advantages that connectivism offers for explaining learning in a social and technologically rich networked context, it still has obstacles to overcome. For example, Kerr (2007) expresses only limited support for connectivism, “specifically when it leads educators to teach ‘learning how to learn skills,’ thus giving students the tools they need to construct their own learning” (as cited in Ireland, 2007, “Critics’ placement”, para. 2). Kerr’s chief reservation has to do with Siemens’ (2006c, p. 33) assertion that “[t]he Achilles heel of existing theories rests in the pace of knowledge growth.” In response to Siemens and other commentators who claim new learning theories are needed to reflect the accelerating pace of information growth that is in turn destined to impact the half-life of knowledge, Kerr contends “that at any given time some knowledge is more durable and important than other knowledge – and that the ‘half life of knowledge’ arguments obscures [sic] that fact. [In his view t]his term is provocative and good [as] a discussion starter but needs more analysis” (Kerr, 2007, p. 4). Put simply, the real question is whether the traditional learning theories and/or connectivism deliver value in the two chief areas identified by Hill (2002), namely a conceptual framework for interpreting what we observe and an orientation to finding solutions to problems.

The controversy surrounding the status or otherwise of connectivism as a learning theory has been distilled by Kop and Hill (2008), who characterise connectivism as (p. 2): “a theoretical framework for understanding learning… [t]he starting point for which] occurs when knowledge is actuated through the process of a learner connecting to and feeding information into a self-organized learning community. … In the connectivist model, a learning community is described as a node, which is always part of a larger network… [whose purpose is to] share resources. … Learning transpires through the use of both the cognitive and the affective domains” (p. 2) and is viewed as an active “knowledge creation process… [as opposed to being restricted to passive] knowledge consumption” (p. 2). Furthermore, “[c]onnectivism stresses that two important skills that contribute to learning are the ability to seek out current information, and the ability to filter secondary and extraneous information” (p. 2). Assessing connectivism relative to the established theories, Kop and Hill find linkage to the externalisation elements of Vygotsky’s formulation of social constructivism, the interplay between learner and environment that is a feature of Papert’s theory of constructivism, and the proposition that knowledge and learning are situated within a community of practice as engendered in the work of Lave and Wenger. The strength of connectivism, according to Kop and Hill, lies largely in “using Web-based activity as an example of learning looking through the connectivist lens” (p. 7), given the ubiquity of Internet connectivity and use. Downes’ (2006) framework for distributed knowledge is deemed to “provide a strong philosophical basis” (p. 7) for the connectivist paradigm. In closing, Kop and Hill conclude that connectivism’s current contributions are insufficient to warrant it being treated as a separate and standalone learning theory, but maintain that it “continues to play an important role in the development and emergence of new pedagogies, where control is shifting from the tutor to an increasingly more autonomous learner“(p. 11).

Contributions of connectivism to learning

Siemens (2006c) argues that the dominant learning theories, ie behaviourism, cognitivism and constructivism, fail to recognise the impact that pervasive technological, social and economic change has wrought on society. Learning is no longer confined to an internal process as much of it now occurs externally; it is no longer individualistic but is distributed across groups, communities and networks. Knowledge is not an objective (or end point/state) to be attained; instead, its dynamic nature necessitates that knowledge creation, acquisition, development and refinement are continuous processes. Our competence is derived from the establishment of connections, and technology’s role is front and centre – not supplemental or logistical – as a medium facilitating the learning process. Siemens (2004, “Limitations of behaviorism, cognitivism, and constructivism”, para. 4) poses a number of questions that challenge theorists to consider if and how traditional learning theories reflect the
transformational effects of technology and the revelations of the “new sciences” (chaos, complexity and networks) on learning:

• How are learning theories impacted when knowledge is no longer acquired in the linear manner?
• What adjustments need to [be] made with learning theories when technology performs many of the cognitive operations previously performed by learners (information storage and retrieval)?
• How can we continue to stay current in a rapidly evolving information ecology?
• How do learning theories address moments where performance is needed in the absence of complete understanding?
• What is the impact of networks and complexity theories on learning?
• What is the impact of chaos as a complex pattern recognition process on learning?
• With increased recognition of interconnections in differing fields of knowledge, how are systems and ecology theories perceived in light of learning tasks?

Learning, according to the connectivist approach, is distributed within a network that is both socially and technologically enhanced. This primacy of technological enhancement differentiates connectivism from the more dominant learning theories. For example, pattern recognition and interpretation of incoming information are of prime significance. Diversity of the network is seen as the principal factor influencing learning. The manner in which transfer of learning occurs is through node (ie learning community) connections, additively or multiplicatively. The social aspect of learning is recognised by social cognitivists and constructivists, but not nearly to the extent of identifying networks as foundational. In connectivism, knowledge is an emergent property of neural connectivity resting in the individual, while memory resides in the collective network. In addition to the above, Siemens (2006c) perceives ‘offloading’ as central to a network model of learning. The work of Stephenson (1998) provides an elaboration of the offloading concept, as follows: “Experience has long been considered the best teacher of knowledge. Since we cannot experience everything, other people’s experiences, and hence other people, become the surrogate for knowledge. ‘I store my knowledge in my friends’ is an axiom for collecting knowledge through collecting people” (p. 1). The learner operates in a perpetual mode seeking currency of information to remain ahead of the expedited decay trend.

In a technologically rich social environment, the role of the instructor has been envisioned to become atelier master in imitation of the art studio relationship of master/student (Brown, 2006), as network administrator (Fisher, n.d.), as concierge (Bonk, 2007) and as curator (Siemens, 2007). Moravec (2008) envisions the next stage in the evolution of education to entail moving from the social construction of meaning to that which is both socially constructed and contextually reinvented, as digital technology continues to become increasingly pervasive. In what he terms “Education 3.0”, he believes teaching will continue to include ‘teacher-student’ and ‘student-student’ (peer teaching) modes, but moreover will incorporate ‘student-teacher’ (reciprocal teaching) and ‘people-technology-people’ modes. As such, in many ways, there will be significant blurring of roles as we witness the embodiment of the teacher or instructor as everybody; all individuals will become associates or peers in learning. Moreover, Moravec predicts that the traditional functions of schools, colleges and universities will be thoroughly infused into society, including places and spaces of work and leisure, rather than being confined to physical or virtual classrooms and campuses. The current and future directions of the education and training environment and the theories of distributed knowledge and connectivism are well matched to provide a platform for adapting teaching/training and learning to meet the needs and demands of the 21st-century world of growing information complexity.
Connectivism and workplace e-learning

Despite what is likely to be an ongoing debate on the merits of connectivism as a learning theory in its own right, connectivist principles have specific implications for and applications to workplace learning in general, and workplace e-learning in particular. Downes’ (2005b) concept of ‘E-learning 2.0’ envisions learning and living as merged propositions where “the challenge will not be in how to learn, but in how to use learning to create something more, to communicate” (“E-learning 2.0”, para. 20). In expounding on the concept, Downes raises several pertinent questions regarding online learning:

What happens when online learning ceases to be like a medium, and becomes more like a platform? What happens when online learning software ceases to be a type of content-consumption tool, where learning is ‘delivered,’ and becomes more like a content-authoring tool, where learning is created? The model of e-learning as being a type of content, produced by publishers, organized and structured into courses, and consumed by students, is turned on its head. Insofar as there is content, it is used rather than read – and is, in any case, more likely to be produced by students than courseware authors. And insofar as there is structure, it is more likely to resemble a language or a conversation rather than a book or a manual. (2005b, “E-learning 2.0”, para. 8)

Within work settings, organisational learning and performance initiatives aligned to connectivist principles have the potential to promote and encourage immediacy, applicability, relevance, and knowledge creation and distribution. According to Siemens (2004), “[a]n organizations [sic] ability to foster, nurture, and synthesize the impacts of varying views of information is critical to knowledge economy survival. Speed of ‘idea to implementation’ is improved in a systems view of learning” (“Implications”, para. 1). The key elements of connecting the right people to the right context (knowledge management), nurturing information flows, cultivating trust through interdependencies and enhancing the collective cognitive capability of the organisation are all addressed through connectivism.

Successful negotiation of today’s work and learning environment necessitates the ability to form networks of utility, to locate current information while filtering secondary and extraneous information, and to see connections between fields, ideas and concepts. Thus, it should be the focus of learning design to create a framework for these connections to occur such that shared or distributed cognition is not a novelty but the mainstay of the organisational work process (Hollan, Hutchins & Kirsch, 2000). Siemens (in an interview with Gualtieri, 2009) offers advice on applying the tenets of connectivism to e-learning to support learning and performance in organisations. In the subsections that follow, an attempt is made to extend these suggestions by including practical applications to support learning in global organisations. It is hoped these ideas will serve as a useful starting point for the implementation of connectivist approaches in workplace e-learning practice.

Context

Nothing influences learning design more than the context in which the learning will occur. Thus, situating learning within a usable and highly relevant context is imperative, and as such, e-learning contexts should be realistic and amenable. As information is increasingly represented in specific environments, alternative learning experiences through mobile devices, simulations and virtual worlds become important. For example, a computer-based simulation has been developed to help the United States Military’s ground troops learn Arabic and practise common phrases when entering rural villages in Iraq. Tactical Iraqi (see www.tacticalanguage.com) is an interactive multimedia instruction (IMI) language learning course and ‘serious’ 3D video game that allows learners to carry out a specific mission by controlling an avatar. (An avatar is a computer-based representation of a user through which he or she performs actions in a game, simulation or other virtual environment.) The goal is for
the avatar to use (culturally) appropriate verbal and non-verbal communication in different 
Iraqi settings (eg business, home, on the street) and with different people (civilian, 
non-civilian), including individuals who are sceptical of the avatar’s intentions. The game also 
provides English translations with Arabic syntax and semantics as scaffolding to assist with user 
translation. Each player’s scores or results are calculated and compared to those of other 
players, and performance scorecards are generated so as to allow learners to track their 
progress and learning over time (see also Losh, 2005).

The US Military example is commensurate with the immersive experiences afforded by virtual 
worlds such as Second Life (SL), except that in addition to highly structured, scripted 
experiences, unscripted experiences can be facilitated in real time in SL with multiple users 
creating relationships, situations and dialogue spontaneously. Numerous diverse corporate, 
government and educational organisations such as IBM, The US National Oceanic and 
Atmospheric Administration (NOAA), Stanford University and The UK Open University have 
begun to use SL for learning interventions and events, product development and launches, 
business meetings and customer support experiences. In implementing and attempting to 
realise connectivist principles, organisations can use simulated experiences within the fluid 
and open-ended environment provided by SL that enable users to co-create the 
experiences, resources and outcomes to mirror those of their current reality. By ensuring that 
the structures are flexible, resources and assistance from others can be used in response to 
problems or tasks, ie for just-in-time learning.

Connections

Social networking sites and applications such as MySpace, Facebook, LinkedIn and Twitter 
are becoming popular tools for individuals and organisations to share knowledge and lessen 
personal distance. Many major e-commerce businesses (eg Amazon.com, Wines.com) have 
a MySpace or Facebook presence to help customers feel connected to the product, service 
and/or brand, provide reviews and create almost a ‘cult’ following with other devoted 
customers. Although these tools have yet to become a central part of workplace learning, 
they hold much potential – the processes of sharing, questioning and reflecting with others 
are cornerstones of learning, and thus need to be taken into account in learning design.

Knowledge transfer strategies that help in the creation and sharing of knowledge speak 
directly to this point. In a comprehensive review of such strategies, Dixon (2000) identified five 
primary methods explicitly used by organisations: serial transfer, near transfer, far transfer, 
strategic transfer and expert transfer. Each of these methods supports knowledge sharing for 
the purposes of learning, reflection and redesign/re-engineering of processes. Serial transfer 
involves sharing knowledge that a team has developed or acquired when completing novel 
and/or ambiguous tasks. For example, After Action Reviews (AARs) are a technique that the 
军 military uses to reflect on new learning, successes and failures, and then share findings and 
recommendations for future improvement with others that may find themselves in similar 
situations. Learning professionals in corporate and other sectors can use this method of 
sharing knowledge when considering how to support training transfer for a new training topic, 
type of program or mode of delivery (eg a leadership development training program 
converted from a traditional to an e-learning format). Near transfer involves sharing explicit 
knowledge that a team uses when performing a routine task so that teams doing this work 
can benefit from the knowledge. Examples include sharing best practices and tracking how 
these have been implemented and evaluated. Conversely, far transfer involves making tacit 
knowledge gained from a non-routine task available for others completing similar tasks. For 
instance, British Petroleum’s Peer Assist program is a way for one business unit to ask another 
for assistance rather than relying solely on resources at the corporate level. The peer 
assistance and exchange occur through formal professional or social networking modes (ie 
virtual communities of practice, action learning groups, social sites). Strategic transfer involves 
using the combined, collective knowledge of the organisation to address a strategic task, 
activity or event that occurs infrequently but is of key importance to the organisation (eg a 
merger or acquisition). Finally, expert transfer is a process in which the expertise of the most
knowledgeable people is employed to answer questions from clients or customers, be they internal or external to the organisation. For example, many universities’ Web sites include an “Ask the Expert” section or page that puts anyone with a question about a specific area in touch with a professor or other individual who has been recognised as being knowledgeable in that area.

Each of these examples upholds and echoes Brown and Duguid’s (1991) call for organisations to support and leverage the knowledge-creating processes occurring in interconnected communities within organisations, which are rich sources of connections and hence learning. Brown and Duguid suggest, albeit prematurely ahead of the advanced technologies we now have, the tenets of connectivism in practice: that “[organisational] architecture should preserve and enhance the healthy autonomy of communities, while simultaneously building an interconnectedness through which to disseminate the results of separate communities’ experiments. In some form or another the stories that support learning-in-working and innovation should be allowed to circulate. The technological potential to support this distribution – e-mail, bulletin boards, and other devices that are capable of supporting narrative exchanges – is available” (p. 54). Learning and development (L&D) practitioners can leverage these mediums, which now include blogs, wikis, podcasts, social networking sites and an array of other Web 2.0 and social software tools, to deliver, create and foster reflection on learning experiences within the workplace.

Choice

It is unrealistic to expect designers to be able to anticipate the full spectrum of learner needs. As a result, learner choice is crucial – This must be reflected in terms of variety, pace, modality (eg face-to-face, online, mobile, hybrid) and degree of support (coached/mentored, self-guided). Rather than having pathways through e-learning material detailed and stipulated, learners should have the option to way-find through the use of personal and social networks. According to Siemens, in this model, learners continue to have access to required resources (and their social and information networks) even after a course of study or training program has concluded (Gualtieri, 2009), thereby creating links to lifelong learning. (See also the article by Whitworth in this inaugural issue of Impact, in which the author argues for negotiation between learner and designer perspectives in the design of workplace e-learning.)

In a review of cross-disciplinary contributions to e-learning, Hutchins and Hutchison (2008) propose a three-point, learner-centred design model that is congruent with connectivism. Drawing from extant research in human resource development, instructional communication and educational technology, the authors suggest that the following be considered in designing e-learning courses and interventions; principles of instructional design (including a front-end analysis of learner needs and evaluation outcomes); immediacy strategies that engage learners with the technology, content and other learners; and usability (to assess the learner experience with the technology). Moreover, e-trainers/facilitators also must be aware of the need to encourage learner autonomy and choice, in addition to fostering and supporting the building of connections among e-learning participants. This may have implications for e-trainer competencies, which might include applying relevant learning theories in the design of e-learning courses, using creative processes in deciding on and developing content, providing continuous assessment of the organisational technology infrastructure, and considering the development and delivery of e-learning from a return-on-investment (ROI) perspective. Assessing needs prior to development provides time and scope for the e-learning team to develop competencies to enhance its effectiveness and efficiency, the need for which may call for the organisation to invest in professional development initiatives (Clay, 1999; Waight & Stewart, 2005). The ability to promote user choice in the learning experience, integrate technology into learning activities and foster dialogue with distributed, autonomous learning groups do not only represent essential competencies for instructors, instructional designers and other L&D professionals, but should also be considered an integral part of any employee’s basic skills repertoire if connectivist
principles and approaches are to be effectively incorporated into workplace learning (Siemens & Tittenberger, 2009).

Connectivist strategies in e-learning

Table 2 offers instructors and instructional designers some practical ideas on positioning various types of learning activities and using a range of techniques and technologies/tools to facilitate learner exposure and competency development in ways that are consistent with connectivist principles.

Table 2: Learning activities matched to ‘sense making and knowledge expansion’ tools
(Adapted from Siemens & Tittenberger, 2009, pp. 32–33)

<table>
<thead>
<tr>
<th>Type of activity</th>
<th>What is it?</th>
<th>Media forms</th>
<th>Techniques (how)</th>
<th>Technologies</th>
<th>Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assimilative</td>
<td>processing narrative media, managing and structuring information</td>
<td>lectures; DVDs; reading texts</td>
<td>concept mapping; defining; brainstorming; buzzwords; crosswords; mind maps; Web searching</td>
<td>word processing and presentation software allowing the integration of text, images, audio and video; Web 2.0 and other social software technologies; Web syndication/ aggregation</td>
<td>Mind/concept mapping tools (e.g. CMAP, Inspiration); Google; Office software; blogs; wikis; social bookmarking tools (e.g. Furl); personal Web portals and aggregators/news readers (e.g. Google Reader, Pageflakes)</td>
</tr>
<tr>
<td>Adaptive</td>
<td>environment that changes according to learner input</td>
<td>simulations; games</td>
<td>modelling; simulation; gaming</td>
<td>virtual worlds; computer-based simulations and models; games</td>
<td>Second Life; Massively Multiplayer Online Role-Playing Games (MMORPGs)</td>
</tr>
<tr>
<td>Communicative</td>
<td>discussion and dialogue</td>
<td>asynchronous or synchronous discussions; chats; text messages</td>
<td>reasoning; arguing; coaching; debate; discussion; negotiation</td>
<td>electronic whiteboards; email; discussion boards; chat; instant messaging (IM); Voice over IP (VoIP); video and Webconferencing; Web 2.0 and other social software technologies</td>
<td>online bulletin boards/newsgroups; Skype; AIM; Windows Live Messenger; Breeze; WebEx; Elluminate; Facebook; MySpace; social bookmarking tools; blogs; wikis; podcasts</td>
</tr>
<tr>
<td>Productive</td>
<td>learners producing something</td>
<td>creating; producing; writing; drawing; composing; synthesising; remixing; mash-ups</td>
<td>artefacts/products; reports; theses; essays; wiki entries; blog posts; journals; literature reviews; multiple choice questions; written tests; puzzles; portfolios; voting; learner-created podcasts</td>
<td>creative applications (image editing, CAD, design software); computer-aided assessment; Web 2.0 and other social software technologies</td>
<td>InDesign; Photoshop; YouTube; Google Video; Hot Potatoes; Office software; Sketch; blogs; wikis; podcasts</td>
</tr>
<tr>
<td>Experiential</td>
<td>interactive activities that focus on problem solving</td>
<td>practising; applying; mimicking; experiencing; exploring; investigating; performing</td>
<td>case studies; experiments; lab activities; field trips; games; role-playing; scavenger hunts; task/job performance</td>
<td>virtual lab; 3D immersive environment; augmented reality</td>
<td>Google Earth; MMORPGs: Second Life; custom Web3D/VRML-based tools</td>
</tr>
</tbody>
</table>
Summary and conclusion

Successful negotiation of today’s work and learning environment necessitates the ability to form networks of utility and locate current information while filtering secondary and extraneous information, as well as the capacity to see connections between fields, ideas and concepts. Accepted learning theories do not appear to satisfactorily capture or explain the new realities of distributed, networked learning. As a response to these shortcomings, connectivism has been proposed as an alternative that recognises that knowledge rests in networks where patterns of flexibility and responsiveness are best at adapting to continual change. Now an external as opposed to purely internal phenomenon, learning as viewed as embedded in socially and technologically enhanced distributed networks is a fitting response to a world of growing complexity fuelled by the proliferation of information.

In this article, the tenets of connectivism were reviewed alongside the traditional and recognised learning theories. Support was offered for connectivism as a viable theory for 21st-century learning, while exploring its main critiques and criticisms. The authors also described how current learning experiences in both traditional and e-learning settings reflect and exemplify many connectivist principles, and suggested specific implications for and applications to learning design, deployment and delivery. In brief, organisations need to develop connection-creating, network-forming environments, in addition to enhancing learners’ participative skills and their ability to access and filter as well as create knowledge embedded in the distributed, networked environment. Instructional design must afford the learner the capacity to create self-learning networks, exploiting connections and social learning tools to facilitate the pass-through of external and iterative knowledge. A potential result is that organisational knowledge may flow more easily between users, thus creating enhanced opportunities for unobstructed knowledge creation and transfer.

To address the critics that question connectivism’s true epistemological and pedagogical contribution, it is recommended that further studies seek to actively develop and demonstrate connectivism as a theory. Theory-building is essential to legitimise the primary concepts of an idea through a process by which discernable explanations and representations of observed or experienced phenomena are verified and refined (Lynham, 2000). Connectivism could benefit from this process – Among other things, future research could explore the application of connectivist principles and guidelines across diverse formal e-learning settings. In particular, a study that compares instructional activities based on the traditional learning theories and those based on connectivism, and that examines affective and cognitive learning outcomes in each case, would serve to further validate the efficacy of connectivism as a learning theory. Connectivist principles could also be tested from an organisational learning perspective, focusing on how innovation, quality improvement and organisational development initiatives may be improved and enhanced.

It might also be the case that current workplace learning approaches are more in line with connectivist principles than originally thought or assumed. Action learning, for example, is a proven workplace learning technique that focuses on problem solving. Put simply, action learning engages participants in processes of issue analysis, reflective questioning, active listening and feedback. Its main premise is that the answers to most problems lie within the individuals brought together to consider the problem. Participants are typically from both within and outside the organisation, thus bringing together multiple perspectives and ideas that may help expand the original ‘problem’ assumptions. The ‘network’, be it based on face-to-face interaction or mediated by technology, learns through asking questions, examining assumptions and providing feedback. Marquardt and Waddill (2004) suggest that action learning is characteristic of many of the foundational learning theories, but perhaps connectivism is also at work within this process. Future research might also consider how successful workplace learning initiatives and good or best practices may be better explained through the lens of connectivism, or otherwise analysed through such a lens to reveal new perspectives and insights.
In sum, Wheatley (2006) characterises information as the creative energy of the universe, a form of ‘nourishment’, per se: “[f]or a system to remain alive, for the universe to keep growing, information must be continually generated” (p. 96). The authors believe connectivism offers a useful and powerful theory to aid us in understanding and appreciating how knowledge and learning can be best accommodated in a world of growing information complexity.

References

http://ultiibase.rmit.edu.au/Articles/dec00/hase1.pdf


