Connectivism: Concepts and Principles for emerging Learning Networks

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Abstract
As social technologies continue to expand in influence, they are reshaping not only the learners’ needs, but also the theories and principles of learning processes design: learning models that have served previous generations are replaced for greater relevance to present’s needs. Connectivism views learning as a network creation process, and look at how we might provide ‘learning ecologies’ to meet the learners’ needs. The main connectivist concepts and principles will be further discuss in this paper, allowing us to examine the extent they can instruct designers to create and foster effective learning ecologies.

Keywords: connectivism, social software, learning ecologies, networks

1 Introduction
Instant messaging, blogs, wikis, RSS, VoIP, and other social networking applications are already a steady presence for learners in virtual environments. These are tools supporting connectivity, knowledge sharing, collaboration, and sociability. As social technologies continue to expand in influence, they are reshaping not only the learners’ behaviour and needs, but also theories and principles of learning processes design and evaluation.

There are many questions to be explored in relation to learning theories and the actual impact of the new technologies on learning processes (Siemens, 2005):

- How are learning theories impacted when knowledge is no longer acquired in the linear manner?
- What adjustments need to 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 rapidly evolving information ecology?
- How do learning theories address moments where performance is needed in the absence of complete understanding?
- With increased recognition of interconnections in differing fields of knowledge, how are systems and ecology theories perceived in light of learning tasks?
Furthermore, our basis for the assessment of the efficacy of technology as a learning tool should reflect its ability to facilitate the development of connections, whether those connections are social, cognitive or emotional. In the followings, intents to explore and reflect upon the impact the new technologies has on learning and cognitive development through George Siemens’ concept of connectivism (Siemens, 2003, 2004, 2005).

2 The changing context of learning

Learning is usually defined as a persisting change in human performance or performance potential which must come about as a result of the learner’s experience and interaction with the world. Over the years, nearly every conceivable form of theory explaining the underlying mechanisms of learning have been proposed: from the purely peripheral behaviourism of Watson to the strongly centralist position of cognitive science; from those wholly dependent upon reinforcement such as Thorndike’s or Skinner’s from those who consider concept irrelevant as Guthrie’s; etc.

Learning is a multi-faceted process: the task determines the approach. Often, learning theories are presented as being the only solution to a concern, when in fact even the best theories are only accurate some of the time, in certain conditions. In certain settings, constructivist learning approaches work well (learning new ideas and concepts), in other settings, rote learning is needed (often in compliance training).

“Experience has long been considered the best teacher of knowledge”, states Karen Stephenson from www.NetForm.com. “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.” We can no longer personally experience and acquire learning that we need to act. We derive our competence from forming connections.

2.1 Sociable media

While “social software” has recently emerged as a phenomenon in the tech community, sociable media has been around since the beginning of the Internet: e-mail, mailing lists, Usenet, chatrooms, etc. all captured the imagination of technologists throughout the 1980s and 1990s.

Broadly speaking, the term social software refers not to a single type of software, but rather to the integrated use of various applications and tools that enables people to meet, connect or collaborate through computer-mediated communication and to form online communities. In other words, people form online communities by combining communication modes:

- one-to-one (e.g., email and instant messaging),
- one-to-many (Web pages and blogs),
- many-to-many (wikis).

Common to most definitions is the observation that some types of social software seem to facilitate “bottom-up” community development, where membership is voluntary, reputations are earned by winning the trust of other members, and the community’s mission and governance are defined by the communities’ members themselves.
2.2 Learning as community development

The traditional, top-down view of learning, where a person is given a teaching “position” is changed, through the effective use of communications technology, to an apprenticeship model, where the mature learner chooses the right teacher. Communities formed by “bottom-up” processes are contrasted to the less vibrant collectivities formed by “top-down” software, in which users’ roles are determined by an external authority and circumscribed by rigidly conceived software mechanisms (such as access rights).

It is therefore a total shift in the balance of power that. It depends totally on learners being mature enough to take advantage of it, and teachers being mature enough to accept that their position is fixed only while they are useful to the learners. What is needed, at all levels of education and learning, is an emphasis on developing:

- mature learners, who know how to learn, how to manage information, who to ask, how to find out, and what questions to ask.
- mature teachers, who know how to learn, but also know how to coach and mentor.
- systems and environments that can be used to support learners in their learning process. It's not about creating "programmes", it's about creating "environments" within which a "learning ecology" can flourish.

3 Learning Ecologies

In his article on Growing up digital, John Seely Brown (2002) proposes the concept of ecology as a metaphor to describe a complex learning environment. Knowledge is more than static content. It's a dynamic, living, and evolving state. In this view, an “ecology is basically an open, complex adaptive system comprising elements that are dynamic and interdependent… constantly evolving and largely self-organising”.

A learning ecology is an environment that is consistent with (not antagonistic to) how learners learn. In other words, it is about the creation and delivery of a learning environment that offers opportunities to students to receive learning through methods and models that best support theirs needs, interests, and personal situations. In such a learning environment, the instructor plays the role of “gardener”. A learning ecology must also enable people to connect to each other, to self-organise, to form discussions groups or communities of practice where people can share insights and explore learning topics.

3.1 Specific features

An ecology, as a knowledge nurturing environment could be described by the several characteristics (Siemens, 2003): *informal, not structured* (the system should be flexible enough to allow participants to create learning according to their needs); *tool-rich* (offer many opportunities for users to dialogue and connect); *trust* (secure and safe environments are critical for trust and comfort to develop); *consistency and time* (to create a knowledge sharing ecology, participants need to see a consistently evolving environment); *simplicity* (great ideas fail because of complexity); *simple, social approaches work most effectively* (the selection of tools and the creation of the community structure should reflect this need for simplicity); *decentralized, fostered,*
connected (as compared to centralized, managed, and isolated); high tolerance for experimentation and failure.

A challenge for creating effective learning ecologies is the creation of enhanced information navigation models that simplify and facilitate learners locating and accessing contextually relevant instructional content. In John Seely Brown’s opinion, “the new literacy, the one beyond text and image, is one of information navigation. I believe that the real literacy of tomorrow will have more to do with being able to be your private, personal reference librarian, one that knows how to navigate through the incredible, confusing, complex information spaces and feel comfortable and located in doing that” (2002).

In other words, “knowing what” and “how” is complemented with “knowing where”. Knowing where to find needed information is valued above possessing information, due to how quickly information evolves and changes. The designer’s role in this domain of learning is to create the construct and opportunities for learners to pursue and provide for their own learning.

3.2 Design challenges
The challenge for developing a learning ecology is to define and create an environment that balances the many resources and methods people may apply to their learning. The learning environment should enable instructional design and content elements to be dynamically reorganised into a diversity of pedagogical models that adapts to varying learning needs.

In brief, various components should be present in a virtual learning ecology (Siemens, 2005):
- a space for masters and apprentices to connect;
- a space for self-expression (blog, journal);
- a space for debate and dialogue (listserv, discussion forum, open meetings);
- a space to search archived knowledge (portal, website);
- a space to learn in a structured manner (courses, tutorials);
- a space to communicate new information and knowledge indicative of changing elements within the field of practice (news, research).

4 Learning networks
A network can simply be defined as connections between entities. In the context of a learning ecology, a network represents a way to organize a learning community, resulting into a personal learning network. A network consists of two or more nodes linked in order to share resources. A node is a connection point to a larger network. Learning communities, information sources, and individuals can all be classified as nodes.

The unique needs of each learning experience drive the selection of the learning approach and method. When designers understand how learning occurs, they can foster connections, and make existing connections explicit. The intended task of learning must be matched with the right approach and the right.

4.1 Self-organisation
Learning networks are self-organizing systems. Self-organization can be defined as the spontaneous formation of well organized structures, patterns, or behaviours, from
random initial conditions. Learning, as a self-organizing process requires that the system (personal or organizational learning systems) be informationally open, that is, for it to be able to classify its own interaction with an environment, it must be able to change its structure.

On a personal level, self-organization is a micro-process of the larger self-organizing knowledge constructs created within corporate or institutional environments. A designer or instructor can influence the creation of new nodes, but the receptivity (and the nature of the existing learning network within a learner) will determine how effectively new information is integrated.

4.2 Networks, Small Worlds, Weak Ties
Albert-László Barabási states that, within a network, “nodes always compete for connections because links represent survival in an interconnected world” (2002, p.106). This competition is largely dulled within a personal learning network, but the placing of value on certain nodes over others is a reality. Nodes that successfully acquire greater profile will be more successful at acquiring additional connections. In a learning sense, the likelihood that a concept of learning will be linked depends on how well it is currently linked. Nodes (can be fields, ideas, communities) that specialize and gain recognition for their expertise have greater chances of recognition, thus resulting in cross-pollination of learning communities.

Weak ties are links or bridges that allow short connections between information. Our small world networks are generally populated with people whose interests and knowledge are similar to ours. Finding a new job, as an example, often occurs through weak ties. This principle has great merit in the notion of serendipity, innovation, and creativity. Connections between disparate ideas and fields can create new innovations.

4.3 Chaos and adaptive networks
Chaos, as a science, recognizes the connection of everything to everything. Unlike constructivism, which states that learners attempt to foster understanding by meaning making tasks, chaos states that the meaning exists – the learner's challenge is to recognize the patterns which appear to be hidden.

Networks are adaptive: they constantly adjust and transform in reaction to the world around. Nodes within the network continually update themselves, accruing ongoing benefit to the entire structure. In a sense, we can see this phenomenon in the field of human knowledge growth over the last half-century. The dramatic advancements of science and society can largely be attributed to the increased capacity of people and organizations to connect with each other.

Meaning-making and forming connections between specialized communities are important activities. Chaos is the breakdown of predictability, evidenced in complicated arrangements that initially defy order. This highlights a real challenge: “sensitive dependence on initial conditions” profoundly impacts what we learn and how we act based on our learning. Decision making is indicative of this. If the underlying conditions used to make decisions change, the decision itself is no longer as correct as it was at the time it was made. The ability to recognize and adjust to pattern shifts is a key learning task.
5 Connectivism
George Siemens (2004, 2005) proposes connectivism as a theory of learning that takes into account the way how learning is influenced by the new learning technologies. He starts from the observations that previous theories of learning -- behaviourism, cognitivism or constructivism -- were created during a time when learning was happening in different technological contexts. It is therefore compulsory that learning models that have served previous generations are replaced for greater relevance to present’s needs, which include technology and connection making as learning activities. As a learning theory, connectivism provides insight into the dynamics of networks, environments, and ecologies that supports a continual learning process. In this view, learning is strongly a networked process where a learner aggregates external contents into a holistic representation.

5.2 Principles of connectivism
Connectivism integrates principles explored by chaos, network, and complexity and self-organization theories (Siemens, 2005). In this view, learning is a process that occurs within nebulous environments of shifting core elements -- not entirely under the control of the individual. Learning is a process of drawing connections between seemingly disparate pieces of data in order to form a more complete comprehension of a subject; nurturing and maintaining connections is needed to facilitate continual learning; ability to see connections between fields, ideas, and concepts is a core skill. Learning (defined as actionable knowledge) can reside outside the learner (within non-human appliances as an organization or a database), is focused on connecting specialized information sets, and the connections that enable people to learn more are more important than their current state of knowing. Capacity to know more is more critical than what is currently known. “Know where” replaces “know what” and “know how”.

Connectivism is driven by the understanding that decisions are based on rapidly altering foundations: new information is continually being acquired. Consequently, the ability to draw distinctions between important and unimportant information is vital. The ability to recognize when new information alters the landscape based on decisions made yesterday is also critical. 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.

5.3 Network Learning and the Individual
Individual is the starting point of connectivism: personal knowledge is comprised of a network, which feeds into communities, organizations or institutions, which in turn feed back into the network, and then continue to provide learning to individual. This cycle of knowledge development (personal to network to organization) allows learners to remain current in their field through the connections they have formed. Landauer and Dumais (1997) note that “people have much more knowledge than appears to be present in the information to which they have been exposed”; moreover, “some domains of knowledge contain vast numbers of weak interrelations that, if properly exploited, can greatly amplify learning by a process of inference”. The value of pattern
recognition and connecting learners own “small worlds of knowledge” are apparent in
the exponential impact provided to personal learning.

One of the biggest challenges of connectivism is a real simple fact: learners cannot
be expected to function in new spaces and structures without developing required
skills. They need to know what’s important (filtering information, or relying on trusted
filters); to seek out and re-purpose learning and knowledge and apply to new spaces; to
balance work, life, and value the learning and knowledge of each domain. These are
functions of the new skills needed.

The network itself is the critical learning element. Connecting learners to networks
and communities ensures that knowledge is relevant and current. Within social
networks, hubs are well-connected people who are able to foster and maintain
knowledge flow. Creating, preserving, and utilizing information flow should be a key
learning activity. Knowledge flow can be contrasted to a river that meanders through
the ecology of a learning community. In certain areas, the river pools and in other areas
it ebbs. The health of the learning ecology depends on effective nurturing of
information flow. Their interdependence results in effective knowledge flow, enabling
the personal understanding of the state of activities organizationally.

6 Conclusions
Connectivism is a powerful idea. John Seely Brown (2002) presents an interesting
notion that the internet leverages the small efforts of many with the large efforts of
few. The central premise is that connections created with unusual nodes supports and
intensifies existing large effort activities. This amplification of learning, knowledge
and understanding through the extension of a personal network is the epitome of
connectivism.

A real challenge for any learning theory is to actuate known knowledge at the point
of application. When knowledge, however, is needed, but not known, the ability to
plug into sources to meet the requirements becomes a vital skill. As knowledge
continues to grow and evolve, access to what is needed is more important than what the
learner currently possesses.

The connectivist view of learning as a network creation process significantly
impacts the way learning is designed and developed. While the act of learning is seen
as a function under the control of the learner, designers need to shift the focus to
fostering the ideal ecology to permit learning to occur. By recognizing learning as a
messy, nebulous, informal, chaotic process, we need to rethink how we design our
instruction. Blogs, wikis, and other open, collaborative platforms are reshaping
learning as a two-way process. Instead of presenting content/information/knowledge in
a linear sequential manner, learners can be provided with a rich array of tools and
information sources to use in creating their own learning pathways. Many in education
are beginning to venture into this transitory stage. There is a clear movement from
formal, rigid learning into an environment of informal, connection-based, network-
creating learning. The instructor or institution can still ensure that critical learning
elements are achieved by focusing instead on the creation of the knowledge ecology,
while the links and connections are formed by the learners themselves.

The developing structure of technology, neural research, institutional
reorganization (from hierarchy to network), and social impact of learning under new
ideologies, is evolving too rapidly to be effectively detailed as “this is what it is” (Siemens, 2004). The moment this declaration is made, the environment has shifted. Those theorists most closely aligned with the new landscape are also those who most readily acknowledge that the process is one of coming to know, rather than of knowing. Learning is an in-process activity; knowing is no longer a destination, but a process of walking in varying degrees of alignment with a dynamic environment.

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