LEARNING AND TEACHING IN DIGITAL AGE

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Abstract:

Purpose – This paper seeks to describe the theory of connectivism as a learning foundation to provides a useful framework for understanding how students learn in digital age.

Design/methodology/approach – The paper explores the theory of connectivism and reviews established learning theories including the design of teaching-learning in the clasroom. The authors discuss new learning landscapes in digital age that is in parallel with the principles of connectivism.

Findings – The paper suggests the need for a unifying theory of students' learning approach in digital age and their skills.

Originality/value – The paper encourages critical inquiry into the ways that emerging theory of connectivism can improve teachning-learning in digital age.

Keywords: Connectivism, Learning ecology, Network learning, Instructional design.

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Introuduction:

The information technology revolution has changed the modes of doing business, services and products, work, and the processes of learning (Fenwick, 2001). A consequence of the global economy work also requires a different training and preparation approaches (Merrian et al., 2006). In this context, learning strategies and education are changing dramatically. The educational institutions are part of the market, selling knowledge as a product in a competitive environment. Therfore, students consider themselves mostly as customers rather than learners (Merrian et al., 2006).

Educational programs are using technologies as an essential tool in a learning experience. During the last several decades, the online programs have increased. Online-based education has expanded the opportunities of learning in formal, no formal and informal settings (Merrian et al., 2006). This atmosphere of change also involves what, how and where people are learning. As a result, the ways of learning are changing.

Siemens (2005) developed a learning theory which was contextualized in a digital era characterized by the influence of technology in the field of education. The technological development and social software have significantly altered the way to access the information and the knowledge, and dialogue with the instructor and each other (Siemens, 2008). Web 2.0 causes a change from classical epistemology of education to a new epistemology, based on active learning pedagogies, constructivism, situated teaching, co-creation of knowledge, peer review, and new forms of assessment (Dede, 2008). This complex and often contradictory environment emerges the connectivism as a new learning theory in digital age.

However, some authors argue that connectivism should not be considered a new theory of learning (Kerr, 2007; Kop & Hill, 2008). It is possible to position it as the development of constructivism to the current scenario of the use of technology in education, functioning though as a philosophy of education. The purpose of this paper is to re-consider the connectivism by drawing connections between educational philosophy and the learning ecology. The concept of connectivism learning theory will be discussed as a potential model for describing the ways in which learning can evolve beyond traditional instructional context. Finally, the implications of that in the learning will be detailed.

1.Learning Theories; Connectivism:

Any consideration of learning requires a review of existing theories. Smith (1999) stated that a learning theory can help us to think about how and why change (in learning) happens.

Driscoll (2000) categorizes learning into three broad epistemological frameworks: 1) Objectivism in which the reality is external and objective- and- knowledge is gained through experiences; 2) Pragmatism in which the reality is provisional, and knowledge is negotiated through experience and thinking; and 3) Interpretivism in which the reality is internal, and knowledge is constructed. These epistemologies in turn form the foundation of the most common theories of learning behaviorism, cognitivism, and constructivism (built on the epistemological traditions)that attempt to address how a person learns.

Gredler (2005) stated that behaviorism was comprised of several theories that found in the epistemological orientation of empiricism that made three assumptions about learning: 1) Observable behaviour is more important than understanding internal activities; 2) Behaviour should be focused on simple elements: specific stimuli and responses; and 3) Learning is about behaviour change.

Mergel (1998) stated cognitivists found in the epistemological orientation of nativism observe changes in behavior and attempt to comprehend what is happening inside the mind of a learner. Learning is viewed as a process of inputs, managed in short term memory, and coded for long-term recall.

Cognitivists see learning as an information processing. The computer is often used as a metaphor for learning (Driscoll, 2000). As Driscoll said the roots of constructivism could be found in the epistemological orientation of rationalism, where knowledge representations do not need to correspond with external reality. In constructivism, learners create knowledge as an attempt to understand their experiences. These three structures of valid knowledge sources provide the basis for reflecting on what it means to learn or know. Educational theories and models are built based on these views of knowledge.

The behaviorism and cognitivism view knowledge as an external accessory to the learner and the learning process is considered as the act of internalizing knowledge. In fact, constructivism

assumes that learners are not empty vessels to be filled with knowledge. Instead, learners are actively involved to create meaning. Learners often select and pursue their own learning. Constructivist principles acknowledge that real-life learning is messy and complex. Classrooms which emulate the "fuzziness" of this learning will be more effective in preparing learners for life-long learning.

Traditional views of learning have been questioned for the last several years (Downes, 2005; Siemens, 2004). The limits of traditional views of knowledge wereaccentuated with the development of the technology. Instead of seeing knowledge as innate, a function of reasoning or experience, connectivism and connective knowledge present an alternative source of valid knowledge.

At the same time, technology has reorganized how we live, how we communicate, and how we learn. Learning needs and theories that describe learning principles and processes should be reflective of underlying social environments. For example, it emphasizes that "learning must be a way of being – an ongoing set of attitudes and actions by individuals and groups that they employ to try to keep abreast of the surprising, novel, messy, obtrusive, recurring events…" (Vaill, 1996).

Therefore, Downes (2006) added a fourth epistemology: the view of knowledge as composed of connections and network. A network is defined as connections between entities (nodes), where the nodes can be individuals, groups, systems, fields, ideas or communities, with a set of broad guiding statements. Knowledge in the network is seen as decentralized where knowledge is too diverse and flows too rapidly to be held in the human mind. The concept of emergent, connected, and adaptive knowledge provides the epistemological framework for connectivism (Siemens, 2004) as a learning theory.

Connectivism is a new theory of learning that takes into account the way how learning is influenced by the new learning technologies. It draws on Snowden's four ontologies of knowledge (simple, complicated, complex and chaotic). Thus, connectivism integrates principles explored by chaos, network, and complexity and self-organization theories (Siemens, 2005). Within connectivism theory, learning is considered to be a process in which, the role of informal information exchange is organized into networks and supported with electronic tools. Learning

becomes a continuous, life-long system of network activities, embedded into other activities" (Bessenyei, 2007).

Connectivism new learning theory showed the potential to significantly improve education through the revision of educational perspectives and generated a greater shift toward learner-centered education (Siemens, 2004). The theory allows for instructors to step back from controlling course content, by pass textbooks and traditional lecture presentations and bring learners to the forefront in locating, presenting and making sense of relevant knowledge. When knowledge is no longer expert-centered and content and conversations are continuous, growth and learning can occur for all classroom participants, including the instructor. But, there are other factors that may affect the development of a new learning theory, namely "how we teach, how we design curriculum, the spaces and structures of learning, and the manner in which we foster and direct critical and creative thought in our redesign of education" (Siemens, 2006).

Therfore, connectivism is mainly concerned with cognitive development, and as such does not concentrate on explaining how connections to networks may be interpreted in relation to physical maturation or the changes that occur over time via a person's exposure to, and interaction, with the social world. This is particularly the case where explaining behavioural performance and moral development in specific contexts is concerned.

2.Learning Ecology:

According to Brown (2002), a learning ecology is an environment that is consistent with (not antagonistic to) how learners learn. In other words, it involvesthe creation and delivery of a learning environment that offers opportunities to students to receive learning through methods and models that best support their needs, interest, and personal situation. Thus, a learning ecology must 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 (Siemens, 2006). In such a learning environment, the instructor plays the role of "gardener".

As Siemens (2003) stated, the ecology as a knowledge nurturig environment could be described by the several characteristcs: 1) informal, not structured (the system should be flexible enough to allow participants to create learning according to their needs); 2) tool-rich (offer many

opportunities for users to dialogue and connect); 3) trust (secure and safe environments are critical for trust and comfort to develop); 4) consistency and time (to create a knowledge sharing ecology, participants need to see a consistently evolving environment); simplicity (great ideas fail because of complexity); 5) simple, social approaches work most effectively (the selection of tools and the creation of the community structure should reflect this need for simplicity); 5) decentralized, fostered,experimentation and failure.

Moreover, to facilitate the interaction within ecologies, both synchronous and asynchronous tools are essential as extensions of course environments. These tools are Blogs, Wiki, RSS, among others. Blogs are on-line social networking tool which allows for the exchange of information between individuals (William, 2008). They can be collaborative spaces where people negotiate and construct meaning and text (Richardson, 2006). This social networking tool encourages a way of thinking beyond each learners isolated experience. The online tools before mentioned are currently belong to the domain of the so called web 2.0 which facilitate a more socially connected Web where everyone is able to add to and edit the information space (Anderson, 2007).

On the other hand, learning environment should enable instructional design and content elements to be dynamically reorganised into a diversity of pedagogical models that adapts to variouslearning needs. The different components should be present in a virtual learning ecology such as 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); and a space to communicate new information and knowledge indicative of changing elements within the field of practice (news, research) (Siemens, 2005). As a result, learning ecology is open, complex, adaptive, dynamic, interdependent environment, and self- organized.

3.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 in 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.

The incorporation of network nodes is the learning structure. Each personal network is enhanced by adding new nodes and connections. Learning is not an isolated experience, rather is an experience of combining and connecting separates nodes of knowledge. 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.

The networks in which people communicate can be small or big, but the main characteristics for networks to support knowledge development will be that they are diverse, open, autonomous, and connected (Downes, 2007). There are parallels with Illich's (1970) educational vision of the 1970s, particularly his idea of 'community webs.' Online networks also come together as interest groups of autonomous participants, but Illich envisaged his webs in community settings and aimed at bringing local people together with learners and 'people with knowledge.' Online networks might be open and may facilitate connections, but local culture and values cannot be incorporated all that easily as the online networks are global, with diverse participants, each bringing his or her own ideas and background to the fore. This might stimulate debate, but the local community and its development would be of less importance than the dominant culture on the network.

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

4.Pedagogic activities:

William (2008) considered allowing students to connect to the internet in the classroom, and encouraged sharing information in the network, connecting with other and using different methods for critical evaluation of the information available. Siemens (2006) pointed out that a learner must be able to see relevance which was defined as the degree to which a resource matches an individuals needs. Relevance is crucial. If the relevance exists a learner motivation will increase. The relationship between the course content and the learner needs should be closely tied for an effective learning process. Also, in this social process, community and collaborative approaches are as important as exposure to the subject matter.

5.Teacher's role:

The role of the teacher and the process of instruction have been under pressure to change for over a century (Egan, 2002). Teachers today face challenges relating to: a) defining what learning is; b) defining the process of learning in a digital age; c) aligning curriculum and teaching with learning and higher level development needs of society (the quest to become better people); and d) reframing the discussion to lay the foundation for transformative education—one where technology is the enabler of new means of learning, thinking, and being.

Bonk (2007), stated that teacher's must assume dual roles: as experts with advanced knowledge of a domain and guides who foster and encourage learner exploration. In the other side, create learning resources that expose learners to the critical ideas, concepts, and papers within a field. While learners are free to explore, they encounter displays, concepts, and artifacts representative of the discipline. Their freedom to explore is unbounded. But when they engage with subject matter, the key concepts of a discipline are transparently reflected through the curatorial actions of the teacher (Siemens, 2006). Instead of controlling a classroom, a teacher now influences or *shapes a network.* The following are roles teacher play in a network learning environments:

1. Amplifying
2. Curating
3. Wayfinding and socially-driven sensemaking
4. Aggregating
5. Filtering
6. Modelling
7. Persistent presence

Amplifying

In networks, teachers are one node among many. Learners will, however, likely be somewhat selective of which nodes they follow and listen to. Most likely, a teacher will be one of the more prominent nodes in a learner's network. Thoughts, ideas, or messages that the teacher amplifies will generally have a greater probability of being seen by course participants. The network of information is shaped by the actions of the teacher in drawing attention to signals (content elements) that are particularly important in a given subject area.

Curating

A curator is an expert learner. He creates spaces in which knowledge can be created, explored, and connected. While curators understand their field very well, they don't adhere to traditional in-class teacher-centric power structures. A curator balances the freedom of individual learners with the thoughtful interpretation of the subject being explored.

The curator, in a learning context, arranges key elements of a subject in such a manner that learners will "bump into" them throughout the course. Instead of explicitly stating "you must know this", the curator includes critical course concepts in her dialogue with learners, her comments on blog posts, her in-class discussions, and in her personal reflections. As learners grow their own networks of understanding, frequent encounters with conceptual artifacts shared by the teacher will begin to resonate.

Way-finding and socially-driven sense-making

The experience of way-finding is now augmented by social systems. The *network becomes a cognitive agent* in this instance ; helping the learner to make sense of complex subject areas by relying not only on her own reading and resource exploration, but also by permitting her social network to filter resources and draw attention to important topics. In order for these networks to work effectively, learners must be conscious of the need for diversity and should include nodes that offer critical or antagonistic perspectives on all topic areas. Sense-making in complex environments is a social process.

Aggregating

Aggregation showed so much potential while it has delivered relatively little over the last decade. Pageflakes, iGoogle, and Netvibes have largely plateaued innovation in aggregation.Aggregation should do the same; reveals the content and conversation structure of the course as it unfolds, rather than defining it in advance.

Filtering

Filtering resources is an important teacher's role, but as noted before, effective filtering can be done through a combination of way-finding, social sense-making, and aggregation. however, expertise still matters. Teacher's often have years or decades of experience in a field. As such, they are familiar with many of the concepts, pitfalls, confusions, and distractions that learners are likely to encounter. Filtering can be done in explicit ways ; such as selecting readings around course topics(or in less obvious ways) such as writing summary blog posts around topics. The teacher assists in the process by providing one stream of filtered information. The student is then faced with making nuanced selections based on the multiple information streams he encounters. The singular filter of the teacher has morphed into numerous information streams, each filtered according to different perspectives and world views.

Modelling

Modelling has its roots in apprenticeship. Learning is a multi-faceted process, involving cognitive, social, and emotional dimensions. Knowledge is similarly multi-faceted, involving declarative, procedural, and academic dimensions. Apprenticeship learning models are among the most effective in attending to the full breadth of learning. Apprenticeship is concerned with more than cognition and knowledge (to know about). it also addresses *the process of becoming* a carpenter, plumber, or physician. The learning activities alone can be addressed through modelling by the teacher.

Persistent Presence

The teacher's needs a point of existence online; a place to express herself and be discovered, a blog or a profile in a social networking service. Twitter is likely a combination of multiple services. Without an online identity, you cannot connect with others to know and be known. Teaching well in networks or weaving a narrative of coherence with learnersrequires a point of presence. As a course progresses, the teacher provides summary comments, synthesizes

discussions, provides critical perspectives, and directs learners to resources they may not have encountered before. Persistent presence in the learning network is needed for the teacher to amplify, curate, aggregate, and filter content and to model critical thinking and cognitive attributes that reflect the needs of a discipline.

6.Technology role:

Connectivism learning theory is often referred to as networked learning but connectivism is about more than just the technology used to achieve the end result. Technologies and tools referred to as web 2.0 software (Hinchcliffe, 2006; O'Reilly, 2006; Fallows, 2006). Web 2.0 is a second phase of the evolution of the World Wide Web in which developers have created Web sites that act like desktop programs and encourage collaboration and communication between users. We focus on the characteristics of the Web 2.0 applications, highlighting the social perspective of relation, collaboration and user participated architecture (McFedries, 2006):

1. Content is user-created and maintained (peer production, user-content ecosystem);
2. User-created and maintained content requires radical trust;
3. Application usability allows rich user experience;
4. Combining data from different sources leads to creation of new services;
5. Services get better as the number of users increase in an architecture of participation.

With 25 years of technological advances and some degree of successful technology integration throughout the curriculum, most practitioners have come to realize that technologies can be used to assist, support, or enhance any aspect of learning" (Allen, 2008).

Connectivism is not the final statement in educational theory. As digital technology evolves and new methods for integrating instructional technology in the college classroom emerge, new learning theories will develop. Perhaps the human mind is being rewired to process information differently in light of our affinity with digital technology and the networked learning process. This is an exciting time to be involved in education as radical shifts in educational technology and e-learning are certain to occur over the next ten years. It will be a challenge for educators to help students navigate the continual deluge of digital information and teach them how to judge with a critical eye. Connectivism allows the future of education to be viewed in an optimistic, almost utopian, perspective as individuals co-create knowledge in a global society.

7.Instructional Designer

The previous consideration of roles of educators was largely conceptual. While equally conceptual, the roles of instructional designers flow from changes to teaching and learning. Availability of open education resources, increased complexity of technology choices, and ongoing dialogue on different pedagogical models all place substantial pressure on the educator. It is not realistic to expect subject matter experts to be well-versed in different technologies, pedagogies, and open content sources. The critical role of the instructional designer is to be an educator to educators.

8.A Model for an Effective Learning Experience

We here to illustrate a four model in the connectivist environment:

1. the online collaboration model presented in (Calvani, 2005)is the starting point of our analysis. this model accounts for effectiveness conditions and principles which are considered to be fundamental for collaboration as highlighted in reference literature (Dillenboug *et al.*, 1996). However, while in (Calvani, 2005) the model was conceived to provide useful steps to support an online collaborative group, the model was rooted in a formal educational context;
2. The second model studied is the one presented in (Ranieri, 2006). This model accounts for individual and collaborative knowledge construction processes but it is not specifically conceived to be focused on telematic environments and does not account at all for collaboration enabling conditions.
3. The third and fourth models are those presented in (Pettenati & Ranieri, 2006a) and then in

(Pettenati & Ranieri, 2006b) in which the authors tried to focus on framing the reasoning in a social networking context in order to account for the benefits of informal learning and online collaboration, as described above. Nonetheless that model did not account for the knowledge flow (or learning stages) occurring in an online learning experience, thus being only partially helpful in the design of a learning experience.

After having confronted the previous three models with the knowledge flow presented in (Siemes, 2007) the idea of the model was re-purposed in light of the "connectivist" idea of the author's

work, thus leading to a new design of the model now focused on highlighting the possible stages on an effective connectivist learning experience. In this new version the schema can provide more concrete help in the design of online learning activities.

Summary

In this paper we tried to provide our idea of the current educational system shaped by new technology and practice of the "Knowledge Society" to locate the role of learning and learners in a connctivism environment. In Connectivism ideas, people within an organization are learning on and through the network. The learning of the whole group is greater than the learning of individuals, learning capability ensure the organization survive in a turbulent environment (Merrian *et al.*, 2006).

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. New technologies such as the 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.

When knowledge is seen as existing in networks, and learning as forming and navigating these networks, many existing aspects of academia are subject to change. First, teachers interact with learners and content in a different manner. The internet has caused a power shift in classrooms, as learners now have greater access information, experts, and peer learners. Secondly, instructional designers, due to the developing complexity of tools and availability of open education resources, play an educational role of directing educators to tools and resources. These two foundational changes, while presented here as a conceptual discussion and in need of additional experimentation and evaluation, may serve as levers for broader changes within the academy.

Our views of learning, as the basis of a new approach to designing and fostering learning, are most useful when they are in line with the changed environment. But, before education can lead

to meeting challenges requested by society, it must first rethink and reconsider its view of learning and knowledge, as well as its approach to teaching.

However, it is necessary to develop more research about the Connectivism as a learning theory, in order to contribute to the discussion about its status as a learning theory. Future research may consider the application of the Connectivism's principles and their strengths and weaknesses in formal and no formal learning experiences. This is particularly applicable in schools programs and training in skills development in the workplace because these fields appear to be more affected by the current economical and technological trends. Also, future research may analyze the impacts of the Connectivism's principles on the educational field in terms of teacher performance, especially in the context of open market societies. I would suggest that the above possible research topics should consider social environment which is characterized by unequal distribution and access to the technologies, as many technological services are oriented towards profit.

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