Connectivism as a Learning Theory for the Digital Age

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Abstract

George Siemens and Stephen Downes developed a theory for the digital age, called connectivism, denouncing boundaries of behaviorism, cognitivism, and constructivism. Their proposed learning theory has issued a debate over whether it is a learning theory or instructional theory or merely a pedagogical view. While the theory presented is important and valid, is it a tool to be used in the learning process for instruction or curriculum rather than a standalone learning theory? It has also forced educators to look at what is being done in digital education and rethink, debate, and philosophize over how each part fits.   Continually evaluating how each new generation learns with regard to instruction and curriculum serves to hold education to high standards. Certainly this theory is worth our thorough consideration.

Connectivism as a Learning Theory

George Siemens and Stephen Downes developed a theory for the digital age, called connectivism, denouncing boundaries of behaviorism, cognitivism, and constructivism. Their proposed learning theory has issued a debate over whether it is a learning theory or instructional theory or merely a pedagogical view.

What are the essential criteria for something to be a learning theory?

A theory generally applies to the synthesis of a large body of information. The criterion of a theory is not whether it is true or untrue, but rather whether it is useful or not useful for explaining or predicting behavior. A theory is useful even though the ultimate causes of the phenomenon it encompasses are unknown. A theory can be refined, or with new information, it can take on a new direction.

If thoroughly tested, a theory may be widely accepted for a long period of time but later disproved (Dorin, Demmin, & Gabel, 1990). So a useful theory of learning must have resulted from considerable testing and observation. In the evaluation of the quality of a theory, one must consider several other criterions as well. The criterion of falsiability, developed by Sir Karl Popper, requires that a researcher carefully examine any negative evidence that proves their conclusions untrue. Additionally, a rule of parsimony is the preference of simple theories over highly complex ones (Johnson & Christensen, 2004).

What are the essential criteria for something to be an instructional theory?
An instructional theory, on the other hand, must prescribe procedures to enable learning efficiently and effectively. According to Jerome Bruner (1966) an instructional theory should

deal with four major elements: (1) the learning predisposition, 2) the design of concepts to be presented and its structure for ease of understanding, (3) the most successful progression of ideas in which to present a body of knowledge, and (4) the administration of rewards and punishments. Therefore, an instructional theory focuses on the overall structure of learning material for the most successful learning experience. As a result of Benjamin Bloom's *Taxonomy of Education Objectives* from 1956, instructional theory enabled the educator to code the learning process (Bloom, 1984). This spawned a series of instructional theorists such as Robert Gagne, who published *Conditions of Learning* in 1965 for the Florida State University's Department of Educational Research.

From the late 1970s, instructional theory has been traditionally split into two categories: behaviorism and cognitivism. B. F. Skinner's behaviorist theories were popular, because they could be evaluated using the new categorization kind of process, were as it was more difficult to demonstrate a cognitive learning result. In opposition, Paulo Freire's *Pedagogy of the Oppressed* criticized the idea of an educational model being "banked". Much like Bruner's definition of instructional theory, Schott and Driscoll (1997) formulated a proposal for a universal instructional theory. Four components for an instructor and designer to consider were: (1) the learner, (2) the learning task, which includes learning outcome goals, (3) the conditions and instructional methods for learning, the overall environment, and (4) a frame of reference for specific learning. "Therefore, the purpose of instructional theory is to be prescriptive, to provide principles by which teachers and instructional designers can assure learning" (Driscoll, p. 353).

Robert M Gagne more clearly defined instructional theory during World War II for the process of training pilots in the Air Force. He later developed a sequence of requirements that codify what educators should use for instruction. Gagne is considered to be the foremost researcher and contributor to the organized approach to instructional theory. His major input to the theory of instruction was his model for "Nine Events of Instruction" from his book, *The Conditions of Learning: Training Applications* in 1996.

1. Gaining attention
2. Informing learners of the objective
3. Stimulating recall of prior learning
4. Presenting the content
5. Providing learning guidance
6. Eliciting performance
7. Providing feedback
8. Assessing performance
9. Enhancing retention and transfer

Robert Gagne is regarded as the leading researcher to a methodical approach to instructional design and teaching. Since the focus is on behaviors as the outcomes that result from specific training, his followers are regarded as behaviorists (Gagne & Medsker, 1996).

What are the differences between a learning theory and an instructional theory?
What might not have been clearly obvious is that learning theory differs from instructional theory in that learning theories describe how learning essentially occurs, while instructional

theories explain how to achieve the preferred learning outcomes. One may reflect on the idea that cognitive theory is the leading theory in instructional design and many of the instructional strategies promoted and used by behaviorists are also used by cognitivists, but for a different purpose. For example, behaviorists evaluate a learner to assess prior knowledge, while cognitivists evaluate a learner to establish their predisposition to learning (Ertmer & Newby, 1993). Therefore, instructional design can be viewed from a behaviorist or cognitivist approach instead of the constructivist approach. Designing instruction by using a behaviorist or cognitive approach requires the educator to analyze the situation and then set specific goals. These goals are broken down into learning objectives and are further broken down into individual tasks. Assessment is based on whether specific criteria for each objective have been met. Instructional designer defines what the learner should know. Evaluation could be based on tests for mastery learning.

The constructivist approach, on the other hand, requires that the instructional designer produce a result that is more facilitative than specific. Knowledge gained is not pre-specified for the learner and evaluation is more subjective, since it does not rely on specific quantitative criteria. Results are obtained from the process and self evaluation of the learner instead. Evaluation could be based on notes, projects, or journals. Because the learner can understand numerous realities, the learner is better able to deal with real life circumstances. If a learner can problem solve, he or she may be better able to apply existing knowledge to a new situation. A learning theory tries to classify what is known about learning. It has two central values for the researcher or instructor. Learning theories provide a conceptual framework and vocabulary to enable observations to be interpreted and understood. By using this commonality, those involved in the learning process can effectively explain what is observed and build or develop new ways to provide more meaning. Second, a learning theory provides a resource for the educator to solve a practical problem with a practical solution. (Merriam & Caffarella, 1991)

What is connectivism?

Stated simply, connectivism is social learning that is networked. Stephen Downes described it as, "… the thesis that knowledge is distributed across a network of connections, and therefore that learning consists of the ability to construct and traverse those networks" (Downes, 2007). Connectivism is characterized as a reflection of our society that is changing rapidly, complex, connected socially, global, and mediated by increasing advancements in technology. It is the orchestration of a complex disarray of ideas, networked to form specific information sets. Ways of knowing are derived from a diversity of opinions. The individual does not have control; rather it is a collaboration of current ideas as seen from a present reality. The core skill is the ability to see connections between information sources and to maintain that connection to facilitate continual learning. Decisions are supported by rapidly altering fundamentals as new information is quickly integrated to create a new climate of thinking. This constant update and shift of knowledge also can be contained outside the learner, such as in a database or other specialized information source. For the learner to be connected to this outside knowledge is more important than his or her existing state of knowing. The first point of connectivism is the individual. Personal knowledge consists of a system of networks, which supplies an organization, which in turn gives back to the system. The individual continues the cycle of knowledge growth by his or her access back into the system. The advantage is that the learner can remain current on any topic

through the connection they have created. Within any defined social network, there is a focus for groups of people with a common goal. They can promote and sustain a well-organized flow of knowledge (Siemens, 2004).

Why Connectivism is a new learning theory for a digital age

Siemens stated that, "Exponentially developing knowledge and complexification of society requires nonlinear models of learning (process) and knowing (state). We cannot sustain ourselves as learning/knowing beings in the current climate with our current approaches" (Siemens, 2009). With increasing technological connection through the internet, digital cities that collaborate on a wide array of topics have become a collective network that links communities both locally and globally. This paradigm shift and proliferation of social networks have caused educators to embrace this new option for knowledge for use in the classroom.

From his viewpoint, Siemens (2006) pointed out that knowledge has changed from categories and hierarchies to networks and various ecologies. Knowledge is based on the two ideas that it explains some part of our existence, and that the knowledge is useful for some kind of action. "Viewing learning and knowledge as network phenomena alters much of how we have experienced knowledge in the last century" (Siemens, p. vii). Concepts can be viewed much like a mind map, as a network, rather than as a linear progression of ideas. He asserts that this networking is the manner that an individual receives learning. Therefore, with such a dramatic change that is continually developing through technology, its institutions and schools are all, "stretching under the heavy burden of change. New epistemological and ontological theories are being formed…" (Siemens, p. 3).

Why Connectivism is considered to be a learning theory

Connectivism could be a learning theory for the following reasons. First, connectivism is characterized as, "the amplification of learning, knowledge, and understanding through the extension of a personal network" (Siemens, 2004). It is only through these personal networks that the learner can acquire the viewpoint and diversity of opinion to learn to make critical decisions. Since it is impossible to experience everything, the learner can share and learn through collaboration. Second, the sheer amount of data available makes it impossible for a learner to know all that is needed to critically examine specific situations. Being able to tap into huge databases of knowledge in an instant empowers a learner to seek further knowledge. Such a capacity to acquire knowledge can facilitate research and assist in interpreting patterns. Third, explaining learning by means of traditional learning theories is severely limited by the rapid change brought about by technology. Connectivism is defined as actionable knowledge, where an understanding of where to find knowledge may be more important than answering how or what that knowledge encompasses.

Opposing viewpoints pose reasons why connectivism might not be considered a learning theory. First, while connectivism is an intriguing development for discussion, it is not a totally new educational approach to learning. Rather, when compared to established learning theories, there is an overlap of ideas. B.F. Skinner considered having a specific boundary as crucial for unique learning theory. Mark McMahon (1997) stated that learning can be defined within the boundaries

of the three broad theoretical approaches: behaviorism, cognitivism, or constructivism (McMahon, para. 6-7). The internet functions in a manner similar to the way person thinks (Gygi, 1990), which implies opportunities to link information required for processing within a cognitive framework. Specifically, Piaget (1977) defined Cognitive Constructionism as learning with a process of accommodation, assimilation, and equilibration. Cognitive Constructionism is a "dialectic process in which the subject resolves perturbations in the coherence of his or her structuring activities by coordinating and constructing new, more adequate cognitive structures" (Saxe, 1991). Cognitive Flexibility Theory (Spiro, 1995), as explained by Archee & Duin, 1995, is another corresponding theory. This theory pulls together multiple elements of content, where knowledge is interconnected and complex (Archee & Duin, 1995). Second, connectivism "misrepresents the current state of established alternative learning theories such as constructivism, behaviorism and cognitivism, so this basis for a new theory is also dubious" (Kerr, 2006, para. 5-7). Additionally, Pløn Verhagen (2006) stated that connectivism is a pedagogical view instead. He asserted that learning theories should address the issue of how to enable the learner at the instructional level. By contrast, connectivism is directed to the examination of what is learned and why at the curriculum level. If connectivism is considered a learning theory instead of a theory of just being connected, there should be a provision for the transference and promotion of the learner's understanding. In agreement with this viewpoint, Bill Kerr (2006) argued that the idea of connectivism as a theory is not valid. His debate with Stephen Downes occurs repeatedly in internet discussions. Kerr considered connectivism to be part of existing learning theories, where various technologies only affect methods of instruction in numerous ways (Downes, 2006). Third, while connectivism might apply to selected areas of knowledge, it would not be universal for all subjects. Knowledge cannot only be derived on a system that is available 24/7. Specific instructor connection and teaching or mentoring must take place for a learner to internalize concepts and apply them to their real world circumstance. While having a current data source handy is helpful and at times, necessary, certain hubs of knowledge must be actualized by the learner. For example, a hospital patient would not be happy to see his or her doctor consulting his iPod for a diagnosis. Even though having the latest in research available is a requisite for the best medical treatment, it is no substitute for experience and personal knowledge from the doctor.

Rather than a new learning theory, connectivism offers an educator a model or mental representation that depicts something that cannot be observed or experienced directly (Dorin, Demmin & Gabel, 1990). While the debate over the status of George Siemens and Stephen Downes' theory of connectivism will continue to be debated for many years, it is undoubtedly an important school of thought directly applicable to the use of technology in the classroom today. There is no doubt that online learning is a direct technological response to different learning cultures, methods, and inspirations. "The integration of 3D interactive graphics and web technologies (Web3D) will allow educators to develop highly interactive and realistic learning environments to enhance online learning" (Chittaro & Ranon, 2007).   Established the learning theories of behaviorism, cognitivism, and constructivism each contribute in unique ways to the design of online materials through their ideas of how learning takes place. Behaviorist strategies teach facts and what is needed for understanding concepts. Cognitive strategies focus on how the process should be implemented for the most successful learning. Constructivist strategies use a shift toward real-life application, where the learner is given the opportunity to construct personal meanings from what is presented. Connectivism can be used as an important

instructional guide or theory to develop previous learning theories for their application to a globalized and networked world, but not as a standalone learning theory (Ally, 2007).

Within the framework of cognitive constructionism, Jean Piaget defined two principles for learning. First, learning is presented actively, and second, learning must be authentic and connected to real life (Piaget, 1977). Connectivism supports this definition by offering specific technological opportunities for the learner to be actively involved in the presentation of a body of knowledge. Students are able to recognize and interpret patterns by connecting to a diversity of representative networks. Furthermore, they are able to personally acclimate within a social network that encompasses experts from specific bodies of knowledge.

For example, with the aid of multimedia, a student can experience a computer based environment on Mars, while still being supported by their larger classroom setting. With constructivist factors that influence learning, such as engagement, participation, social, or cultural issues, the student can also build their own society or culture there, allowing networking opportunities to assist the critical analysis of this new world. Factors associated with prior knowledge of how life is supported and adapted to the elements and patterns seen in this new world show how being immersed into a new situation through the computer can make the learning personal and meaningful.

Technology influences all theoretical viewpoints by providing techniques and unique instructional methods. Every new idea or theory presented merits close examination for the possibility of helping students learn more successfully. With such a diverse population, an equally diverse selection of instructional techniques is necessary. Connectivism offers that diversity through a variety of networks, helping the new generations collaborate to find solutions to an ever increasing number of questions. Chris Dede (2007) mentioned how the nature of collaboration has changed. Throughout the years, educators and technologist had to learn to incorporate these changes in order to maximize learning. Engaged learning relies on collaboration among the members of the learning community (Conrad & Donaldson, 2004). These connectivist socializations help the learner structure (cognitivism) and create meaning from what is observed (constructivism), thereby establishing recognizable patterns to use in future situations (connectivism). Although Siemens (2006) argues for the shortcomings of existing learning theories, the continued rapid advancement of new technologies and associated ideas will continually transform instructional methods and expectations for acquiring knowledge.

There is always a certain amount of core knowledge that is required to be able to understand any information presented. Depending on the field of study, this core knowledge will vary. If a person with limited core knowledge accesses internet information beyond his or her ability to understand, then that knowledge is useless. Most people will give up and not continue learning. In order to acquire the core knowledge for a specific field, a structured study using the existing learning theories is required. Most individuals will not have the understanding in a specific field to access the data in that field and then assimilate the knowledge in a sequence that will make it understandable.

While the theory presented by George Siemens and Stephen Downes is important and valid, it is a tool to be used in the learning process for instruction or curriculum rather than a standalone

learning theory. It has also forced educators to look at what is being done in digital education and rethink, debate, and philosophize over how each part fits.   Continually evaluating how each new generation learns with regard to instruction and curriculum serves to hold education to high standards.

References

Ally, M. (2007). Foundations for educational theory for online learning. In T. Anderson (Eds.), *The theory and practice of online learning*, (pp. 15-44). Edmonton, AB: Athabasca University Press.

Anderson, T. (Ed.) (2008). *The Theory and Practice of Online Learning*. Edmonton, AB: Athabasca University Press.

Archee, R., & Duin, A. H. (1995,). *The WWW and Distance Education - Convergence or Cacophony?* Paper presented at the AUUG '95 & Asia-Pacific WWW '95 Conference and Exhibition, Sydney, Australia.

Black, E. (1995). *Behaviorism as a learning theory*. Retrieved from http://129.7.160.115/inst5931/Behaviorism.html

Bloom, B. S. (1984). *Taxonomy of Educational Objectives*. Boston, MA: Pearson Education.

Bruner, J. (1966). *Toward a Theory of Instruction*. Cambridge, MA: Harvard University Press.

Chittaro L., Ranon R. (2007). Web3D technologies in learning, education, and training: Motivation, issues, and opportunities. *Computers and Education*, 49(1), 3-18.

Conrad, R., & Donaldson, A. (2004). *Engaging the o line learner*. San Francisco, CA: Jossey-Bass.

Dede, Chris. "The Importance of Collaboration featuring Dr. Chris Dede." Walden University. 2008. Laureate Education, Inc.

Dorin, H., Demmin, P. E., Gabel, D. (1990). *Chemistry: The study of matter.* (3rd ed.). Englewood Cliffs, NJ: Prentice Hall.

Downes, S. (2007). *What connectivism is*. Retrieved from http://halfanhour.blogspot.com/2007/02/what-connectivism-is.html

Driscoll, M. (2000). *Psychology of Learning for Instruction*. Needham Heights, MA: Allyn & Bacon.

Ertmer, P. A., Newby, T. J. (1993). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. *Performance Improvement Quarterly,* 6 (4), 50-70.

Freire, Paulo. *Pedagogy of the Oppressed.* New York, NY: Continuum, 2007.

Gagne, R. M. & Medsker, K. L. (1996*). The conditions of learning: Training applications*. Fort Worth, TX: Harcourt Brace College Publishers.

Good, T. L., Brophy, J. E. (1990). *Educational psychology: A realistic approach.* (4th ed.).White Plains, NY: Longman

Gygi, K. (1990). *Recognizing the Symptoms of Hypertext... and What do Do About It*. In B. Laurel (Ed.), The Art of Human-Computer Interface Design (pp. 279-287). Reading, NY: Addison Wesley.

Hosford, P. (1973). *An instructional theory: A beginning.* Englewood Cliffs, NJ**:** Prentice Hall.

Johnson, B. & Christensen, L. (2004). *Educational research: Quantitative, qualitative, and mixed approaches*. Boston, MA: Pearson.

Kerr, B. (2006). *A challenge to connectivism*. Retrieved from http://billkerr2.blogspot.com/2006/12/challenge-to-connectivism.html

McMahon, M. (1997). *Social constructivism and the World Wide Web-a paradigm for learning.* Retrieved from http://www.ascilite.org.au/conferences/perth97/papers/Mcmahon/Mcmahon.html

Merriam, S. & Caffarella, R. (1991). *Learning in Adulthood. A comprehensive guide.* San Francisco, CA: Jossey-Bass.

Piaget, J. (1977). *The Development of Thought: Equilibration of Cognitive Structures*. New York, NY: Viking.

Riedel, C. (2009). The evolution of education: Empowering learners to think, create, share, and do. *The Journal*. Retrieved from http://thejournal.com/articles/2009/01/30/the-evolution-of-education-empowering-learners-to-think-create-share-and-do.aspx

Saettler, P. (1990). *The evolution of American educational technology* . Englewood, CO: Libraries Unlimited, Inc.

Saxe, G. B. (1991). Culture and Cognitive Development: Studies in Mathematical Understanding. Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Siemens, G. (2004). *A learning theory for the digital age.* Retrieved from
        http://www.elearnspace.org/articles/connectivism.htm

Siemens, G. (2005, January). *Connectivism: A learning theory for the digital age.*
        International Journal of Instructional Technology & Distance Learning.
        Retrieved from http://www.itdl.org/Journal/Jan_05/article01.htm

Siemens, G. (2006). *Knowing knowledge*. Retrieved from www.knowingknowledge.com

Siemens, G. (2009). *elearnspace*. Retrieved from http://www.elearnspace.org/blog/

Verhagen, P. (2006). *Connectivism: A new learning theory?* Retrieved from
        http://elearning.surf.nl/e-learning/english/3793