Learning is not limited to formal environments in which educators provide students with information. Connectivist thinking invites us to imagine possibilities for self-directed learners to use Web 2.0 technology to create informal networks. Grounded in the notion that, in this digital age, knowledge is available all around us, connectivism holds that learners will connect with information, activities, and individuals through technological processes that they find interesting and efficient. These connections often result in incidental and unexpected learning that complements the learning associated with traditional modes of instruction.

Connectivism has been described as a theory that “emphasizes the importance of non-human appliances, hardware and software, and network connections for human learning. The theory stresses the development of ‘metaskills’ for evaluating and managing information and network connections, and notes the importance of information.
pattern recognition as a learning strategy” (Couros, 2009, p. 233). As health care teachers, we know that our students must make sense of vast quantities of rapidly changing information. Connectivism, with its emphasis on knowing how to use technology to find needed information, to network, and to judge the relevance of information, is tailor-made for us. George Siemens, the founder of connectivism, could well have had the education of health professionals in mind when he wrote:

Learning occurs as a result of reflection on, and validation of, content . . . this process is most often initiated through interaction. In this model (and online), content is not less important. The difference is in how content is explored . . . and to a degree who provides it—teacher, student, or both. Effective teaching requires equipping students with the skills and beliefs to be able to provide for their own learning. (Siemens, 2002; ellipses in original)

This focus on learning as a process of interaction was the beginning of the theory of connectivism.

In December 2004, Siemens posted his first article on this new learning theory, “Connectivism: A Learning Theory for the Digital Age.” In this concept paper, Siemens explains the underpinnings of connectivism: “Including technology and connection making as learning activities begins to move learning theories into a digital age. We can no longer personally experience and acquire [the] learning that we need to act. We derive our competence from forming connections” (2004, “An Alternative Theory,” para. 1). In other words, much of what we need to know now exists in virtual form, beyond the reach of direct experience. Then, drawing on chaos theory (Gleick, 1987), self-organization theory (Rocha, 1998), and Barabási’s (2002) network theory (order is created by patterning and organizing information, a process in which certain pieces of information are assigned a higher value than others), Siemens further refined the theory of
connectivism. To promote discussion of the emerging theory within the broader education community, in 2005 he established a website (www.connectivism.ca) devoted to the exploration of connectivism.

In “Learning in Synch with Life” (2006), Siemens examined challenges currently faced by educators and found them similar to those experienced by organizations. For example, today’s learners and educators are experiencing evolving societal pressures, immersion in constantly changing technology, rapid information growth requiring the effective use of technology and networks to store information, the globalization of interactions, and the breakdown of centralization in order to allow for adaptation and growth. Siemens concluded that these pressures demand an examination of how we teach and learn in the twenty-first century.

**BACKGROUND THEORY**

*What Is Connectivism?*

Siemens identified eight fundamental principles of connectivism:

- Learning and knowledge rests [*sic*] in a diversity of opinions.
- Learning is a process of connecting specialized nodes or information sources.
- Learning may reside in non-human appliances.
- [The] capacity to know more is more critical than what is currently known.
- Nurturing and maintaining connections is needed to facilitate continual learning.
[The] ability to see connections between fields, ideas, and concepts is a core skill.

Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.

Decision-making is 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. (2004, “Connectivism,” para. 3)

In the same paper, Siemens introduced the idea of networked learning, that is, learning as a process of network creation. A network consists of two basic elements: nodes and connections. Siemens defined a node as “any element that can be connected to any other element” and a connection as “any type of link between nodes” (2005, p. 5). As he explains, “Virtually any element that we can scrutinize or experience can become node. Thoughts, feelings, interactions with others, and new data and information can be seen as nodes. The aggregation of these nodes results in a network” (2005, p. 6). More specifically, he described networks as having the following characteristics or elements:

- Content (data or information)
- Interaction (tentative connection forming)
- Static nodes (stable knowledge structure)
- Dynamic nodes (continually changing based on new information and data)
- Self-updating nodes (nodes which are tightly linked to their original information source, resulting in a high level of currency, i.e., up to date)
• Emotive elements (emotions that influence the prospect of connection and hub formations). (2005, p. 7)

According to Siemens, the connections within a network are strengthened by emotion, motivation, exposure, patterning, logic, and experience. All of these nodes and connections are influenced by socialization and technology.

According to the theory of connectivism, learning is an activity that consists in forging connections and thus creating networks. Learning is ubiquitous, and it takes place continuously. It may result from deliberate action on the part of an individual, or it may occur in random or haphazard ways. However, as we saw, connectivism acknowledges “the importance of information pattern recognition as a learning strategy” (Couros 2009, p. 233). This pattern recognition can be actualized at the individual or group level; when the process occurs at the group level, the group becomes a networked community. As Stephen Downes puts it, “Knowledge is a network phenomenon. To ‘know’ something is to be organized in a certain way, to exhibit patterns of connectivity. To ‘learn’ is to acquire certain patterns. This is as true for a community as it is for an individual” (2006, “The Semantic Condition,” para. 1).

Stephen Downes entered the connectivist discussion in a 2005 blog post, in which he argues that, in addition to qualitative and quantitative knowledge, we must include a third type in the domain of knowledge, which he called distributed, or connective, knowledge:

Distributed knowledge adds a third major category to this domain, knowledge that could be described as connective. A property of one entity must lead to or become a property of another entity in order for them to be considered connected; the knowledge that results from such connections is connective knowledge. (2005, sec. a, para. 2)
Furthermore, Downes stresses, “Connective knowledge requires an interaction. More to the point, connective knowledge is knowledge of the connection” (2005, sec. a, para. 6).

Distributive knowledge, or distributive cognition, is not new to the educational psychology literature. In 1998, the concept was reviewed by Hewett and Scardamalia, who discuss schooling as “communities grounded in the practice of knowledge building” (p. 75). In that early Internet era, these authors, citing Pea (1993), indicate an evolution over time in technology supporting distributed learning: “Textbooks, notebooks, rulers, the organization of desks, and the writing on blackboards and bulletin boards are seen as cultural artifacts that carry intelligence in them” (Pea, as cited in Hewett and Scardamalia, 1998, p. 76).

In sum, the theory of connectivism as articulated by Siemens has at least some foundation in the idea of distributed knowledge. Connectivism is a theory of learning that is about more than the individual and more than content. This theory speaks to learning as a result of connections formed among ideas, people, and experiences, connections that the learner has been able to sort and pattern into meaning.

**How Is Connectivism Experienced in Online Learning?**

Online learners start alone and create links among nodes of information and people as they seek to understand concepts or phenomena. A new skill set in online learning requires learners to find information and to figure out if and how the new knowledge fits into the networks they are developing. Connectivism stresses two important skills that contribute to learning: the ability to seek out current information and the ability to filter secondary and extraneous information (Siemens, 2008).
In the digital arena, the amount of information and the number of networks of people are virtually limitless. As the connective experience progresses, learners filter new information as it relates to patterns forming in their minds about topics relevant to their courses and learning needs. Students use the filters of their own values, beliefs, and perspectives to contextualize newly discovered information. Each connectivist learner develops an individual knowledge base focused on his or her own learning goals. Knowing that this type of learning may, at least in part, be informal learning that does not take place within the designated course structure, connectivist teachers need to tune in to their students’ unique motivations and interests. Connectivist thinking suggests that achieving a robust individual knowledge base related to a subject is powered by learners themselves and requires motivation and effort on the part of students.

Assessment of connectivist learning is challenging when criteria traditionally used to assess and value learning are applied to judge whether a student has achieved an effective learning network. In health care education, students must be able not only to articulate what they know but also to provide relevant evidence from credible sources in order to support their professional decisions and actions. Information derived from RSS feeds, Twitter, Facebook, blogs, MySpace postings, videos, and other Web 2.0 tools may or may not be accurate. In health care, misinformation could be life-threatening. Thus, if connectivist approaches to learning are to be valuable, the information gathered must be reliable. Learners may need help from their instructors in the form of feedback, guidance, role-modelling, and moral support to become competent in locating appropriate sources of information and then evaluating that information. Additionally, although learners may recognize their own tremendous growth and learning, it will not always be transparent to external evaluators. Furthermore, as Siemens concludes,
“the capacity to know is more critical than what is actually known” (2008, para. 6), and this is something for which traditional education has not developed assessment criteria. When they begin to think as connectivists, students and educators may need to undergo a paradigm shift in their beliefs about how online learning occurs and how it is measured.

According to Siemens, then, connectivist online learning occurs within a distributed technological network that includes a focus on social interaction among participants. Learning is a dynamic and ongoing process that involves recognizing and interpreting patterns. Learners gain knowledge by remixing the content of their existing networks and then adding to their knowledge base by making new connections between what they know and what they discover. Knowledge transfer occurs by connecting to (adding) nodes and making informed judgements about what is relevant and accurate. Connectivist learning theory is well suited to learning about complex subjects in a field where knowledge is rapidly changing and where diverse and abundant knowledge sources are available. Learners in health care disciplines must develop ways of using technology to find credible information and to filter that information efficiently and effectively in order to make connections—that is, in order to learn.

TEACHING ACTIVITIES AND STRATEGIES CONGRUENT WITH CONNECTIVISM

The following teaching practices are grounded in connectivist theory and can facilitate health care professionals’ learning. Since technology and networks are both essential components of connectivism, these activities and techniques are presented under those two categories.
Using Technology Creatively to Connect

SEE ONE, DO ONE, TEACH ONE—WITH TECHNOLOGY

Given the centrality of technology in connectivist thinking, the well-known health care teaching strategy of “see one, do one, teach one” can help keep online learning environments current. The strategy involves observing an action (“see one”), implementing the action (“do one”), and then showing a colleague how to implement the action (“teach one”).

New ways of establishing digital connections emerge daily, making it difficult for institutions to keep up. Currently, digital connections are made through Internet forums, weblogs, social blogs, micro-blogging, wikis, social networks, podcasts, virtual game worlds, virtual social worlds, and social media websites. This list changes constantly as new technologies for connecting emerge. Rather than relying on educational program infrastructure to stay current, instructors can create a short activity requiring students to observe how a technological application works (see one). Then, the students practice working with it (do one), and ultimately, they demonstrate it to the class or someone they know (teach one). The emphasis is kept on the possibilities that the application offers for communication and connection among learners. The students can also be asked to evaluate the technological application in relation to their practice. The activity concludes with an online discussion question such as “Is this application accessible, relevant, and worthwhile in furthering your professional knowledge and/or networks?”

WEB QUEST OR DISCOVERIES FORUM

An online forum titled “Web Quest” or “Discoveries” can be used to encourage online students to investigate available information on a topic and make connections between the new information and what
they already know. The students search online resources to find scholarly sources that they believe relate to a course topic. Based on their discoveries, they contribute links to published peer-reviewed papers, credible videos and podcasts, or other resources to the forum. Students provide a short written description with their contribution of how they used technology to make their “discovery” and to describe the connection they see between the content of their submission and what they already know about the topic. Other students may use the contributions to the forum in their own learning.

WORKING WITH WIKIS

A wiki is a tool that invites multiple users into a single online space or document. Each individual who has access can edit or add to the web page or document, facilitating collaboration. Wikis can, for example, be used to accumulate information that will be available to an entire group, with students adding items or resources to a list or chart. A wiki is also an excellent tool for scheduling group activities: each participant can indicate the times at which he or she is available. In addition to such relatively simple uses, students can use wikis to peer review scholarly work (Park et al. 2010) or to participate in a group assignment. A quick explanation of wikis and how to use them can be found in the YouTube video “Wikis in Plain English” (http://www.youtube.com/watch?v=-dnLooTdmLY).

JOIN A MOOC

The massive open online course (MOOC), a relatively new teaching and learning technology, has received a great deal of press recently. The original MOOCs, facilitated by George Siemens, Stephen Downes, and David Cormier, were semi-structured events around the theme of education and were open to anyone and everyone who found the website and logged on. Participants found themselves on a wiki page with
multiple links branching off to specific interest areas. Within inter-
est areas, individual participants created blogs, Facebook pages, and
Twitter streams to collaborate and share ideas and to network. The
content was created and refined during the process.

Recently, moocs have been embraced by professors, consortiums,
and private vendors as a way to transmit content to a large number of
people simultaneously. A system of badges or assignments is embed-
ded in some of the moocs to enable the granting of credit for com-
pletion of specific objectives. Although this type of mooc still offers
potential for a variety of student interaction, it defines content and
process more clearly and therefore real knowledge creation is less
likely.

*Forming Relevant Networks*

**IN-DEPTH INTRODUCTIONS: WHAT IS YOUR FAVOURITE _____?**

Since social interaction is crucial to connectivist learning, teaching
strategies that encourage class participants to get to know one another
are foundational. Interventions that allow geographically distributed
learners and teachers to share details about their professional back-
grounds and personal interests and aptitudes are precursors to stu-
dents engaging with one another socially within the online course.
One teaching approach that may facilitate this is encouraging in-
depth introductions. As we emphasize throughout this book, intro-
ductions are critically important and can take various forms. For
example, from a connectivist theoretical perspective, students may
be invited to share one or more photos of themselves involved in an
activity they enjoy. The photos may include family members, friends,
pets, or images of their homes. Students could be asked to share a
photo of a favourite item (for example, a T-shirt, teapot, painting, car,
location, or flower) and explain why it is special to them. Students
may also share the titles of songs they currently enjoy or the name of
a book or movie they have read or seen more than once. This sharing usually reveals details about students that may not be apparent in a short introduction, thus providing more nodes for connection. When class participants know one another on a more personal level, existing connections will become apparent and interactions may follow. In addition, instructors can convey their membership in the group by introducing themselves in a creative way and sharing appropriate details about their values, interests, and priorities.

Profiles That Pop

Social media sites such as Facebook, LinkedIn, Twitter, Bebo, and MySpace allow users to create profiles that illustrate who they are, including their interests and perhaps even others who are part of their network. Knowing the importance of both technology and networking within connectivist thinking, instructors can invite students to post “profiles that pop” on these sites. Younger learners, those in paraprofessional programs, or students just beginning the process of socializing into their chosen health care field may have more experience with creating personal profiles using social media than with creating professional profiles. However, the informal and tacit knowledge that learners all have about the kind of online presence they want to convey is invaluable. A well-crafted profile, one that “pops,” can encourage connections from interested others. In most health care disciplines, establishing boundaries between personal and professional profiles is an important topic of discussion. After they have drafted their profiles, learners can share their drafts with others in the group and exchange feedback about the kinds of impressions the profiles make.

Online Trading Cards

Youth are often familiar with “trading cards” that portray sports personalities and athletic heroes. A trading card may have a picture of a
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baseball or hockey player, a short history of the featured player, and the player’s sport statistics in terms of touchdowns, goals scored, and so on. The object of actually trading the cards with others is to acquire the most prized or popular cards as part of one’s card collection. This activity can be adapted to the online learning environment as an ice-breaking activity among students and between students and the instructor.

In this activity, students are invited to create their own personal trading cards by logging on to the Big Huge Labs trading card web page at http://bighugelabs.com/deck.php. The name of their trading card is their own name. Each student uploads a picture to share with fellow students and the instructor. In the description area of the card, students provide information about themselves (such as interests, hobbies, or pets) and the place where they would like to work after graduating. The students then save their trading card to their own computer and upload it to an online discussion forum within the course that is solely for the trading card activity. Each student creates his or her own thread. All class members are then invited to respond to the trading cards of at least two other students. Instructors can also engage in this activity to help students to get to know them better.

PERSONAL PORTFOLIO DEVELOPMENT

From the connectivist point of view, learners create their learning (or connections) to fulfill their unique learning needs and goals. To facilitate this, the teaching strategy of personal portfolio development may be appropriate. In this approach, rather than students being required to complete specific assignments to achieve a grade in the course, they are asked to develop a personal portfolio to demonstrate their learning in the course. An artist’s portfolio contains examples of the artist’s work and is used for purposes of promotion. Each of the items in the portfolio has been chosen because it reflects the artist’s skill and is representative of his or her style and preferred subject matter.
Similarly, students’ portfolios will contain items, or artifacts, that illustrate their individual interests and expertise.

The student-produced artifacts that constitute their portfolios could include scholarly papers, PowerPoint or Prezi presentations, reports, videos, or podcasts. Students individualize their learning within the content scope of the course by deciding what they want to learn and how they are going to show their teacher that they have achieved their personal learning outcomes. Guidelines regarding both the types of assignments required and the level of the assignments (paraprofessional, continuing education, undergraduate, or graduate level) will assist students in creating their portfolios. These guidelines can be framed using questions such as the following: At the end of our course, what would each of you want to have in your portfolio to show others what you can do? What do you most need to know from the field of _____, and how can you create an item, assignment, object, or artifact to illustrate your accomplishments and knowledge?

From the Field: Online Office Hours

Cheryl Crocker uses a variety of communication technologies to be part of the students’ networks and to make herself available when they need her. She provides the students with contact information and a designated time each week to reach her through email, texting, instant messaging, Skype, and so on. She initiated this as a way to reduce the number of emails. Office hours are typical in face-to-face teaching, and she thought that they might transpose well to online courses. She holds her official office hours for one hour per week throughout the term and comes online during that specified
hour. Students are aware that she is available and meet with her online as they deem necessary. During these meetings, Cheryl guides students in making connections that facilitate their learning and answers questions related to the course and assignments. Student feedback about this approach is primarily positive. Cheryl reports that her office hours are used quite extensively near assignment deadlines and frequently after the return of an assignment.

**EMAIL AN AUTHOR**

Connectivist thinking encourages learners to reach out to individuals and information sources that are well beyond the confines of their online classroom. A significant requirement of any health care education program is incorporating information from published works to support care decisions. Evidence-informed practice is essential to excellence in health care. While students are probably familiar with publications as information sources, they may not always view the authors of those publications as possible connections as well. Instructors can suggest that students email an author of a publication they found valuable, stipulating that professional communication with an author includes informed comments on the publication, thoughtful questions, and respect for the author’s time. If the author’s email contact is not included with the publication, students can email the publisher of the book or journal with a request to forward their message to the author.
CONCLUSION

“At its heart,” Downes writes, “connectivism is 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” (2007, para. 1). Networks are made up of unlimited numbers of nodes that connect to one another in random and ever-changing ways. However, the ways in which these connections occur can form patterns that can be recognized by an individual or a group. Moreover, as Siemens notes, “Networks can combine to form still larger networks (each node in a larger network can be a network of nodes itself). A community, for example, is a rich learning network of individuals who in themselves are . . . learning networks” (2005, p. 6).

In health care education especially, it is vitally important that learners be able to recognize what they need to know, seek out information from a diverse array of sources, and then organize that information and critically assess its value. Connectivist theory emphasizes these skills and thus helps learners make optimal use of the abundance of information available in a digital world. Connectivist learning is predominantly informal and initiated by students themselves in response to their own interests and needs. This can make measuring student progress and achievement challenging when traditional methods of student assessment are used. Connectivism, with its presumption that a “right” answer today may be wrong tomorrow, offers teachers a fresh point of view for course design, teaching, and student evaluation.

REFERENCES


