Connectivism Learning Theory:

Instructional Tools for College Courses

by

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Abstract

This qualitative thesis explores the work of George Siemens and connectivist learning theory, 'A Learning Theory for the Digital Age'. Findings are based on a literature review which investigated the foundations, strengths and weaknesses of connectivism and synthesized conclusions into a knowledge base of practical applications for the college level, Instructional Technology classroom. The half-life of knowledge is shrinking, especially in the field of Instructional Technology; connectivism helps to ensure students remain current by facilitating the building of active connections, utilizing intelligent social networking and encouraging student-generated curricula. Connectivism allows the future of education to be viewed in an optimistic, almost utopian perspective, as individuals co-create knowledge in a global, networked environment.

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I. Introduction

There is continuous and significant online discussion, theoretical research and interest in the literature regarding the theory of connectivism and the development of connectivist instructional tools for college classes. This thesis will focus on the development of the connectivist learning theory and the compilation of connectivist instructional tools to help practitioners inform their college teaching in the area of Instructional Technology coursework.

Connectivism learning theory, properly applied, has the potential to significantly improve education through the revision of educational perspectives and generate a greater shift toward learner-centered education (Siemens, 2004). The theory allows for instructors to step back from controlling course content, bypass 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.

Background/Overview

George Siemens, Associate Director of Research and Development with the Learning Technologies Center at the University of Manitoba, and founder and president of Complexive Systems Inc., proposed connectivism learning theory in December, 2004. His interest in technology's potential to transform teaching, learning and society drove his research into the area of e-learning.

Based on his research and experience, Siemens explained existing learning theories did not provide for the changing nature of learning and learners due to the influence of technological advances, 'Connectivism is the integration of principles explored by chaos, network, and complexity and self-organization theories' (2005). He described learning as 'messy, chaotic,

social, collaborative, and connected with other activities and interests. Formal education, in contrast … [is] artificial and structured' (2006).

In his groundbreaking paper, '*Connectivism: A Learning Theory for the Digital Age*', Siemens (2004) outlined the following principles of connectivism:

- Learning and knowledge rests in 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 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.

While Siemens held to the validity of three major learning theories, behaviorism, cognitivism, and constructivism, he argued these theories have inherent limitations. The theories do not reflect the type of learning that occurs in today's digital age nor do they 'meet the needs of today's students' (2004). He agrees established theories and techniques should not be summarily dismissed as their value is still appropriate for certain learning tasks that require a more formal and structured environment. Siemens acknowledges, 'No one concept or theory is universal in its application' (2006).

Another supporter for revitalizing education through the effective use of technology and connectivism practices is Marc Prensky. Prensky is a speaker, author and consultant in the area of education and learning, and has focused on digital game-based learning as one solution to the issue of waning student engagement. In his article, '*Engage Me or Enrage Me'*, Prensky (2005) explained that today's learners are no longer interested in or even capable of learning in environments that do not reflect their real-world experiences. Students today come to class equipped with a myriad of wired devices such as cell phones, laptops and iPods. They are constantly in touch, motivated by and responding to their changing world with the spontaneous exchange of knowledge. Instructors that teach with an old-fashioned, 'chalk and talk' approach will have difficulty in significantly reaching these students. Prensky further explained that students' lives are rich in media, communication and creative opportunities outside of school:

Rather than being empowered to choose what they want and to see what interests them and to create their own personalized identity as they are in the rest of their lives—in school, they must eat what they are served. And what they are being served is, for the most part, stale, bland, and almost entirely stuff from the past. Yesterday's education for tomorrow's kids [*sic*].

While to some, it may appear that today's learners have short attention spans, Prensky points out that students only have, 'short attention spans for the old ways of learning. They don't have short attention spans for their games, movies, music or Internet surfing' (2005). Prensky coined the term 'Digital Natives' which refers to today's students as 'native speakers' of the digital world while others not born into this digital world can be considered 'Digital Immigrants'. Prensky (2001) explains:

As Digital Immigrants learn …to adapt to their environment, they always retain…their

"accent," that is, their foot in the past…the single biggest problem facing education today is

that our Digital Immigrant instructors, who speak an outdated language…are struggling to

teach a population that speaks an entirely new language. Digital Natives are used to receiving

information really fast. They like to parallel process and multi-task. They prefer their

graphics *before* their text rather than the opposite. They prefer random access….They

function best when networked. They thrive on instant gratification and frequent rewards.

They prefer games to "serious" work.

Within connectivism theory, learning is considered to be a process in which, 'the role of

informal information exchange, organized into networks and supported with electronic tools,

becomes more and more significant. Learning becomes a continuous, lifelong system of network

activities, embedded into other activities' (Bessenyei, 2007). Bessenyei further stated:

The motivation for gaining and contextualizing information becomes stronger if searching

and evaluation become a cooperative, network activity. Thus the collective knowledge once

again becomes a source of individual knowledge. As the number of cooperative activities

increases, personal social networks become the scene of informal exchange of expertise, and

"communities of practice" develop. Besides the questions of "how" and "what" to learn, we

now have the question of "where to learn".

Instead of institutions and publishers holding the keys to knowledge, learners can become

active participants in the creation of knowledge. At the heart of the matter is that of networks,

where, as stated in the John Guare play, *Six Degrees of Separation,* 'every person is a new door

opening up into other worlds' (http://www.enotes.com/six-degrees/) . Essentially, each person

provides others with varying learning experiences and the community as a whole becomes the

curriculum and the classroom. 'Six degrees of separation is intriguing because it suggests that, despite our society's enormous size, it can easily be navigated by following social links from one person to another-a network of six billion nodes' (Barabasi, 2002).

Another facet of established learning theories that clashes with modern-day education is the premise that established theories do not take into consideration the information explosion and the 'half-life of knowledge' (Gonzalez, 2004) that exists in today's digital environment. Essentially what one learns today may be completely irrelevant and useless tomorrow. There are very few things that change more rapidly than technology. Gonzalez explains:

> One of the most persuasive factors is the shrinking half-life of knowledge. The "half-life of knowledge" is the time span from when knowledge is gained to when it becomes obsolete. Half of what is known today was not known 10 years ago. The amount of knowledge in the world has doubled in the past 10 years and is doubling every 18 months according to the American Society of Training and Documentation (ASTD). To combat the shrinking half-life of knowledge, organizations have been forced to develop new methods of deploying instruction.

Connectivism learning theory places emphasis on the importance of instructing students to search for, filter, analyze and synthesize information in order to obtain knowledge. Siemens stated, 'When knowledge… 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' (Siemens, 2004).

Siemens compared the 'flow of information…in a knowledge economy' to the 'equivalent of the oil pipe in an industrial economy. Creating, preserving, and utilizing information flow should

be a key organizational activity. The pipe is more important than the content within the pipe. Our ability to learn what we need for tomorrow is more important than what we know today' (2004).

When looking at the history of e-learning it becomes clear that there was a need to develop a new learning theory that would encompass the type of learning that takes place online. In the late 1990's the Internet was evolving and content was shifting from the controlled distribution of information to include end-user generated materials. As the barriers to developing network content continued to fall, end-users found they were able to 'create, collaborate and share with relative ease' (Siemens, 2007). As a result, this information revolution had significant impact on traditional education as educators, no longer tied to textbooks, were able to offer students collaborative, online learning opportunities. The emergence of personal Websites and Web 2.0 tools such as blogs, wikis, mashups and podcasts, provided a global medium for discussion and the presentation of varying points of view.

The edublog movement gained significant ground in the early 2000's and created a community for educators interested in utilizing evolving technologies. Edublogs provided a forum for reflections on pedagogical methodology, practical applications and best practices. In general, online community members started to learn from each other rather than depend on official, published works. 'This distributed learning resulted in the co-formation of understanding' and learning became a 'network creation process' (Siemens, 2007).

Web 2.0 tools that support online interactivity are unlimited, with new tools emerging on a daily basis. The open source movement and rapid enhancements in social networking allow for the free sharing of information and form the basis of e-learning 2.0, with its traits of network, self organization and embedment in activity. Bessenyei (2007) states:

It has become possible to construct personally reflected knowledge adapted to one's

individual needs from information represented in cyberspace….[students] will only be able to

keep up with the challenge of global knowledge exchange and be able to use interactive

networks if they become familiar with these tools and opportunities at an early stage. The

most important competencies should be searching for and evaluating information and making

connections between different fields of knowledge, ideas and concepts.

Educators have been applying connectivist teaching and learning strategies long before the

emergence of the formal theory of connectivism. This thesis will examine the early theoretical

roots and practical applications that led to the theory's development and will consider emerging

applications that build upon the theory's foundation. Connectivist learning theory can and should

have a major impact on traditional educational institutions. The utopia of network learning as

first proposed by Ivan Illich in 1970 may soon become a reality. The connectivist teaching and

learning model can eventually lead to a greater unification of the global community of life-long

learners. Perhaps John Seely Brown (2000) draws the best conclusion:

> The Web helps build a rich fabric that combines the small efforts of the many with the
>
> large efforts of the few. By enriching the diversity of available information and expertise, it
>
> enables the culture and sensibilities of a region to evolve. Indeed its message is that
>
> learning can and should be happening everywhere-a learning ecology. All together, a new,
>
> self-catalytic system starts to emerge, reinforcing and extending the core competencies of a
>
> region…. [there is] an interesting shift that I believe is happening: a shift between using
>
> technology to support the individual to using technology to support relationships between
>
> individuals. With that shift, we will discover new tools and social protocols for helping us
>
> help each other, which is the very essence of social learning.

Statement of the Problem

By reviewing the history of connectivism from 2000 to 2008, this paper will provide

examples of how connectivism learning theory has been translated into college teaching. These

examples can help practitioners inform their teaching practice by incorporating connectivist

instructional tools and methods into Instructional Technology college courses.

Research Questions

1. What is connectivism?

2. Who developed connectivism?

3. How can connectivism be applied by practitioners in Instructional Technology college

classes?

4. Which connectivist learning tools would be effective in Instructional Technology college

classes?

5. What are the instructional weaknesses and strengths of connectivism?

Definition of Terms

The following is a list of definitions for terms and concepts about or related to connectivism

that has significant meaning for my qualitative study:

Instructional Technology Coursework. For the purpose of this thesis, this term refers to

undergraduate, college level courses geared towards teacher education students.

Networked Learning. In this thesis, this term is used to describe connected, online, digital

learning that occurs between learners, instructors, learning communities and learning resources.

Interactions can be synchronous, asynchronous or both and can occur through a variety of digital

media including digital text, audio, graphics, video, etc.

Web 1.0/e-learning 1.0. This term refers to the state of the Internet and e-learning in a time

before user interaction with online content became the norm. Characteristics of Web 1.0/e-learning 1.0 include static Web pages, content that is not interactive and the use of proprietary software.

Web 2.0/e-learning 2.0. This term refers to second generation Web developments that have been designed to facilitate online communication and collaboration; examples include social networking, video sharing sites and the use of wikis, blogs, and podcasting.

Web 3.0/e-learning 3.0. This term can also be referred to as the semantic Web. Web 3.0 technologies build upon Web 2.0 technologies and refer to a vision of digital data that is understandable by computers, so that the technology can assist in finding, sharing, and combining online information.

Limitations of the Study

This paper will focus on the theory of connectivism and the practical application of connectivism instructional tools and techniques as they apply to the undergraduate, college-level, Instructional Technology classroom. It will not cover applications designed for the pre-K-12 learning environment, college graduate level or courses outside of the Instructional Technology area. This study will not attempt to evaluate the suggested practical applications of connectivism; it will merely present them in relation to their affiliation with connectivism learning theory.

Need or Significance

Connectivism provides an ideological framework that can impact how practitioners design and develop instructional tools for college courses. This framework places emphasis on building the learner's ability to navigate and connect current information beyond knowledge of the existing linear curriculum. The selection of a qualitative methodology contributes to college

teaching because it will help to develop a knowledge base of practical applications of connectivist instructional tools.

Researcher's Perspective

As an educator who works with college students, the researcher will document biases and assumptions as related to the potential findings of research.

II. Review of Literature

The review of literature for this thesis involved a thorough synthesis and analysis of available literature, in English, related to the study. The review was developed in two phases following the procedures in the *Qualitative Research Framework for ED 591* and *The Publication Manual of the American Psychological Association, Fifth Edition.* The literature selected for review focused on the research questions previously outlined in the Introduction.

The first section of this literature review will focus on the problem exploration-definition stage of research to substantiate the choice of topic and methodology, and will provide a sound theoretical and conceptual basis for this study. The review will highlight the rise and development of connectivist learning theory, which bases its foundation on the following theories: network, chaos, complexity and self-organization. This review will depict how the established theories of behaviorism, cognitivism and constructivism are inadequate to fit today's college learning environments, thus reflecting the need for the development of new learning theories.

The social learning theories of rhizomatic knowledge and learning ecologies will be explored within the review, along with a history of the social Web, the development of Web 2.0, e-learning 2.0, and the open educational resource movement. The second part of the literature review will be a synthesis with the following questions in mind: What is missing from the literature? What was learned from putting the literature review together? What are the theories which are supported by the literature? What questions does the literature review suggest/generate?

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. Connectivism can be seen as

a networked construct encompassing neural, conceptive and external processes. While neural and conceptive processes take place within the individual, technology is the only external construct that lends itself to the learning process. The modern day shift in the cognitive process itself is what is significant and different, and this shift requires new theoretical perspectives.

The principles of 'networking' and 'networked learning' have been in place long before modern day digital technology emerged. For example, farmers in agrarian societies have been sharing knowledge amongst themselves for thousands of years. Younger generations of farmers would build upon the work of others and continue to make small advances in tools and techniques. New technologies have allowed us to extend beyond our own humanity in order to formulate the continuous, global networks we employ today.

One of the first references to the networked learning model of education can be found in Ivan Illich's description of educational and learning webs. He suggested that with webs, 'we can provide the learner with new links to the world instead of continuing to funnel all educational programs through the teacher' (1970). His views were several decades ahead of digital technology developments.

George Siemens found through research and literature review, five stages that led to the modern day conception of digital networked learning. To begin, there was the development of infrastructure-the actual, physical and technical structures required to store and distribute content including software, hardware and connectivity. In the area of education, this was realized through the initial investment in the wiring of classrooms and the purchase of stand-alone computer work stations. Siemens (2008) explains:

As such, early definitions of learning networks were focused on infrastructure: "Learning networks are composed of hardware, software, and telecommunication lines" (Harasim et.

al., p. 16) and as "groups of people who use CMC [computer-mediated communication] networks to learn together, at a time, place, and pace that best suits them and is appropriate to the task" (p. 4).

The second development towards digital networked learning occurred when the physical, technological structures merged with existing and established research bases such as those in the mathematics, sociology, and physics fields. This merger provided connectivity between schools, universities, and students with 'computer mediated communication (viewed) as a transformative agent' (Siemens, 2008).

Third, individuals accessed and interacted with established, digital research bases resulting in 'theoretical and transformative views of learning, knowledge, and cognition'. Cognition occurred in a more collaborative fashion and at a global level due to rapid computer technology growth and surging interest in social networking. 'Technology aids in the distribution of cognition as it enables us to "project ourselves outward digitally" (de Kerchove, 1997, p. 38), or, more boldly, "to treat the Web as the extension of the contents of one's own mind" (p. 79)' (Siemens, 2008).

Barabasi explained:

Network thinking is poised to invade all domains of human activity and most fields of human inquiry. It is more than another helpful perspective or tool. Networks are by their very nature the fabric of most complex systems, and nodes and links deeply infuse all strategies aimed at approaching our interlocked universe (2002).

To take this development to the next level, Haythornthwait and Wellman (2001) use the term, 'networked individualism', where people use personal, digital networks, 'to obtain information, collaboration, orders, support, sociability, and a sense of belonging'.

The fourth development in digital technology that led to the rise in networked learning was the emerging popularity of personal and social networking sites. In 2003, MySpace and Facebook brought social networking into the mainstream. While social networking was in place for the academic community prior to the launch of these sites, academic social networking had limited wider appeal.

Personal and social networking participants quickly learned how to navigate these new systems. They discovered ways to locate people and information and how to solve problems using newly developed 'network thinking skills' (Siemens, 2008). Statistics reported on the Facebook site, (www.facebook.com/press/info.php?statistics), state there are currently 175 million active Facebook users. Clearly, this points to an established trend in digital networking.

The fifth and final development in networked learning occurred when educators started to explore various networked learning models and looked to them to enhance the education processes. Collaborative online learning combined with mobility-learning anytime, anywhere, with anyone-resulted in the digital network systems currently in use. Current definitions of 'network' no longer only refer to the wires and boxes that create physical online connections. Siemens (2008) explains:

By 2005, the definition of learning networks (in this instance, asynchronous) advocated by experts reflected a greater emphasis on people: "ALN's [asynchronous learning networks] are people networks for anytime anywhere learning" (Hiltz & Goldman, 2005, p. 5). Connectivism, as a theory of learning, is developed against the backdrop of physical network infrastructure, development of the social learning theory, and distributed conceptions of cognition and knowing…learning networks have always accompanied the development of

human knowledge. Connectivism reflects these developments in suggesting the need to craft new views of learning more reflective of the daily reality of learners.

With connectivism learning theory, the flow of information is compared to a pipeline, where the pipe itself is more important than the content within the pipe. Learning becomes a sequence of inputs and the network itself evolves and learns as it, 'builds better pipes, relations and connections to high-priority resources' (Siemens, 2008).

Siemens felt the need to develop connectivist learning theory as the established theories of the day did not adequately match modern day, digital learning environments. While earlier learning theories of behaviorism, cognitivism and constructivism have general aspects that can apply to many learning situations, each holds that knowledge is an objective that can only be attained through reasoning or direct experience. These theories fail to address learning that occurs outside of the individual, in particular, that which can be stored and manipulated by technology. Additionally, the theories do not explain how learning can happen in networks and organizations, they tend to focus on learning processes and not the value of what is being learned.

Behaviorism states that learning is unknowable; there is no way to understand what is going on inside of a person when learning is occurring, learning is only a change in behavior. The theory explains that understanding observed behavior is more important than understanding the actual, internal processes that occur and that human behavior is controlled by a simple stimulus and response process.

With cognitivism theory, our minds are viewed as similar to computers; we accept input and data, manage it in short-term memory, archive in long-term memory, retrieve into short-term

memory as needed and generate output. It is also held that the human mind, or 'black box'

should be opened and understood.

Constructivism theory states that learners create knowledge in their attempt to understand

experiences. Unlike cognitivism and behaviorism which view learners as empty vessels waiting

to be filled with knowledge, constructivism states that learners actively construct meaning as

they select and pursue learning.

In today's digital age, information is continually being developed, distributed and acquired.

Connectivism theory takes this fact into consideration. For learners, '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'

(Siemens, 2008). Individuals are constantly making connections to ever changing and evolving

networks. Siemens (2004) explains:

> …in a networked world, the very manner of information that we acquire is worth exploring.
> The need to evaluate the worthiness of learning something is a meta-skill that is applied
> before learning itself begins…we need to act by drawing information outside of our primary
> knowledge. The ability to synthesize and recognize connections and patterns is a valuable
> skill.

Rapid advances in technology have required the development of entirely new approaches to

thinking and learning about the knowledge building process. Connectivism theory also states,

'We derive our competence from forming connections' (Siemens, 2004). Since we cannot

possibly experience everything ourselves as the cognitive load would be too great, other people,

(the network), become our source of knowledge.

Connectivism is also the integration of principles based on the following theories: chaos, complexity and self-organization. 'ScienceWeek (2004) quotes Nigel Calder's definition that chaos is "a cryptic form of order". Chaos is the breakdown of predictability, evidenced in complicated arrangements that initially defy order' (Siemens, 2004). In chaos theory, meaning exists, but it is the learner's challenge to recognize hidden patterns. Complexity refers to the learning process as being complex, not complicated. Within complex learning theory, learning is influenced by innumerable, unpredictable factors. Whereas complicated learning can eventually lead to a clear result or end product, like the solving of a difficult jigsaw puzzle, complex learning can only be interpreted based on underlying factors and the outcome is greater than the sum of its parts.

Siemens (2004) explains self-organization with the following information:

Luis Mateus Rocha (1998) defines self-organization as the "spontaneous formation of well organized structures, patterns, or behaviors, 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.

 Connectivism can be referred to as networked learning. To explore this description, a closer look at networks is required. Networks are inherently simple; at the minimum they require two elements, nodes and connections. Nodes are elements that can be connected to other elements and connections are the links between nodes allowing for the flow of information. The stronger the connection between nodes, the faster information can travel.

Siemens (2005) explains that nodes can take any shape or form including, 'thoughts, feelings, interactions with others…new data and information'. Collections of nodes create networks and

networks can combine to form even larger networks, in fact, '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 completed learning networks'. As individuals join network communities and contribute data and information, the entire network benefits. 'In a sense, the network grows in intelligence'.

Connections between nodes in an individual's personal learning network can vary in strength. Strength depends upon several factors including an individual's motivation, exposure, emotions and experience. Individuals with specific learning objectives will be more motivated to make new connections based on the objectives. Exposure relates to repetition as a means to strengthen a connection. The more popular a node, the more other nodes link to it. How individuals feel about nodes (emotions) plays a part in the value placed on the nodes and how differing perspectives are interpreted. An individual's personal experience helps to define the creation of a network.

Siemens (2005), details Stanley Milgram's small world effect:

[Milgram] discovered that most nodes within a network are connected by a fairly short path. Information flow from one domain of a well developed network to another generally requires a small number of "hops". A learning network has similar short paths between information elements.

These small hops are also known as weak ties. Weak ties allow for short connections between information and learning results from these weak ties to other networks. Information between nodes is interpreted differently by learners based on individual perspective.

The creation of networks allows individuals to stay current despite the rapid pace of knowledge development. Again, the ability to learn becomes more important than what is being

learned as content is quick to change. The aim of networked learning is to facilitate the

development of deep understanding, complex worldviews and the ability to quickly assimilate

and adapt to shifts in the knowledge base.

The theory of rhizomatic learning is a social learning/network theory based on the work of

Deleuze and Guattari. Their theory offers a flexible conception of knowledge for today's digital

age. David Cormier (2008) explains the botanical metaphor in relation to knowledge acquisition:

A rhizomatic plant has no center and no defined boundary; rather, it is made up of a number

of semi-independent nodes, each of which is capable of growing and spreading on its own,

bounded only by the limits of its habitat. In the rhizomatic view, knowledge can only be

negotiated, and the contextual, collaborative learning experience shared by constructivist and

connectivist pedagogies is a social as well as a personal knowledge-creation process with

mutable goals and constantly negotiated premises. The rhizome metaphor, which represents a

critical leap in coping with the loss of a canon against which to compare, judge, and value

knowledge, may be particularly apt as a model for disciplines on the bleeding edge where the

canon is fluid and knowledge is a moving target.

Cormier believes the traditional, painstaking process of validating knowledge where experts

interpret information into knowledge, which is then rigorously assessed by degree-holding peers,

and compared to an existing canon is virtually obsolete. With the nature of today's ephemeral

Web knowledge base, this process is no longer a valid means of guiding the development of

curriculum. Today, any delays in sharing knowledge from emerging fields can make the

knowledge subject outdated by the time it is verified. Cormier (2008) explains:

This lack of a center of measurement for what is "true" or "right" makes the identification of

key pieces of knowledge in any of these fields a precarious task. In less-traditional curricular

domains then, knowledge creators are not accurately epitomized as traditional, formal,

verified experts; rather, knowledge in these areas is created by a broad collection of knowers

sharing in the construction and ongoing evolution of a given field. Knowledge becomes a

negotiation (Farrell, 2001).

Cormier (2008) believes a new model of evaluation and validation needs to emerge which

allows for, 'socially constructed, negotiated knowledge', where the community is not responsible

for the path to the curriculum, 'rather, the community *is* the curriculum', and the path to

knowledge is open. The rhizomatic model allows for the real-time, spontaneous creation of

curriculum through collaborative contribution. The learner-controlled and driven community

helps to shape, construct and reconstruct the knowledge base in the same way that a rhizome

offshoots or changes paths in response to changes in the environment. Members of learning

communities are responsible for engaging in the knowledge building process. Flexibility in

knowledge production is key.

John Seely Brown presents another social aspect to learning when he describes the mind and

learning as an ecology. Kesim (2008) explains, 'J. S. Brown (2000, p.19) defines an ecology as

basically an open, complex, adaptive, dynamic and interdependent environment. It is an evolving

and self-organizing system.' Learning ecologies are alive; they support and foster learning, are

responsive and self-organized and have a diverse, informal structure. Siemens (2003) outlines

some of the key components of a dynamic, living, and evolving learning ecology:

- Informal, not structured. The system should not define the learning and discussion that
  happens. The system should be flexible enough to allow participants to create according
  to their needs.

- Tool-rich - many opportunities for users to dialogue and connect.

- Consistency and time. To create a knowledge sharing ecology, participants need to see a consistently evolving environment.

- Trust. High, social contact (face to face or online) is needed to foster a sense of trust and comfort.

- Simplicity. Other characteristics need to be balanced with the need for simplicity. Great ideas fail because of complexity.

- Decentralized, fostered, connected...as compared to centralized, managed, and isolated.

- High tolerance for experimentation and failure.

Over the past eight years, thousands of Web applications have been developed, modified and improved to meet the needs of these emerging, social, online communities. These developments have revolutionized how people use the Web and interact online. Initially the Internet, from 1991 to 2003, was mainly used for the storage and acquisition of digitized materials, including text, pictures, audio and video files. While it was possible to access a wide variety of materials, the Web was not interactive. This earlier version of the Internet has been referred to as Web 1.0. Typical Internet users during this time only browsed Web pages and downloaded content, they did not actively engage in the creation of online content.

Concurrently, Learning Management Systems (LMSs) started to become popular and e-learning 1.0 emerged. Early LMSs contained organized databases and communication tools which allowed instructors to place content online for secure student access and retrieval. These first online courses mirrored the traditional face to face experience as they delivered expert-driven content in linear, structured units and lessons.

This situation changed with the emergence of Web 2.0 technologies, where users, no longer limited to simply searching for available information, could now create and share their own

content with others. E-learning 2.0 reflected these technology developments and resulted in,

'personal information management based on immediate needs' (Bessenyai, 2007).

Bessenyai explains:

   Within networks of contemporaries, cooperation, learner-centeredness and the ideal of self-

   organized learning become a real possibility. The boundary between learning and teaching

   becomes less distinct. For the "download generation", the Internet is not a medium for

   learning; it is the platform and the center of personal study. In the milieu of e-learning 2.0,

   the opportunity exists to reconstruct an organic learning environment.

   There were many ground-breaking developments on the road to Web 2.0, e-learning 2.0, and

the evolution of the Read-Write Web. The following section of the literature review will

highlight major accomplishments that led to the rise of connectivism learning theory and

networked learning.

   In 2000, Real Simple Syndication (RSS) feeds emerged as a digital solution to publishing

frequently updated works into a standardized format. RSS allowed readers to subscribe and gain

access to real-time updates of items such as news headlines, audio and video streams. Users had

the ability to aggregate many feeds from different favorite sites into one, central location which

allowed for a constant connection with desired content.

   That same year, Wikipedia came online, which provided the opportunity for users to

collaborate on content through the medium of a fully editable, digital encyclopedia. This

advancement was significant as it gave users the ability to co-create content rather than accept at

face value, the expert-centered, established knowledge base. Wikipedia has contributed to the

development of global awareness on many issues by allowing individuals to contribute to this

peer-edited knowledge base. Despite the popularity of Wikipedia, university students are not

encouraged to use the site for research as Wikipedia is not considered a creditable or verifiable source. Wikipedia contents can be tampered with and online articles may not receive the same level of peer-review as occurs with academic journals.

 In 2002, Flickr was launched which allowed for users to upload and share digital images and videos. Friendster, the first online social networking site, was launched this same year and enabled users to share digital content (video, photo, messages) via their profile and friend network. The practice of social tagging emerged at this time and the term 'folksonomy' was coined to reflect the practice of user-generated, collaborative tagging.

2003 was a significant year in terms of the growth of online social networking with the development of the following sites: Del.i.cious, LinkedIn, MySpace, and Second Life. Del.i.cious popularized social bookmarking and provided individuals with a location to store, share and find Web bookmarks. This site facilitated the growth of online learning communities as like-minded individuals were able to share resources based on content interests. LinkedIn provided an outlet for professional development networking, allowing users to post resumes and career goals and connect to others within similar industries for the purpose of career growth (Schlotz, 2007).

MySpace placed social networking officially into the mainstream by providing a popular, interactive, international site which allowed for the sharing of friend networks, personal profiles, blogs, groups, photos, music, and videos. The full influence of massive social networking sites like Myspace and Facebook , which was launched in 2004, has yet to be realized. Also during this time, blogging became a part of online, mainstream media.

Other emerging technologies include Second Life which is a 3-D a virtual world where users, ('residents'), can interact through avatars in order to explore, socialize, participate in activities

Podcasting uses RSS to distribute online audio files for use on portable media players, and Skype allows users to place telephone calls over the Internet, use instant messaging features, and engage in audio and video chat.

In 2005, users were able to create their own social networks through the Website Ning and YouTube emerged as the premier location for uploading, viewing, sharing and commenting on video clips. From 2006 to the present, there continues to be a strong emergence of social software Websites and 'mashups' which represent combinations of Web 2.0 technologies. According to listings found on the Website, ProgrammableWeb, (http://tinyurl.com/dcrdlb), There are currently over 275 Flickr mashups such as SadakMap which allows for blogging, combined with Google Maps and Facebook integration. New Google applications are in constant development and offer limitless flexibility in how the Web can be used.

Schlotz (2007) predicts:

The future of networked sociality is clearly linked to the anticipated two billion cell phone users of the near future. They will make the one hundred million bloggers look marginal. In mobile social space and on the Internet, it'll be critical to evaluate and re-evaluate the interests and values (and the driving forces behind those agendas) that guide technological developments.

Another component that led to the rise of connectivism learning theory is the open education movement. The shift towards making educational materials freely available to educators and learners around the world is helping to close the educational divide and represents a modification in the control of knowledge distribution. Open educational resources (OERs) are free educational materials that anyone can use, remix, improve and redistribute. OERs include learning content (course materials, content modules, learning objects, collections, and journals), tools (software)

and open licensing agreements.

Several organizations have key roles in the open education movement: Massachusetts Institute of Technology (MIT) OpenCourseWare, The OpenCourseWare Consortium (OCC) and Creative Commons. MIT allows free and open access to over 1890 online courses at both the graduate and undergraduate level (http://ocw.mit.edu/OcwWeb/web/about/stats/index.htm). While users cannot receive certificates or degrees for completing coursework, the knowledge within courses is available to anyone, anywhere.

OCC represents a collaboration of more than 200 higher education institutions and international organizations that use a shared model to develop and deliver open educational content. Their mission is to advance education and empower people worldwide. Creative Commons is a non-profit organization whose mission is to help promote creativity via the availability of copyright licenses for a free, public body of work that can be legally shared, and remixed (http://creativecommons.org/about/).

After conducting a thorough review of the literature available within the area of study, there are still many concepts that deserve further development through continued research. Educational theory is a complex topic and as digital technology continues to change and evolve, so will learning theory.

Marcy Driscoll (2000) writes:

Keep in mind the nature of theories as provisional and limited in their views of learning. That is, any given learning theory accounts for only some of the data that have been amassed about learning phenomena. Because learning is such a complex matter, it is perhaps impossible to conceive of a single theory broad enough to encompass all important aspects of learning and yet still specific enough to be useful for instruction….we must

evaluate each separate theory for what it illuminates about learning and for how it can guide

the development of effective instruction.

Another area requiring further study is the practical application of connectivism learning

theory in the college classroom. It is easier to propose new and exciting theories with the

potential to influence education as we know it, but it is much more difficult to put these theories

into action and have them adopted at a systemic level. It is the individual, forward thinking

educators that are beginning to harness the true, collaborative power of the Internet and are

pushing students to achieve in completely new and different ways.

The concepts of connectivism and networked learning have yet to make it into the

mainstream perception of the administrative educational base. As digital technology continues to

become faster and cheaper and access to the Internet improves, the tools needed to effectively

employ these theories will become more accessible. Change in the classroom is inevitable; as the

'Digital Immigrant' population of educators continues to age and retire the 'Digital Natives' will

be left to navigate the future of education. It is unlikely that individuals that have grown up in

highly connected environments will be content to use the same type of instructional strategies

that were used by their predecessors.

There are additional questions that require clarification and research that must occur before

a shift in today's educational framework can take place:

- In connectivism learning theory, what is the clear, defined role of the educator? What

    teaching methods and strategies are best employed? Is there an optimal size for a learning

    network?

- In connectivism learning theory, what is the clear, defined role of the learner? How do we

    assess students as individuals in a connectivist environment?

- Do the existing classroom models make sense? Should the one-instructor classroom make way for more diverse approaches?

- What is the best way to create curriculum? How should research be conducted? How is validity established?

- What is the best way to bridge the divide between 'Digital Natives' and 'Digital Immigrants' in a classroom setting? What is the best way to bridge the global educational divide?

- Considering the 'half-life of knowledge' what is the best way to keep educators and educational practices current? How do we deal with information overload?

- What is the future role of the university in society? What will happen to traditional degrees? What will happen to the accreditation process?

- If the future of educational materials is open source, how will revenue be generated? What is the future of the textbook? How are issues of online privacy and ownership going to be handled?

- How can systemic change be accomplished? How can political/governmental support be obtained in order to enact connectivism practices?

- How can we best humanize and communicate our emotions in a virtual, multi-cultural environment?

- What are the possible educational implications of the Semantic Web (Web 3.0)?

The researcher believes the conducted literature review has provided a thorough and detailed response to the initial research questions: What is connectivism? Who developed connectivism? The review also provided a strong foundation to move forward in researching the practical applications of connectivist tools in the Instructional Technology college classroom. While

connectivism learning theory may not be appropriate or practical to apply to all learners in all locations, its merits are undeniable.

Connectivism encompasses more than technology, more than the wires and boxes that carry a digital flood of information into our daily lives. Connectivism involves making connections with others and building upon the work that has come before. In many ways, connectivism is a return to the basics: learning from one another, trust in the creative process, and a strong sense of mentorship between teacher and pupil. With connectivism, active participation is required by all involved in the learning process. As such, the theory serves as an excellent model for life-long learning.

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.

III. Methodology

This thesis used a traditional qualitative design of collecting data and information from journal articles, books, online databases, and interviews, from making guided observations and reaching conclusions supported by reliable, valid and bias free information. Qualitative research uses a naturalistic approach to understand issues in context-specific settings, such as classrooms. This type of research produces findings without the use of statistical procedures or other means of quantification. This study seeks an understanding of the practical applications of connectivism learning theory in college level, instructional technology classes.

The researcher is currently employed as the 'Information Technology Supervisor for Technology Training and Blackboard Learning Management System (LMS) Administrator' at the University of the Virgin Islands (UVI) and is primarily based on the island of St. Thomas. Regular trips to St. Croix are part of the researcher's responsibility in ensuring that faculty on the sister campus receive face to face training and support.

In this position, the researcher is actively engaged in providing classroom technology support and instructional technology professional development to the faculty of the university. This includes developing comprehensive faculty training programs to support the academic and administrative uses of technology, assisting faculty in identifying training needs and then finding relevant solutions to address those needs.

The researcher develops and offers training institutes to lead faculty through specific projects and develops support mechanisms for faculty and students engaged in distance learning. Additional responsibilities include developing training programs to build and measure faculty technology competencies, providing leadership to help build integration expertise, and providing technology-based instructional design and curriculum support. The researcher is also tasked

with assessing and introducing new techniques to the faculty including pedagogy and best practices as well as introducing emerging hardware and software technologies to assist in developing innovative and effective teaching practices.

As an LMS/Blackboard administrator, the researcher interacts on a daily basis with students through the provision of help desk support and classroom-based faculty technology support. This responsibility also entails providing Blackboard training and support for students, as well as providing curriculum support for faculty to facilitate online course delivery functions.

On the UVI campus, Blackboard is used to supplement face to face courses and video-conference courses as well as to provide asynchronous distance learning (ADL) courses. Some instructors provide students with a hybrid course experience, allowing for regular face to face meetings with additional coursework taking place online via Blackboard. Based on the results of a 2008 survey conducted by UVI Faculty Technology Services, over half of the UVI faculty members are regular users of Blackboard and are comfortable with basic technology integration methods.

UVI Faculty Technology Services is currently conducting research to assess the validity of encouraging and expanding blended learning through the use of hybrid, asynchronous distance learning and videoconference technology. Blended learning strategies would help to ease scheduling challenges that arise due to the limited, physical campus environments and would provide flexibility in course offerings.

In order to assist with the blended learning initiative, UVI Faculty Technology Services is planning to provide intensive instructional design training to boost faculty technology skills and strategies for technology integration. The UVI Office of the Provost and the Chief Information Officer have developed two Centers for Excellence in Teaching and Learning (CETL), one

CETL per campus, to serve as hubs to promote new technologies and encourage faculty

collaboration. The CETL also serves as a training center for utilizing technology-based teaching

tools.

   This thesis has been conducted in order to help in the development of innovative instructional

strategies, based on connectivism learning theory, in the hopes that they will be implemented

into the learning environment of the University of the Virgin Islands. The aim of the research

was to develop a knowledge base and rationale for the practical application of the theory into the

classroom, improve faculty technology professional development and improve the student

learning experience through the use of emerging practices.

   It is important to have an understanding of the culture of the learning community when

attempting to implement innovative teaching and learning practices. The information that follows

will present an overview of the culture and climate of the University of the Virgin Islands in

regards to basic statistics as well as information on technology resources and access.

   The University of the Virgin Islands (UVI) was founded in 1962 is accredited by the

Commission on Higher Education of the Middle States Association of Colleges and Schools and

is a member of the Historically Black Colleges and University (HBCU) system. UVI holds the

distinction of being the only HBCU outside of the continental United States.

   The university has two campuses on the two islands of St. Thomas and St. Croix. The

islands are located approximately 30 miles from each other and inter-island small plane travel is

the norm in facilitating the distribution of people and materials between campuses. Video-

conference methods are frequently employed to provide course access opportunities to students

in either campus location. The school has affiliations with and provides video-conference

courses to down-island universities including Clarence Fitzroy Bryant College on the island of St. Kitts and the University of St. Maarten on the island of St. Maarten.

Based on the spring 2008 statistical Fact Book published by UVI's Office for Institutional Research, the population of UVI's 2,418 full-time, part-time and graduate students is primarily composed of local students from the U.S. Virgin Islands representing 91.4 % of the total and the remaining 8.6 % being comprised of students from the mainland United States and fifteen other countries. The majority of international students come from down island, Eastern Caribbean countries (http://www.uvi.edu/sites/uvi/Pages/IRP-Home.aspx?s=RE).

81% of the UVI student population is female and 19% is male. The ethnic makeup of UVI students is 73% Black, non-Hispanic, 5% Hispanic, 5% White, non-Hispanic with the remaining 17% percent made up of Asian-Pacific Islanders, non-Resident Aliens and those of unknown ethnicity. The faculty is comprised of 225 full and part-time members and reflects diverse ethnic and cultural backgrounds.

Due to the unique situation of the US Virgin Islands, in terms of location and political status as an unincorporated territory, resources and funding can be limited and institutional change can occur at a much slower pace compared to stateside counterparts. As an island location, disruptions in electrical and Internet service are not uncommon and can hinder instructional technology usage. Weather, climate and local wildlife all take their toll on the island and university infrastructure.

For example, in 2007, a lighting strike during the hurricane season on the St. Thomas campus caused serious damage to the microwave unit that transmits shared, online resources between UVI facilities on the St. Thomas and St. Croix campuses. The majority of network resource servers reside on the St. Thomas campus and their signal was interrupted due to the damaged

microwave component. As a result, St. Thomas students were able to access resources but major

shared services to St. Croix including inter-island video-conference capabilities, inter-island

phone extension dialing, Banner access and email Exchange access were unavailable for a week-

long period.

Based on the unique and aged microwave technology, repair parts were difficult to locate and

a repair specialist from the mainland was required to provide specialized repair service. The

situation has greatly improved over the past two years as UVI administrators, the UVI Board of

Trustees, and the Chief Information Officer have made technology support a priority, and have

dedicated additional funding to repair, upgrade and maintain technology resources.

 It is both a challenge and mission critical that UVI, and universities in general, keep up with

the status quo in regards to student expectations of technology resources. This includes increased

and reliable bandwidth, improved access to both on and off campus digital resources and

increased foresight in providing opportunities to access and utilize emerging technologies. It is

fiscally responsible for universities to place emphasis on continued improved access to said

resources.

Today's college students are overwhelmed with choice when it comes to selecting quality

educational experiences and most have never known a world without computers, the Internet,

interactive video games and cell phones. 'Digital Native', multitasking students expect

university faculty to expertly use technology to communicate knowledge. This often implies that

faculty must have the skills and resources to go beyond the simple transfer of lecture notes into

PowerPoint (Roberts, 2005).

As connectivism is a relatively new and emerging learning theory, formal literature on the

topic is limited. While the researcher was able to locate material on basic concepts of the theory,

examples of practical classroom applications were more challenging to locate. In the absence of reliable data, a qualitative research approach was the most applicable method for this study.

Research findings were based on descriptive data and analysis combined with the subjectivity of the researcher. A qualitative research approach is useful to explore areas, like connectivism, about which little is known and can help the researcher to better understand new concepts. Qualitative research helps to answer questions and shed light on issues that cannot be assessed by quantitative means.

A modified action research approach was appropriate for this study as the researcher is seeking solutions and improvements to practical, educational problems. The researcher is conducting this study in order to collect data to understand and improve her own practice and the practice of her colleagues. Mills (Airasin and Gay, 2003) associates the following results with action research:

- Encouraging changes in schools

- Empowering a democratic approach to education

- Empowering individuals through collaboration on projects

- Encouraging educators to reflect on their practice and have a voice

- Encouraging teachers to try new approaches to old problems

- Encouraging teachers to engage in professional growth

- Instilling in teachers the feeling that action research is a professional responsibility

Research Design and Rational

The researcher followed a qualitative paradigm to collect, evaluate and present data as explained in the six credit online course for ED 591, *Independent Thesis Research in Education*, and under the guidance of the instructor, Dr. John Caruso Jr. In order to conduct this study, the

researcher organized the data into themes that flowed in a coherent manner and built a foundation for the further exploration of the subject matter.

The first theme of research required a thorough investigation of the basic tenets of connectivism learning theory. Initial study was based upon the research of George Siemens. It was important for the researcher to have a solid understanding of the theory as well as an understanding of the conditions that led to the need to develop a new learning theory that could be applied to today's learners. The work of Marc Prensky was used to understand the concept of the 'Digital Natives' and 'Digital Immigrants' that populate the educational community and to comprehend that a fundamental shift has occurred as a result of advances in digital technology.

During the exploration of the theoretical basis of connectivism, the researcher was led to investigate themes related to the roots of social network learning theories. The researcher reviewed practices in pre-literate cultures such as handing down knowledge from one generation to another and building upon that which has come before. The researcher examined the work of Ivan Illich in regards to his utopian view of student-centered, student-led learning and his thoughts on 'deschooling' society and education. It was important to understand that networked learning was not a new concept, but today's modern, digital technology has changed what networked learning can accomplish in the local classroom level and at the global level.

The rise of digital networked learning was another theme that required investigation. The researcher examined the work of George Siemens to understand the five stages that led to modern day developments in digital networking. It was important to understand how the term, 'networking' went from being understood in relation to the physical boxes and wires of technology, to an understanding of the term in relation to collaborative, creative efforts by online learning communities.

The next theme explored was that of established learning theories and their limitations based on today's technological environment. The theories of behaviorism, cognitivism and constructivism were reviewed and critiqued in terms of basic tenants and were compared and contrasted to connectivism learning theory. Siemens stated that the principles of connectivism are based on the theories of chaos, complexity and self-organization. These theories, along with rhizomatic learning and learning ecologies were researched in order to understand the specific principles that they lend to connectivism learning theory.

As connectivism has been referred to as networked learning, it was important to research this theme in depth. The social network elements of nodes and connections were explored in order to recognize how learning communities and networked individuals function, grow and respond to one another. The work of Barabasi was critical to understanding social networking as a field of study.

The researcher then shifted focus away from theoretical background in order to take a look at the themes of Web 2.0 and e-learning 2.0 technologies. These technologies consist of interactive Web facilities that allow for users to own and exercise control over their own online content. The use of Web 2.0 tools provides a rich user experience due to dynamic content and metadata, encourage openness and shared intelligence through user participation.

The history of social network learning was also covered by the Literature Review. Major developments from 2000-2008 were highlighted as was the shift from expert generated content to that produced by individual users and the emergence of the Read-Write Web. The theme of open educational resources/open education was investigated to assist the researcher in understanding how free, online, educational materials have contributed to the development of connectivism learning theory. In particular, the work of Massachusetts Institute of Technology

OpenCourseWare project, the OpenCourseWare Consortium and Creative Commons were looked at in terms of how access to materials is helping to close the global digital divide.

Much of the research conducted for this study was based on educational journals, books and articles collected from sources that attempted to present a point of view while remaining objective and impartial. The majority of articles consisted of appropriately collected and analyzed data. The authors' work that was used for this study was supported by evidence to support the interpretations that were made, although at times the authors felt very strongly about their interpretations, which may have contributed to study limitations.

 In terms of locating materials related to the practical applications of connectivism learning theory, the researcher relied on anecdotal evidence as shared by educators on personal Websites, blogs and Edublogs. These types of sources added to the information already been gathered on connectivism and was considered credible.

IV. Findings

After conducting research into connectivism learning theory and its practical application into the Instructional Technology college level classroom, many recommended strategies were identified to successfully implement the theory. Research began by investigating the following questions: What is connectivism? Who developed connectivism? The researcher believes these questions were addressed thoroughly the Literature Review. The following questions are addressed in this chapter: How can connectivism be applied by practitioners in Instructional Technology college classes? Which connectivist learning tools would be effective in Instructional Technology college classes? What are the instructional strengths and weaknesses of connectivism?

The chapter begins with an outline of variables that facilitate the application of connectivism learning theory into the classroom, including recommendations for the physical environment, and recommended behaviors for instructors and students. The chapter focuses on examples of tools, tips and techniques for the practical application of the theory and concludes with an overview of the weaknesses and strengths of connectivism.

In order to apply connectivism learning theory into an Instructional Technology course, consideration must be given to the physical classroom space, and a rationale for deciding to meeting in a face to face environment versus hybrid or a totally online class needs to be explained in detail. Educational learning spaces are usually characterized by classrooms located inside of buildings. Courses occur in a scheduled manner and students sit at desks in rows. While many Instructional Technology classrooms are equipped with computers, or students bring their own laptops to class, 'the design remains essentially one where students assemble in a room to

focus on dedicated learning activities, usually in the form of some sort of content delivered by a teacher' (Downes, 2008).

The textbook, even for a rapidly changing course like Instructional Technology, is usually required and places an additional financial burden on the student. Connectivism provides an alternative to this educational norm. Downes (2008) presents a vision of what could/should be:

…schools will be converted into meeting facilities, workrooms and laboratories, multimedia studios, and more. Specialized equipment, such as sound-proof recording studios and high-speed video editing equipment will be made available. Libraries will evolve (in a transition that is happening today) into multimedia studios, where students engage with interactive media, games, and other types of content. VR rooms, such as the CAVE, will be constructed, emulating the simulation environments that police and military use today.

When learning takes place in a classroom with students in rows facing a teacher-expert who provides filtered content, Siemens (2008) believes:

… [this] suggests a certain view of learning. Learning is seen as bounded, structured, managed by a single expert (the teacher), and occurring within the confines of a small group of peers. In contrast, the Internet can be seen as an ecology of learning with different affordances. For example, the Internet, with its emphasis on openness and diversity, challenges the classroom conception of authority and expertise…the Internet is a hub of creative chaos.

 Universities can offer courses that provide a blended learning approach, allowing for traditional, in-class learning, supplemented with online activities and resources. An example would be to offer one, weekly face to face class and then provide online conferencing opportunities and readings for the remainder of the week. With a connectivist approach, learners

form relationships with experts worldwide, access academic resources from other institutions and are presented with multiple perspectives. The dispersal of universal, wireless Broadband transmission can make it possible for everyone to call upon information from any location at any time.

Siemens (2008) feels the type of learning environment preferred by the student should be the one the university provides. Institutions should be encouraged to provide flexible, individualized scheduling to serve students who learn best in face to face, hybrid or totally online learning environments. One strategy for flexibility is for instructors to create and lead scheduled face to face study groups and allow students to attend on a drop-in basis. This type of format appeals to students that need extra face to face time while allowing more independent learners the freedom to decide whether or not to take advantage of these meetings.

Knowing Knowledge, a Creative Commons licensed eBook by George Siemens (2006), provides a comprehensive overview of connectivism. In the book, he suggests that instructors can approach teaching in a variety of ways. The educator can be viewed as a, 'Master Artist' where the learning forum is likened to an art studio. Students create learning in full view of their peers and the 'master' points out unique approaches. 'The activities of all students can serve to guide, direct, and influence the work of each individual.' In the Instructional Technology course setting, student Blogs can serve as the open space where the instructor/mentor provides comments and guidance based on the perspectives of the established experts, or 'past masters'.

Siemens references Clarence Fisher's approach of 'Teacher as Network Administrator' where the instructor:

[helps] students to gain the skills they require to construct networks for learning, to evaluate their effectiveness, and work within a fluid structure. As learners encounter new

information sources, the educator encourages them to critically evaluate the source's

suitability as part of a holistic and diversified learning network.

As Instructional Technology approaches are constantly evolving, this is an essential skill set

for instructors to impart to students.

Siemens believes instructors can also be viewed as, 'Curators', 'experts with advanced

knowledge of a domain and guides who foster and encourage learner exploration'. This type of

instructor:

> …acknowledges the autonomy of learners, yet understands the frustration of exploring
>
> unknown territories without a map. A curator is an expert learner… he creates spaces in
>
> which knowledge can be created, explored, and connected. A curator balances the freedom
>
> of individual learners with the thoughtful interpretation of the subject…learners are free to
>
> explore, they encounter displays, concepts, and artifacts representative of the
>
> discipline…(yet) the key concepts of a discipline are transparently reflected through the
>
> curatorial actions of the teacher.'

The 'Curator' approach is effective for the Instructional Technology educator as course

participants are often students gearing their learning to match educational settings situations

where they plan to teach. Student interests will vary based on the age/grade level that they plan

to teach, as well as other considerations such as school location, student-body composition and

access to classroom technology resources. The educator as 'Curator' allows for different

perspectives while providing the class, as a whole, with strategic guidance and access to

fundamental discipline concepts.

It is important for Instructional Technology educators to stay current regarding the latest

trends in educational technology to effectively impart information to students. Instructors should

subscribe to relevant listservs, read e-learning blogs, visit technology integration sites, and use aggregator services to track current trends and issues.

Educators should communicate in the same style and language used by students. This means that a 'Digital Immigrant' instructor should be prepared to go faster, use less of a step-by step approach and be more comfortable and prepared for random access learning opportunities. Instructors should know how to utilize textbooks and then go beyond them. Textbooks should be used to facilitate questioning and discussion, and not for rote memorization.

Students within a connectivism model of learning in Instructional Technology classes should exhibit certain behaviors in order to achieve academic success. In *Knowing Knowledge*, Siemens (2006) outlined some basic learning traits he believes students should have, including the ability to: stay focused on tasks despite distractions, manage and navigate the flow of knowledge and extract important elements, connect with others through network-building, stay current and informed, relate at a human level to form social spaces, know how to determine the value of knowledge and ensure validity, be able to recognize patterns and trends, and be able to accept uncertainty. Online learners should also display confidence, independence and discipline in accepting responsibility for their participation in online coursework.

There are many tools, tips and techniques that lend themselves to the practical application of connectivism learning theory into Instructional Technology coursework. The ideal learning environment, 'should provide multiple, tool-rich opportunities for students to dialogue and connect including video, audio, text, and face to face formats. Today's students need an online environment that fosters a sense of trust and comfort' (Siemens, 2006).

To begin, the findings will look into Learning Management System (LMS) models and highlight components that effectively apply connectivism theory. The LMS has evolved since the

early days of WebCT and Blackboard; knowledge and content are no longer simply expert led

and generated, the systems can now allow for student interaction and the co-development of e-

learning materials. Many of today's LMSs have moved away from a typical, 'publication model

of storage and distribution' that is, 'institutionally based' to provide greater flexibility in e-

learning (Downes, 2008). Interaction can occur through LMS additions of Web 2.0 tools

including blogs, wikis, podcasting, and eportfolios.

Newer applications allow for LMS generated materials to be taken out of the LMS itself.

Students are no longer restricted to an e-learning environment similar to a 'walled garden'-

meaning once a course has ended, students no longer have access to the learning materials

(Cormier, 2008). Campus Pack Suite, a set of Web 2.0 tools that can be integrated into an LMS,

provides 'permalinks' which allow others without access to the LMS the ability to view course

materials. Student eportfolios initially created within the confines of the LMS can be exported

and shared. Students can retain ownership of materials, thus they are provided with opportunities

to build upon a body of work to refer to in the future.

Instructional Technology educators utilizing connectivism learning theory can require

students to create Personal Learning Environments (PLEs) which are similar to the eportfolio

model in that they allow students to retain and build upon coursework long after the course has

ended. A PLE allows students to create their own learning goals and manage content and allows

students to have control over the type of learning process that they prefer. Newer LMSs, like

ANGEL, have built in features that allow for flexible student customization and creation of

PLEs.

A PLE allows students to interact with others within the same field of study, incorporates

formal and informal learning opportunities, and allows for the utilization of peer to peer and

social networking capabilities. Bessenyei (2007) explains that the strength of a PLE/eportfolio learning model lies in the fact that, 'if the professor falls out of the system, the stored knowledge elements and the weak ties that can be mobilized do not allow the network to collapse or weaken.'

Elgg is an open source, social networking product, created for use by the educational community to facilitate PLE development. Universities can install Elgg and host the social network locally on their own servers. Elgg provides an aggregation of social networking services; students can create a user profile, access the site member network, create and join groups, create blogs, interact on discussion boards, embed media such as photos, word documents, audio files, videos, PDFs, engage in microblogging, conduct social bookmarking and tagging, and utilize RSS capabilities.

One unique feature of Elgg is the ability to assign profile items, blog posts, and uploaded files with item-specific access restrictions allowing users can designate viewing capabilities of particular items. As an educational tool, this capability allows students to have the freedom of maintaining a personal social network with space to interact with friends outside of the educational sphere, while permitting instructors to view specific items relevant to coursework. Students can retain and develop their online identity without fear of repercussion from the instructor.

Web 2.0 tools can be used in creative ways to enhance Instructional Technology coursework. Siemens (2005) elaborates:

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. The instructor or institution can still ensure that critical learning elements are achieved by focusing instead on the creation of the knowledge ecology. The links and connections are formed by the learners themselves.

Wikis offer flexibility and limitless opportunities to create shared learning resources, they can be used to develop collaborative, student-created textbooks or Instructional Technology students can be encouraged or required to contribute to Wikipedia. This activity would help to make the following points: knowledge can be distributed across a network of individuals rather than reside under the control of a publisher and student contributions to the global knowledge base are relevant and important.

Other Web 2.0 technologies that lend themselves to networked learning include blogging and podcasting. Blogs present opportunities for students to create intelligent, thoughtful responses to topics and engage in critical discussion with others. Student-produced podcasts and videocasts are becoming a popular means of assessing student learning and can replace a traditional typed essay or PowerPoint-enhanced oral presentation. Audio and video files can be published to the Web where they can be viewed and commented upon by the instructor, classmates and the wider community.

Instructors can utilize other dynamic options to motivate students in Instructional Technology courses. Elluminate is a product that allows for real-time discussion and interaction through live conference sessions, remote guest speakers, the ability to connect students from other classes for combined lessons, and record and share course content. Skype, a Web based service that allows for instant messaging, file transfer and video conferencing can be used to produce conversations that can then be broadcast live to the Web through the utilization of the free Website, UStream.

Virtual 3-D worlds, like Second Life, can provide students and faculty with a new medium for exploring distance learning and simulation in a collaborative environment. Users create avatars, or 'residents,' that can interact with one another; this medium is engaging as it is reminiscent of popular gaming platforms and appeals to the natural environment of 'Digital Natives'. Other online games and simulations can also be used to motivate students.

The open education movement is helping to create a shift in e-learning. The movement is reinforcing connectivism principles, helping to close the digital divide and is providing unique opportunities for supplementing Instructional Technology coursework. Siemens (2008) explains:

MIT's OCW, OpenLearn, Open Yale, Johns Hopkins OCW, and others—have the capacity to change education globally. OpenCourseWare Consortium lists over 100 collaborating members with each committing to putting a minimum of 10 courses online. Other initiatives, such as: (a) iTunes U initiatives by Berkeley, Duke, Stanford, and Yale, (b) recorded conference presentations… (c) YouTube recordings (such as the Stanford Prison Experiment); (d) TeacherTube; (e) open access journals; and, additionally, (f) Wikiversity, Curriki, and WikiEducator, offer curriculum and educational resources creating a climate where content is readily accessible.

 In face to face learning situations, instructors should allow students to use search engines in order to supplement class discussion. People rely heavily on search engines, so much so that without access to them individuals may feel as if part of their knowledge has disappeared. Many instructors are dropping memorization requirements as students can access that type of information when they need it. The instructional focus can shift to building and establishing new connections.

There are many perceived weaknesses to connectivism learning theory which may contribute to a slower rate of theory adoption among educators. Connectivism, as an emerging theory, is still without a substantial body of empirical research literature that would lend it greater credibility. Employing the theory assumes individuals have access to digital computer technology and the Internet and this is not the case on a global level. The digital divide affects basic access to e-learning resources and does not allow for the development of the skills required to effectively use digital resources. Although the costs of purchasing technology are lessening, for many in the developing world, these tools are still out of reach.

While connectivism draws strength from open source educational materials, strict intellectual property laws and economy-minded publishers can hinder access to valuable learning resources and block the adoption of new pedagogy. Political and administrative leaders may have difficulty embracing connectivism due to variables in student assessment and some may have an established, rigid adherence to specific learning outcomes. The 'teaching to the test' approach that is central to accreditation and correlated with university funding will not function within a connectivist model. A complete restructuring of the educational model would have to take place at a systemic level in order to bring about the radical changes that connectivism encourages.

Other arguments against connectivism and the e-learning model of 'educator as facilitator' focus on the premise that a networked learning approach actually provides students with a limited perspective as learners are more apt to connect and agree with like-minded individuals versus expanding their lines of thought through direct, critical engagements with expert teachers that may present challenging and alternative points of view.

Wingard surveyed faculty to elicit responses regarding teaching Web-enhanced courses. While many instructors had positive outcomes, there were difficulties cited including;

information overload, student distraction, worries about the validity/credibility of online

resources, fragmented student writing styles, varying comfort levels with the Web, increased

need for technical training and support and increased need for instructional development support.

'Digital Immigrants' continue to wrestle with emerging technologies, indicating that faculty

adoption of connectivism learning theory is slowly developing (2004).

Conversely, there are strengths related to connectivism learning theory. Connectivism

practices help to meet the diverse learning needs and styles of all students by providing

opportunities for students to interact with and create meaningful curriculum content. The half-

life of knowledge is shrinking, especially in the field of Instructional Technology; connectivism

helps to ensure students remain current within their field by facilitating the building of active

connections. The theory promotes instruction in meta-cognitive skills, including the ability to

search, analyze and evaluate information. With today's information overload, connectivism

principles help to control this flow of information through intelligent social networking and it

provides unlimited access to future learning opportunities.

Connectivism practices hold the attention of students; the means and methods are relevant

to the daily life style of the 'Digital Native'. Applying the theory in the classroom helps to ensure

that students are exposed to multiple perspectives and opinions, versus being subject to the

limited point of view of the instructor and course-related textbooks.

Dave Cormier (2008) explains the value of networked, online social learning in relation to

modern fields of study such as Instructional Technology, 'where the parameters of knowledge

are constantly shifting and a canon has not yet been solidified'. He provides the following

example of Alec Couros's graduate-level, educational technology course at the University of

Regina in Saskatchewan, Canada:

Students in Couros's class worked from a curriculum created through their own negotiations of knowledge and formed their own personally mapped networks, thereby contributing to the rhizomatic structure in their field of study… students created their own rhizomatically mapped curriculum by combining their blogs with information to which Couros pointed them and linking the combination to the particular knowledge that they discovered through discussions with key people in Couros's professional community. In accessing Couros's professional network, students had the opportunity to enter the community themselves and impact the shape of its curriculum as well as their own learning. The role of the instructor in all of this is to provide an introduction to an existing professional community in which students may participate—to offer not just a window, but an entry point into an existing learning community.

In conclusion, the researcher argues the cited examples relate the greatest strength of connectivism learning theory; the key to success lies in allowing students to become active participants in creating and building the canon in their respective fields of study. When learning is made meaningful through the use of methods shared in these research findings, students are more apt to pay attention, make thoughtful, intelligent contributions, and understand how to clearly defend their position with facts and logic, take pride in their contributions and remain motivated throughout the duration of a course.

V. Discussion

This thesis used a traditional qualitative design of collecting data and information from journal articles, books, online databases, interviews, guided observations and reaching conclusions supported by reliable, valid and bias free information. The researcher followed a qualitative paradigm to collect, evaluate and present data. This thesis based findings and conclusions on a thorough literature review which investigated the roots of connectivism learning theory and synthesized possible applications of those theories and principles into practical applications for Instructional Technology coursework.

The thesis was based on five basic research questions, beginning with questions related to the background and general understanding of the learning theory: What is connectivism? Who developed connectivism? The thesis then progressed into the investigation of questions related to the practical application of the theory: How can connectivism be applied by practitioners in Instructional Technology college classes? Which connectivist learning tools would be effective in Instructional Technology college classes? What are the instructional strengths and weaknesses of connectivism?

A summary of the thesis follows:

The roots of connectivism and networked learning were first proposed in the 1970's when Ivan Illich presented his ideas on 'deschooling' education and encouraged a movement towards student-centered, socialized learning opportunities. His view was utopian in its ultimate manifestation and in view of today's globalized environment there is evidence his ideas are becoming reality. The following is a quote from Illich's *Deschooling Society* and can be related to modern day connectivist principles:

A good educational system should have three purposes: it should provide all who want to learn with access to available resources at any time in their lives; empower all who want to share what they know to find those who want to learn it from them; and, finally, furnish all who want to present an issue to the public with the opportunity to make their challenge known.

George Siemens, Associate Director of Research and Development with the Learning Technologies Center at the University of Manitoba, proposed connectivism learning theory in 2004, in the ground-breaking paper, '*Connectivism: A Learning Theory for the Digital Age'*. His research was driven by interest in technology's potential to transform teaching, learning and society. Siemens found the established and accepted learning theories of today, such as behaviorism, cognitivism and constructivism, were insufficient in addressing learning that occurs outside of the individual, learning which can be stored and manipulated by technology. Established theories did not explain how learning happens in networks and organizations, as often occurs in today's online environment.

Many connectivism theory principles were in use before the terminology emerged. Connectivism encompasses more than the fiber optics and servers carrying digital information, it involves making connections and building upon the work of others. Connectivism is a return to the basics: learning from one another, trust in the creative process, and mentorship between teacher and pupil. Active participation is required by all involved in the learning process. The theory serves as an excellent model for life-long learning.

Connectivism holds to many principles related to digital technology influence including: 'Learning may reside in non-human appliances', 'The capacity to know more is more critical than what is currently known.' 'Currency (accurate, up-to-date knowledge) is the intent of all

connectivist learning activities.' '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' (Siemens, 2004).

Connectivism is based on the theories of chaos, complexity and self-organization; the theory can be referred to as networked learning. Networks are made up of nodes, which are elements connected to other elements, and connections, which are the links that occur between nodes and allow for the flow of information. As individuals join communities of practice and contribute data and information, the entire network community/learning ecology benefits and grows in intelligence as it adjusts and transforms in reaction to the world around it.

The growth of human knowledge has been tremendous over the past twenty years with advances in science and society attributing to the increased capacity of people and organizations to connect with one another. The half-life of knowledge is shrinking; knowledge becomes obsolete faster than before. To stay current and informed in one's respective field, it is essential to develop meta-cognitive skills like searching, analyzing and evaluating available information and making relevant connections.

 A new model of knowledge validation is emerging, where 'the community is the curriculum' (Cormier, 2008). The traditional process of validating knowledge where experts interpret information and compare it to an existing canon is virtually obsolete. Today's ephemeral Web knowledge base makes this process invalid as any delays in sharing knowledge from emerging fields can make subject matter outdated by the time it is verified.

Connectivism learning theory is helping institutions shift from a model where the university/publisher controls knowledge, to that of an active, student-centered/student-

participation model. Value is placed on student contributions and spontaneous, collaborative, student-generated curriculum; learners create their own knowledge in their own space. Using a rhizomatic learning approach, the learner-driven community shapes and constructs knowledge similar to how a rhizome changes paths in response to the environment. Instructors can eliminate textbooks and traditional lectures and bring learners to the forefront in locating, presenting and making sense of relevant knowledge, thus allowing a fluid, social networking model the freedom to emerge.

Many Web applications have been developed to meet the needs of online communities. The history of online social networking provides insight into why the need arose to develop a new theory of learning. Early Web 1.0/e-learning 1.0 technologies provided a static experience for users, only allowing for the browsing and downloading of content. The emergence of personal Websites and Web 2.0 tools such as blogs, wikis, mashups and podcasts, provided a global medium for the discussion and presentation of varying points of view.

The evolution of the Read-Write Web allowed users to become active creators of content. Wikipedia, Flickr, Friendster, Del.i.cious, LinkedIn, MySpace, Facebook, Second Life, Ning and YouTube all contributed to the rise of social networking. 'Mashups' which represent combinations of Web 2.0 technologies are now common and Web 3.0/semantic Web technologies are emerging. There is a movement towards cloud computing, where services and applications are hosted and accessed over the internet versus residing on individual computers. Cloud computing allows users to access applications through browsers rather than install and access software directly on personal machines.

Movements towards open source, open content and open education have strong ties to connectivism theory. Recently, MIT decided to enact a policy to place all scholarly articles

online for free, public access (http://tinyurl.com/ccwlop). This indicates that the university values

the free flow of ideas, and faculty are willing to help advance research by making their studies

available worldwide. Downes (2008) explains the motivation behind adopting a more open

ideology in regards to sharing work:

> Share without thinking about what you will get in return, without worrying about people
>
> taking advantage of your work. When you share, people are more willing to share with
>
> you. In a networked world, this gives you access to more than you could ever produce or
>
> buy by yourself. By sharing, you increase your own capacity, which increases your
>
> marketability. People who regularly throw their ideas into the public domain are generally
>
> confident that there will be even better ideas popping up tomorrow.

'When we share, we attach identity to what we have created. In creating knowledge, we

experience life, identity, hope. To contribute to the public space, to be recognized, to be a part of

something bigger—these motivations drive us' (Siemens, 2006).

The following quote from David Weinberger (http://tinyurl.com/cvayfp) is particularly

intriguing in regards to thinking about the Web on both a connectivist level and beyond to a

metaphysical level:

> Indeed, the Web only exists because a whole bunch of humans are interested in
>
> communicating with other humans. This means that the Web is built on people going
>
> beyond themselves, connecting with others. In this sense, the Web is based on
>
> transcendence, on being out of oneself, on going towards a *something more,* something
>
> beyond ourselves. This transcendence also characterizes the movement of spirit. The new
>
> Web metaphysics is fundamentally spiritual.

> Practitioners in Instructional Technology college classes can answer the call for academic

reform by effectively applying connectivist learning tools and understanding recommendations for the physical learning environment, recommended behaviors for the instructors and students, and having a working knowledge of the tools, tips and techniques that lend themselves to the practical application of the theory.

Regarding the physical environment, students would be better served if classrooms were 'converted into meeting facilities, workrooms and laboratories, [and] multimedia studios' with 'specialized equipment, such as sound-proof recording studios and high-speed video editing equipment' (Downes, 2008). Educators need 'to get past the idea that learning is something that is delivered, school is not the privileged center of learning' or a 'self-contained, closed world in which students acquire knowledge…The class is not the primary learning event. It is life itself that is the main learning event' (Wenger, 2004).

Universities can offer courses that provide a blended learning approach, supplementing face to face meetings with online activities and resources. A connectivist approach allows learners to form relationships with experts worldwide, access academic resources from other institutions and gain exposure from multiple perspectives on subject matter. The type of learning environment preferred by the student should be the one the university provides. Institutions should provide flexible, individualized scheduling to serve students who learn best in face to face, hybrid or totally online learning environments.

The connectivist educator can be viewed as a 'Master Artist' where the learning forum is likened to an art studio. Students create learning in view of peers and the 'master' points out unique approaches. Instructors can take a, 'Teacher as Network Administrator' approach, helping students gain the skills to construct networks for learning, and evaluate their effectiveness. Alternatively, instructors can be viewed as, 'Curators', experts with advanced knowledge who

guide, foster and encourage interpretation and exploration.

It is important for educators to stay current regarding the latest trends in educational technology in order to effectively impart information to students. Today's students are innately different, their thinking patterns have changed. They are not content to learn with old-fashioned techniques and methods. Educators should know how to communicate in the same style and language used by students and be prepared to go faster, use less of a step-by step approach and utilize random access learning opportunities. Instructors should know how to use textbooks to facilitate questioning and discussion, and should have an understanding of the effective use of open education resources.

Student behavior in the connectivist model includes: staying focused despite distractions, efficiently manage and navigate the flow of knowledge, extract relevant information, connect with others through network-building, stay current and informed, relate at a human level to form social spaces, ensure validity, recognize patterns and trends, and accept uncertainty. Connectivist learners should also display confidence, independence and discipline in accepting responsibility for their participation in online coursework.

Regarding the tools, tips and techniques for the practical application of connectivism, instructors should ensure that the learning environment provides 'multiple, tool-rich opportunities for students to dialogue and connect including video, audio, text, and face to face formats. Today's students need an online environment that fosters a sense of trust and comfort' (Siemens, 2006). If instructors are using a Learning Management System, the LMS should allow for student interaction and the co-development of e-learning materials. Interaction can occur through LMS additions of Web 2.0 tools including blogs, wikis, podcasting capabilities, and eportfolios. Student work generated within an LMS should have export capability which allows

students to retain ownership of materials, providing them with opportunities to build upon a body of work.

Personal Learning Environments (PLEs) allow students to retain and build upon coursework after the course has ended. If central, university elements are damaged, (i.e. ill professor, closed department, textbook shortage), the learning network remains. Students can create their own learning goals, manage content and have control over the type of learning process they prefer. Other practical connectivist tools include Elluminate, for real-time discussion and interaction through live conference sessions, Skype, for instant messaging, file transfer and video conferencing, and 3-D virtual worlds like Second Life, along with online games and simulations.

Connectivism does have instructional weakness; as an emerging learning theory there is an insubstantial body of empirical research literature to lend it greater credibility. Employing the theory assumes individuals have access to digital computer technology and the Internet and this is not the case on a global level. Often intellectual property laws can hinder access to valuable learning resources and block the adoption of new pedagogy.

Political and administrative leaders may have difficulty embracing connectivism due to variables in student assessment and a rigid adherence to specific learning outcomes. Other arguments state connectivism would provide students with a limited perspective as learners are more apt to connect and agree with like-minded individuals versus engage in critical discussion with expert teachers who may present alternative points of view.

Faculty teaching Web-enhanced courses may be prone to encounter difficulties including; information overload, student distraction, worries about the validity/credibility of online resources, fragmented student writing styles, varying comfort levels with the Web, increased

need for technical training and support and increased need for instructional development support. 'Digital Immigrants' continue to wrestle with emerging technologies, indicating the faculty adoption of connectivism learning theory may be slow.

Conversely, connectivism has instructional strengths; connectivism practices help to meet the diverse learning needs and styles of all students by providing opportunities for students to interact with and create meaningful curriculum content. As the half-life of knowledge is shrinking; connectivism helps to ensure students remain current within their field by facilitating the building of active connections. The theory promotes instruction in meta-cognitive skills, including the ability to search, analyze and evaluate information. With today's information overload, connectivism principles help to control this flow of information through intelligent social networking along with the provision of unlimited access to future learning opportunities.

Connectivism practices hold the attention of students, the means and methods are relevant to the daily life style of the 'Digital Native'. Applying the theory in the classroom helps to ensure that students are exposed to multiple perspectives and opinions, versus being subject to the limited point of view of the instructor and course-related textbooks. The greatest strength of connectivism learning theory is that it allows students to become active participants in creating and building the canon in their respective fields of study. When learning is made meaningful, students are more apt to pay attention, make thoughtful, intelligent contributions, and understand how to clearly defend their position with facts and logic, take pride in their contributions and remain motivated throughout the duration of a course.

These are exciting, changing times; the practitioners that are exploring connectivism today are directly involved in establishing the validity of the theory in today's educational climate. While the role of the university in society remains vital, connectivism is providing opportunities

to disengage from the institution of education as is it currently known. Perhaps one day students will not need to take formal coursework or be issued degrees in order to prove that they have mastered content; other methods of authentic assessment will take their place. Connectivism will not be the final statement in educational theory. As digital technology evolves and new methods for integrating technologies into the college classroom emerge, new learning theories will naturally develop. Connectivism allows the future of education to be viewed in an optimistic, almost utopian perspective as individuals co-create knowledge in a global society.

A shift towards student-centered, student-generated content, allowing students to set their own learning goals, work at their own pace and use learning strategies that work for them can only establish a positive educational trend. The deluge of information that we are confronted with on a second by second basis is not going to slow down and the archives of stored knowledge are not going to shrink.

It is essential as educators, to stay current in order to provide the most authentic and accurate learning experience possible. We need to be prepared to leave behind old-fashioned methods of teaching in order to evolve and allow students to use online social networking to make connections and develop their own personal learning environments. Teaching students to search, filter, and verify online information are key instructional responsibilities. Educators must encourage students to take advantage of online content.

It is my sincere hope this study and its findings help to advance the adoption and understanding of connectivism learning theory both here at the University of the Virgin Islands and worldwide. It is hoped this research, consisting of background information on the development of connectivism, along with ideas to implement the practical application of the theory into the classroom, will be helpful for individual educators who are considering forging

ahead in adopting connectivism principles and strategies. It is hoped that other researchers will build upon this compilation and extend the thoughts and ideas presented here.

It is my intent to share this work via open source licensing so that others may take the information that I have gathered and reinterpret, remix and reapply it to make new connections. It is hoped others may feel as enthusiastic, inspired and optimistic about the subject matter as I did during the writing of this thesis. Further research into connectivism learning theory is critical in helping others to understand the real implications of the theory and bring its adoption into the mainstream consciousness of today's educators.

Future research is recommended to focus on the following areas in an effort to promote cohesive research investigations into connectivism learning theory and its practical application into the college classroom:

- What are the clear, defined role of the educator and the student within a connectivist framework?

- What are the options for restructuring physical classroom spaces to best employ connectivist principles?

- How are issues like curriculum, research, and assessment best handled in a connectivist environment?

- How can we continue to bridge the divide between the 'Digital Natives' and 'Digital Immigrants' as well as bridge the global educational divide?

- What connectivist strategies can be employed to help deal with information overload?

- From a connectivist perspective, what is the future role of the university in society, the granting of traditional degrees and the accreditation process?

- What needs to occur, systemically, in order for connectivist principles to be fully applied
  into today's educational climate?

In conclusion, I feel that researching and writing this paper was an exercise in connectivism as the theory resonated with my learning experience. As a distance learner located in the US Virgin Islands, I was fortunate to be able to enroll in the course, *Independent Thesis Research in Education*, as offered through Western Connecticut State University located in Danbury, Connecticut. I was privileged to be afforded the opportunity to work directly with Dr. John Caruso Jr., an instructor whose innovative methods and practices have never ceased to surprise and motivate me over the course of my extended, eight year quest towards my Master of Science Degree in Instructional Technology.

In true connectivist fashion, I was given the freedom to select a thesis topic that excited me and that I was passionate about. I was able to independently and informally learn about the research process and connect with experts within the area of Instructional Technology and connectivism learning theory. I was able to work at my own pace and in my own style, as I am the type of person that achieves and self-regulates with little formal structure. Dr. Caruso was always available to answer my questions via email and guide me in the right direction through the provision of thoughtful chapter edits, supplying me with articles and information relevant to my study and providing endless positive support and encouragement.

My learning was achieved through connections to people and resources, through practical experience, by reflecting on my experiences and by having an interested, approachable instructor that trusted me to follow through on this project. I have learned that I enjoy the research process and I am looking forward to continuing my education with postgraduate studies.

I would like to conclude this thesis with the writing of George Siemens (2006). His

ground-breaking and innovative insights into modern day cognition and his development of the

connectivist learning theory have the potential to revolutionize education:

> We are in the early stages of dramatic change—change that will shake the spaces and
> structures of our society…Previously, knowledge served the aims of the economy—
> creation, production, and marketing. Today, knowledge is the economy…We have to
> unlearn what no longer serves us well—to jettison the mindsets formed by existing in only
> physical worlds…To function in the new world of knowledge, we need to see the power of
> connections—connectivism and connective knowledge. Sense-making, pattern recognition,
> suspended certainty—these are our needed skills….A holistic, integral approach to
> thinking, learning, and knowledge is required as our society grows in complexity. The
> opportunity for change is tremendous. Opportunities to restructure organizations and
> society are rare. Yet periodically—in periods of substantial social, technological, or
> ideological change—we have the opportunity to remake our existence, to rewrite the
> inefficiencies of antiquated modes of operation. With vision, foresight, and awareness of
> change, we can move forward with a model that will serve humanity well. We exist in such
> a time.

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