INTERNATIONAL JOURNAL OF INSTRUCTIONAL TECHNOLOGY AND DISTANCE LEARNING

October 2015
Volume 12 Number 10

ISSN 1550-6908

PUBLISHER'S DECLARATION

Research and innovation in teaching and learning are prime topics for the *Journal of Instructional Technology and Distance Learning* (ISSN 1550-6908). The Journal was initiated in January 2004 to facilitate communication and collaboration among researchers, innovators, practitioners, and administrators of education and training involving innovative technologies and/or distance learning.

The Journal is monthly, refereed, and global. Intellectual property rights are retained by the author(s) and a Creative Commons Copyright permits replication of articles and eBooks for education related purposes. Publication is managed by DonEl Learning Inc. supported by a host of volunteer editors, referees and production staff that cross national boundaries.

IJITDL is committed to publish significant writings of high academic stature for worldwide distribution to stakeholders in distance learning and technology.

In its first decade, the Journal published more than 600 articles; 7,500 pages of research and theory by over 1,000 authors. It logged over ten million page views and more than a million downloads of Acrobat files of monthly journals and eBooks. Many authors benefited from refereed publication for retention, promotion, tenure, and advancement in their profession

International Journal of
Instructional Technology & Distance Learning

Vol. 12. No. 10.

ISSN 1550-6908

Table of Contents – October 2015

Return to Table of Contents

Editorial

Discipline vs. motivation

Donald G. Perrin

I remember the first lesson I taught on instructional television. It was an audiovisual course for teachers in training. The topic was Dale's Cone of experience – with abstract at the top and concrete learning experiences at the bottom. I constructed a rocket with the cone at the top, and invited my assistant Jim Wallington (who was later best-man at my wedding) to be strapped to the rocket. As I tightened the belt he cocked his head and looked up and me and said, "You can capture my body, but you cannot capture my mind." His profound and spontaneous response continues to challenge me as a teacher. It gives me concern about physical and verbal punishments as an inducement for learning. Punishments do not work for many students and put learning in a negative context. Fear of the teacher and fear of doing things wrong impedes one very powerful method of self-teaching – learning from our mistakes and the mistakes of others.

I do not punish students for mistakes or for submitting homework late. I provide model answers for assignment and tests so students can know where they went wrong. I also give students the opportunity to fix errors and resubmit their work for a full grade. I remain open for student questions and offer tutoring where I consider it is needed. To me, grading tells you where learning is imperfect; more work is needed to reach criterion performance. The student should complete the coursework with a grade of A. Do you want to fly with a pilot who scored 80% on landings or 60% on navigation? The lowest grade I will accept in an academic course is 90%. That is not only for the benefit of the student. If the course is significant and necessary for his future career, it assures a satisfactory level of competency for the employer.

A clever teacher can motivate a student to learn. There is a whole literature about motivation by making things relevant and important for the student. Conditioning with the stimulus-response-reward cycle may need physical rewards to initiate the process, but for very practical reasons these should be quickly be transformed to more abstract and symbolic rewards. It's irrelevant here, but I remember a psychology student shaking hands with his mentor after completing his doctoral exam. As he opened his hand, he offered M&Ms to his mentor. When his mentor opened his hand, he offered M@Ms to his successful candidate. That was in the era when Skinnerian psychology was popular. Modern books on teaching methods offer a great array of teaching techniques to simulate motivation, but the current trend is to develop (or recover) the learner's capacity for self-direction and self-motivation.

When a student is faced with failure, he may be tempted to cheat. In education we believe that, because cheating is taking unfair advantage, the cheater should be punished if caught. It is a classic case of inappropriate response to the needs of a learner. There are many levels of cheating, from peek-at-the-answer (to clarify what the teacher required or see how to solve the problem) to submitting a copy of the instructor's answer sheet (hopelessly lost and give in on this course). The former can be resolved by instructing how to solve similar problems in class or through learning materials. The student should not be forced into unfamiliar territory before he has the basic tools and experience. The latter raises questions about prerequisites for the class, or the need for tutorial experiences – or interactive multimedia – to provide step-by-step instruction for the less able learner.

Many problems we attribute to students are challenges to our methods of teaching and the rules by which we operate. All students have unique needs and unique abilities. It is time to relax the rules and examine student needs one-by-one. Individualized Educational Programs (IEPs) set up for learners with disabilities are one approach to increase guidance and support, and to develop an achievable curriculum to meet the needs of each individual student. With the internet, interactive multi-media, learning management systems and artificial intelligence, we now have the tools to individualize the curriculum and learning for the masses.

Return to Table of Contents

Return to Table of Contents

Editor's Note: This paper explores the theoretical foundations of Connectivism and relates it to previous theories of learning. Its focus is on networks – neural, internal (conceptual) and external. It relates the role of teacher, learner and knowledge within a dynamically changing environment. The illustrations and examples clarify the position of the authors in asserting the relevance and importance of connectivity theory and practice to technology supported learning.

Understanding knowledge network, learning and connectivism

Alaa A. AlDahdouh, António J. Osório and Susana Caires
Portugal

Abstract

Behaviorism, Cognitivism, Constructivism and other growing theories such as Actor-Network and Connectivism are circulating in the educational field. For each, there are allies who stand behind research evidence and consistency of observation. Meantime, those existing theories dominate the field until the background is changed or new concrete evidence proves their insufficiencies. Connectivists claim that the background or the general climate has recently changed: a new generation of researchers, connectivists propose a new way of conceiving knowledge. According to them, knowledge is a network and learning is a process of exploring this network. Other researchers find this notion either not clear or not new and probably, with no effect in the education field. This paper addresses a foggy understanding of knowledge defined as a network and the lack of resources talking about this topic. Therefore, it tries to clarify what it means to define knowledge as a network and in what way it can affect teaching and learning.

Keywords: learning theory; constructivism; Connectivism; knowledge; network learning; e-learning, Massive Open Online Course; MOOC; epistemology; ontology; online learning; Artificial Intelligence; AI

Introduction

One may find it appropriate to resemble the education field as a melting pot: Philosophy, Technology, Science and Arts are some of the many disciplines that take part and intersect in this multidisciplinary field. Finding a tenable theory that combines and harmonizes this heterogeneous mixture is like playing an open-ended game. New discoveries and insights give place to changes in the background on which the current theories are based. Connectivism-a recent and growing learning theory-argues that there are tremendous changes happening in the learning processes and it is not possible to build on the previous theories. Instead, a new conceptual framework should be built in an attempt to explain the emerging phenomena. According to Connectivism, new theoretical trends are founded in different circumstances and Connectivism is founded in information age.

In this rapid change process, technology plays a leading role inside the classroom scenario. For instance, technology development is affecting, amongst others, in: (1) the tools developed around the classroom and (2) the curriculum development. Regarding the first one, tools development, the rapid development of technological tools such as the personal computer (PC), laptop, internet, smart phone, multi-media and web 2.0 has involved the educators in a battle of keeping pace with its speed. While educators were in debate about using or not using PCs in classroom, the internet emerged. When research started to embrace the internet, the smart phone was invented; and the cycle continues. Concerning the second one – curriculum development -, it has also been significantly affected (Cormier, 2008). For instance, consider a student of computer science at the university. In his first year, a new study plan was applied. During his 4-year program, he studied according to this plan. After graduation, what he studied was already outdated. In this new era, a

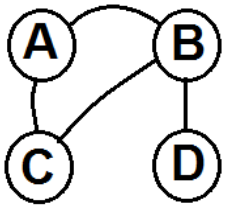
4-years period can involve significant technology changes; it all happens too fast and, in a short time, information can become obsolete!

Connectivism theory recognizes these issues along with an understanding of network sciences. According to Connectivism, it does not make sense to consider learning merely as an internal construction of knowledge. Rather, what learners can reach in the external network should be considered as learning. Moreover, the knowledge itself has a structure; it is not something fuzzy or mysterious. It is complex and chaotic, of course, but it has a structure. Connectivism uses what has been discovered so far in network analysis to interpret knowledge and assumes knowledge as a network (Siemens, 2008).

Meantime, defining knowledge as a network needs some clarification. In this paper, the authors propose to shed some light to this new framework adding some tangible examples of knowledge as a network. In other words, how network structure can represent the diversity and complexity of knowledge. From different disciplines, this paper moves step by step with simple examples to explain the complexity and chaotic characteristics of knowledge. Knowledge, however, is full of more sophisticated and complex examples.

Knowledge as a network

The network refers to a set of nodes connected with relationships. Therefore, the network consists of one or more nodes connected by one or more relationships. In the figure below, the network consists of four nodes (A, B, C, D) connected by four relationships.

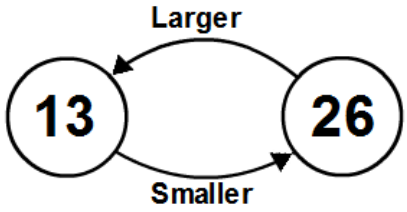


Network components

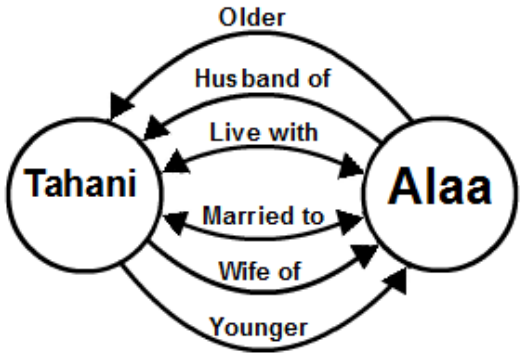
Node: The node refers to any objects that can be connected. Connectivism recognizes three node types: neural, conceptual (internal) and external (Siemens & Tittenberger, 2009). In the neural level, the network consists of neurons connected by neuron's axon and dendrites (Stufflebeam, 2008). In the conceptual level, the network consists of concepts, ideas and thoughts connected by conceptual links like similarity and positive correlation. In the external level, the network consists of people, books, websites, programs and databases connected by internet, intranet or direct contact.

Relationship: The relationship is a link between two objects. One or more relationships can be gathered in a tie. There are some special relationships or characteristics of network relationship.

> **Graded:** The relationship between nodes is not necessarily sharp. It is sometimes interpreted or graded. For example, consider a relation of 'friendship' between two persons. It is clear that the friendship is not a quantitative relationship. Instead, it is interpreted, graded or, even, contains sub-relationships. In this case, 'friendship' is considered as a 'tie'.
>
> **Direction:** The direction of the relationship makes a difference. Some relationship is reversed when you flow from one node to another. For instance, consider the relationship of 'smaller' that join a node of a number '13' and a node of '26'. The relation must be reversed to 'Larger' relationship when flowing from '26' to '13'.

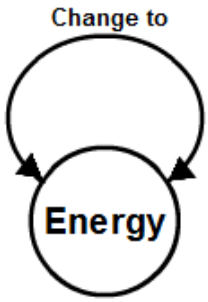


This is not a case with all relationships. Consider a tie that joins a couple, 'Alaa' and 'Tahani'. The relationship of 'Married to' and 'live with' are similar for both directions. However, the relations 'Husband of', 'Wife of', 'Younger' and 'Older' have different directions.



Other relationships go in one direction without inverse. For example, consider a relationship of 'subtract' between two numbers.

Self-join: The node can connect to itself. Consider, for instance, a person who blames himself. Another example of self-join relationship is the law of Conservation of Energy; energy cannot be created nor destroyed, but can change from one form to another (Planck, 2013, p. 40). Therefore, if the energy is represented by a node, then it should connect to itself with a relationship of 'changed to'.

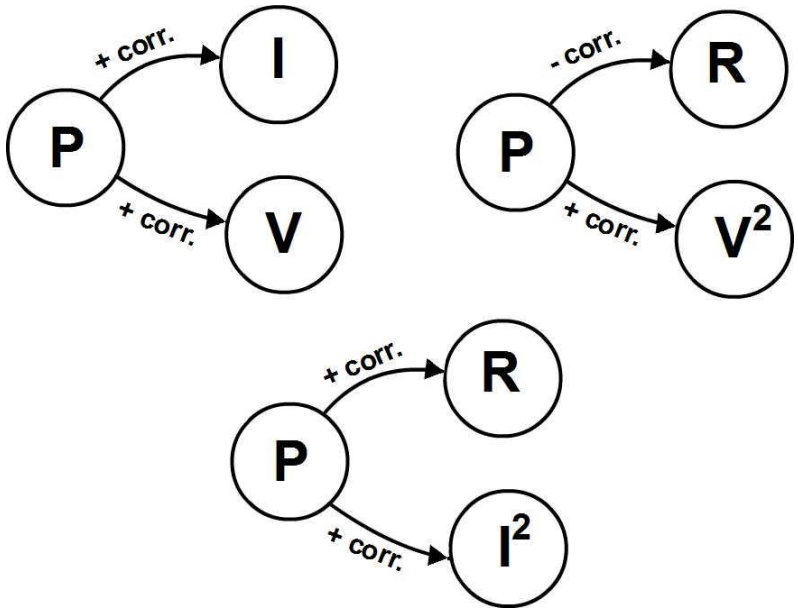


Pattern: The pattern refers to a set of connections appearing together as a single whole. This is one of the most important concepts of Connectivism. The examples given previously were talking about a simple relation that joins one or two nodes. Things go more complex when a relation cannot be seen between two nodes as an isolated relation. For instance, consider an electrical power formula in a Direct Current (DC) circuit.

$$P = IV = \frac{V^2}{R} = I^2R$$

Where: P = electrical power; I = electrical current; V = electrical voltage and R = resistance

The electrical power in DC circuit is recognized by one of the formulas listed above. The next figure represents the formulas as three separated networks:



The first formula states that 'P' is positively correlated with 'I' and 'V'. But is it true to say that 'P' is positively correlated with 'I' alone? To answer this question, let us move to the second and third formula and look at the relation between 'P' and 'R'. Unfortunately, the relation is negatively correlated in the second formula whereas it is positively correlated in the third formula! Therefore, it is not true to say that 'P' is positively correlated with 'R' and it is not true to say 'P' is negatively correlated with 'R'. Even more, it is not true to say 'P' is not correlated to 'R'. The notion is that a single relation between two nodes in this network does not make sense: it is a chain of relations that include the relationship between 'P', 'R', 'V' and 'I' all together or, in this case, subset group of them. These chains are called patterns. Therefore, the meaning is distributed among patterns of relations (Downes, 2007). The neural system presents another example of distributed knowledge. Researches in neuroscience suggest that a single neuron cell is not the holder of information; instead, it is patterns that connect a set of neurons (Siemens & Tittenberger, 2009).

Node formation

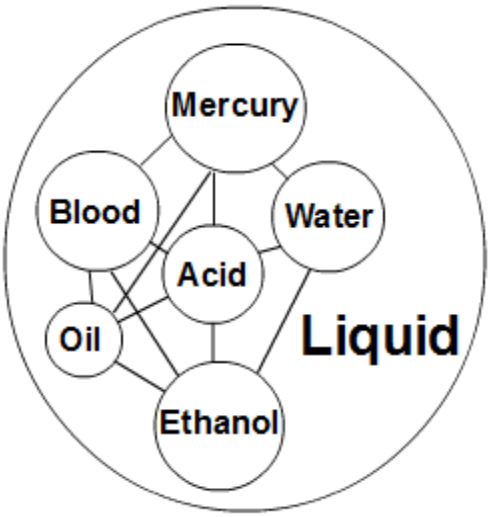
In the previous section, the node is described merely as a black box or an ambiguous object. Connectivism argues, however, that the node itself is a network. "Every entity is composed of additional entities" (Downes, 2007). The entity can be viewed in three separated levels:

Neural level

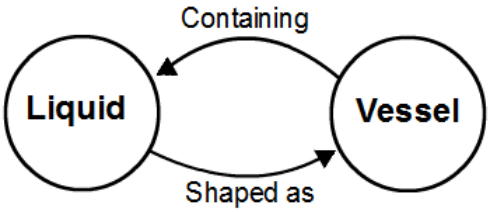
The network in neural level is a set of connected neurons; so, every neuron is connected to between 5,000 and 200,000 other neurons (Stufflebeam, 2008). But the neuron itself is a network. A typical neuron has a Soma in its center, which contains the nucleus of the cell. The cell is surrounded by plasma membrane. The nucleus and the membrane are connected to each other in dependency relationships to achieve the neuron function. The Soma itself is a network of protein synthesis and so forth (Lodish et al., 2000b). Neurons don't have the ability to divide. A damaged neuron, therefore, cannot be replaced, at least so far (Purves et al., 2001). Despite researchers' attempts to generate neurons from stem cells, the adult neural network does not grow; it is fixed.

Conceptual level

The node in this level is the concept. The concepts refer to ideas and thoughts that help human beings to interpret the world. The concepts are connected to each other in a network structure (Siemens & Tittenberger, 2009). For example, consider the 'liquid' concept. Actually, there is no physical instance named 'liquid'. The liquid is just a concept in human mind to gather relatively similar instances such as water, oil and ethanol. All these instances have something in common which makes them gather under one same concept: 'liquid'.



Therefore, the liquid is a concept that consists of a network of sub-nodes connected to each other with 'similar to' relationships. Creating a single node to represent an aggregation of different nodes simplifies human's network of concepts. The idea of aggregation returned to a philosophical idea of associationism: "two things that are relevantly similar become connected in the mind. This connection or association in turn allows knowledge about one to be inferred of the other" (Downes, 2007). Moreover, a liquid node can simply be connected to other conceptual nodes. For example, a 'liquid' connects to a 'vessel' node with a 'containing/shaped as' relationship.



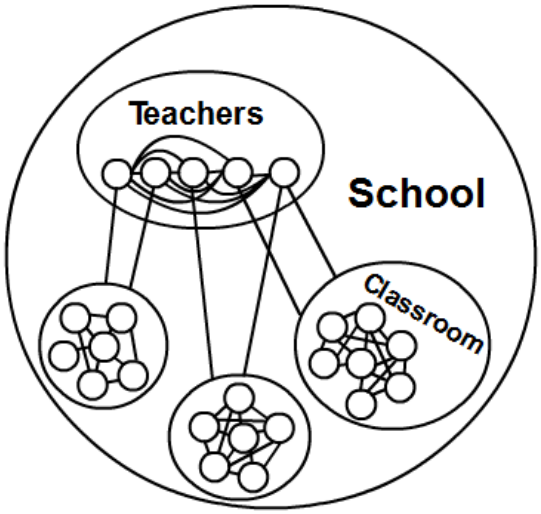
This also allows *density of liquid* to connect to *depth* and *gravity* to form a *hydrostatic pressure* formula. The differences between the inner nodes (water, oil, ...) are still recognized but, in such cases where their differences do not matter, a liquid concept comes as a black box. Thus, if one sees 'gasoline' for the first time, he/she will successfully treat it as liquid even without knowing its reality.

External level

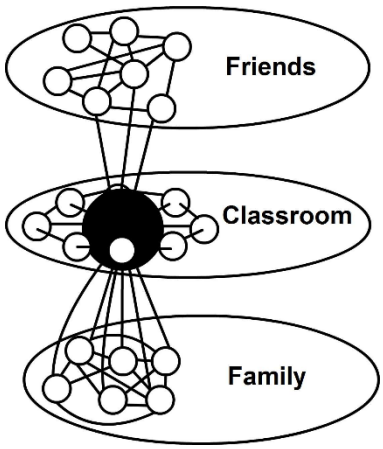
Unlike previous levels, the external network has a diversity of node types. Connectivism summarized all type of nodes by defining them as social or external nodes. Connectivism, in this level, built on Actor-Network Theory (ANT), which in turn, was built on Scientific Realism and

Social Constructivism (Frohmann, 1995). ANT realized that social environment is just a network of actors. Two main contributions are mentioned here: First, the topology or the structure that best describes environment is the network. Second, the actors of this process are not just human. Instead, humans and non-humans are all actors. The notion here is "in networks of humans, machines, animals and matter in general, humans are not the only beings with agency, not the only ones to act; matter matters" (Risan, 1997). Connectivism, however, puts more emphases on technology and assumes it as both, actor and connector. So, according to Connectivism, technology has actors such as Artificial Intelligence (AI) agents, smart phone devices, electronic books and websites; and connectors such as social network, internet and intranet.

Many different examples may be given for the formation of each node type in this level. In this section, some examples for human and non-human will be given. Consider, for example, a school as a node of a humanitarian network. The network consists of students, teachers and administrators. Within this network, sub-networks or clusters have emerged, such as classrooms and teachers' cluster. Clustering or dividing the network into sub-networks depends on the number of connections between elements. Therefore, it is heavily connected within a sub-network and loosely connected between sub-networks. The classroom itself can be divided into sub-networks of best friends and so forth.



It is important to know that the example above is just one sector of the real network. The real network is much more complex. For example, one student in the previous classrooms is connected to other networks such as friends and family.



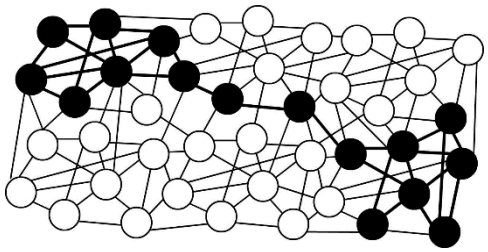
Similarly, non-human nodes participate in networks and consist of networks. A food chain is one of the famous examples. Considering the 'feed on/eaten by' relationship between humans, animals, plants and living things ends up in a food chain; and more precisely food network. One study in food network revealed an interesting finding which could be considered for other networks: Adding more parasites to food network increases connectance sometimes dramatically (Lafferty, Dobson & Kuris, 2006), where connectance is a key metric affecting the whole food web stability. In other words, small changes on a direct relation between two nodes, say 'A' and 'B', may have effects on the 'C' node, which does not have connection with either one.

Flow of information

In the previous section, the node is described as a network of related nodes. "Knowledge may reside in non-human appliances" (Siemens, 2006b, p. 31). However, knowledge is alive and the information is passed through the nodes. "Nodes that are no longer valued are weakened within this environment"(Siemens, 2006b, p. 30). In this section, the flow of information will be described partially in the three levels of networks:

Neural Level

Neural network send messages back and forth using electrochemical nerve impulses. The neuron function is based on synaptic signaling, a pattern of connections or pathways that connects neurons and helps signals' transmission. This process is partly electrical and partly chemical (Lodish et al., 2000b). Each group of neurons is responsible for processing specific kinds of phenomena, for example; computing verticality and quantity. When two groups of neurons in the brain are activated together over and over again, they will find a short path that links them together. Therefore, they are becoming connected. Later, activating one group will activate the other (Lakoff, 2009a).

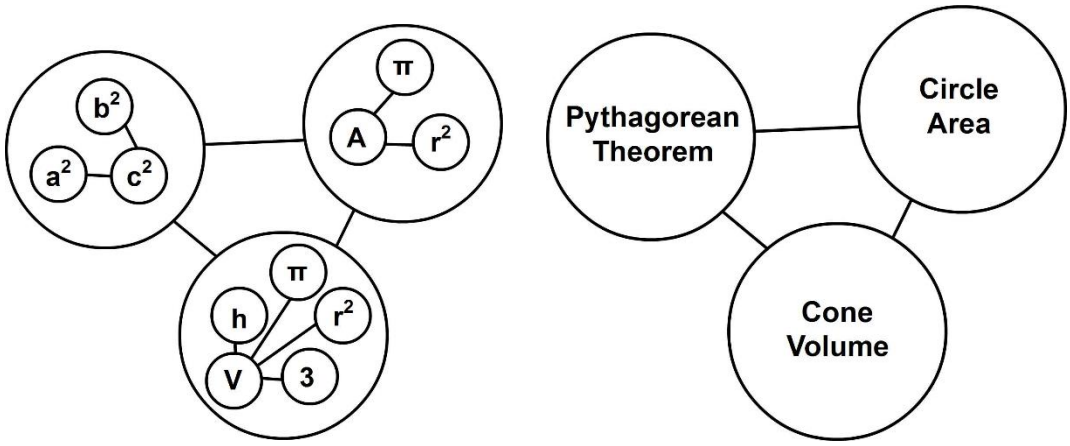


Each time the neuron is activated, the connection to the next neurons gets stronger. Without such signals, cells activate a so-called suicide program and eventually die (Lodish et al., 2000a). A child of 5 years old may get half of his neuron connections die off if they are not used (Lakoff, 2009b).

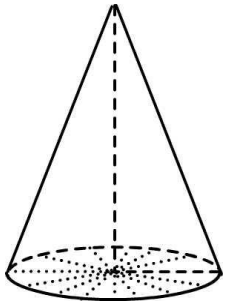
Conceptual level

Connectivism sees the node in conceptual network as ideas, thoughts and concepts. The information, events and experiences flow through one's ideas, thoughts and concepts in the process of thinking, dreaming, imagining and even while living and experiencing the real life. According to Connectivism, the conceptual network is working continuously and independently from the real world and the information flows either consciously or unconsciously, being, in most part (98%), an unconscious process(Lakoff, 2009a). The second assumption of Associationism says that "a certain amount of energy applied to a system will create a certain amount of kinetics-in other words, your brain goes on thinking even though it is not receiving input" (Downes, 2007, p. 5-6). The flow of information that passes through these ideas and concepts strengthen them, while the ideas and thoughts that are rarely visited by surrounding events, experiences and information slowly lose their connections to other nodes, and eventually are removed or

forgotten. Consider for example a student who perfectly masters the Pythagorean Theorem of rectum triangle. By the time of studying the course, the student is fully aware of all details of this theory. She/he can calculate any given examples and can connect this theory to other broader areas and topics, such as circle's area and cone's volume. Over time, and if she/he doesn't face these concepts in real life, the first thing that may be forgotten is the inner connections of the Pythagorean Theorem, the circle area and cone volume concepts. Therefore, they become ambiguous entities. Finally, the connections between the broader areas may, gradually, be lost.



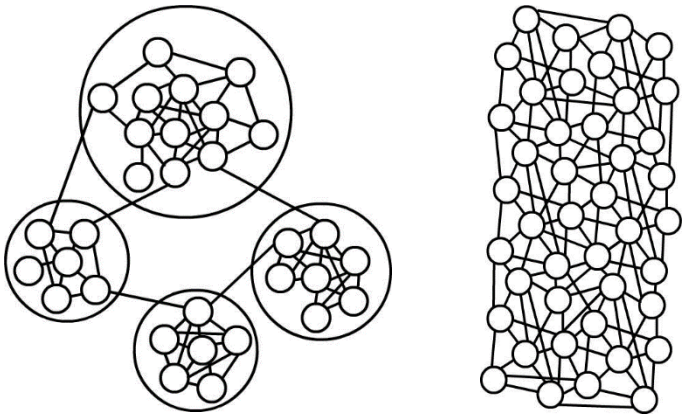
On the other hand, "a learner who continually encounters new information and events, will dynamically update and rewrite his/her network of learning and beliefs" (Siemens, 2006b, p. 30). Hereby, Connectivism applies the same concepts shown previously at the neural level. The flow of information between two conceptual nodes needs activating and extending both of them at the same time until the short path occurs. For example, in order to create a short path (connection) between Pythagorean Theorem, Circle Area and Cone Volume, each concept should be extended until the learner can see the relation that gathers them all.



External level

The flow of information at the external level comes as a form of social connection. The social studies of science and technology have revealed that the node (which may be human or non-human) is socially connected to its environment in a network based "topology". The node has a unique position in the network. Hence, it can only see, perceive, send and receive information through this position. The position in the network (centrality), the number of direct connections (density), the importance, or the uniqueness, of a connection to other nodes (bridge) and the minimum number of connections needed to reach a target node (distance) are all subjects of analysis in Social Network Analysis (SNA). What really flows through these connections does not matter, from SNA's perspective, as the frequency, repetition and availability of messages. In other words, SNA does not usually analyze the content; it analyzes the maximum, the minimum, the average and the total number of messages between nodes.

Technology makes both the connections and the flow of information more feasible. In a broader view, technology has dragged the society from densely connected groups or communities to a loosely connected group but a more connected individual. In other words, it lead society to 'networked individualism' (Dirckinck-Holmfield, Jones & Lindström, 2009). It sounds contradictory, but it can easily be explained: the average number of connections per node has increased but those connections are no longer limited to a certain group of nodes. Instead, the connections spread out through the whole network.



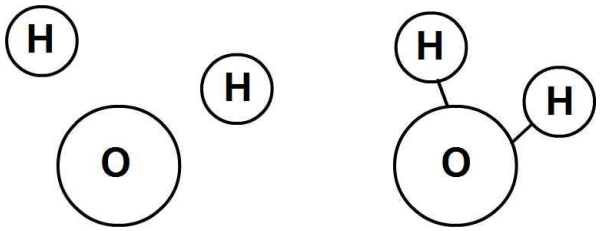
The relation between the connection and the flow of information is a unique relationship. The information needs a connection to reach the target and the connection needs the flow of information to stay alive. Therefore, no flow of information exists without connection and no connection remains without flow of information.

As an example of flow of information and the effect of technology in the creation of social connections, consider a software company, which imposes a hierarchical personnel structure with managers on the head and closed groups of programmers on the bottom. The Chief Executive Officer (CEO) has realized, after a while, that there are leaks of the codes that were developed inside the company. He hired a security company to track the flow of information and to insure no intruder can reach those codes. The first investigation revealed no security threats and the flow of information is secured. The second investigation, however, revealed that the closed groups of developers were not closed at all. Some employees were using virtual work websites and hiring other developers to get their jobs done. Some administrators have seen this as threat, others as an opportunity. The latter administrators have created many virtual companies, which gathered developers from all over the world. Similarly, educators may perhaps see these changes either as threats or as opportunities.

Known and unknown knowledge

Connectivism uses the network topology to represent the knowledge structure. One of Connectivism's questions is: 'does knowledge already exist – so the learner just has to explore, discover and aggregate it – or is it something 'in the open' and growing, so the learner can invent in addition?' Actually, Connectivism recognizes both scenarios but it concentrates more on known knowledge. Describing knowledge as abundant and easy to access, connectivists hold that adding something new to the existing knowledge is very complicated and requires the effort of others. Like Siemens (2006b) says, "Problems are becoming so complex that they cannot be contained in the mind of one individual — problems are held in a distributed manner across networks, with each node holding a part of the entire puzzle" (p. 44). Therefore, according to the connectivist's view, aggregating, exploring and discovering the known knowledge is more important than inventing new knowledge.

It is also important to know that the aggregation of existing knowledge is seen, by itself, as new knowledge. So, a compounded node is larger than the sum of its inner nodes. In other words, the compounded node has an emergent property where the node properties are not merely the collection of inner nodes properties (O'Connor & Wong, 2002). Actually, in some cases, they can be completely different. Consider, for example, the properties of oxygen and hydrogen atoms. Hydrogen gas is highly flammable and oxygen gas is necessary for combustion. If one oxygen and two hydrogen atoms are combined, the result is one water molecule (H_2O). It is a *liquid*, which is used for *extinguishing* fire! The emergent property resulting from this combination has nothing to do with any of these single atoms' properties.



Similarly, gathering one administrator, secretary and accountant does not mean a sum of them. Instead, it may mean tourism agency.

So, according to Connectivism, unknown knowledge will find its way to known knowledge when its surrounding nodes need it in their path. Electricity and gravity may have not been discovered without the preliminary discoveries. Those preliminary discoveries make it logical to think and find the pattern of relation between the fallen apple, the force and the acceleration.

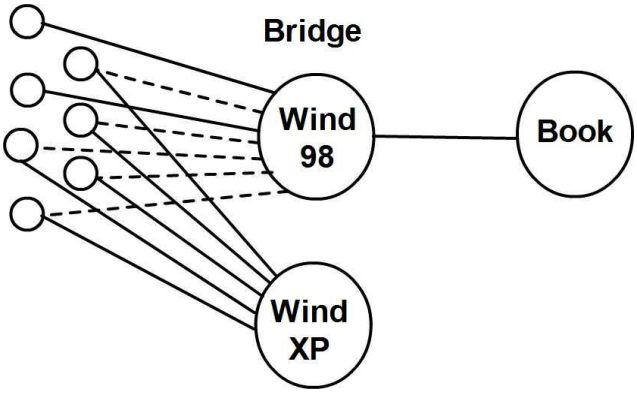
What if the network was partially unknown, are we able to handle it? Are we able to use it? Observation emphasizes that human beings are able to deal with uncertainty, make use of complex objects and manipulate "black boxes": water has been used long before its synthesis was discovered; students use calculating machines without really knowing how they work. As Siemens (2006b) would say, that is the human's artistry: "The artist sees (and accepts) the beauty of uncertainty and values learning as both a process and a product... Tools are used like paint brushes to create the desired painting of learning" (p. 108).

Moving node

All previous theories recognize knowledge as an object or state to be acquired or built in the learner's mind. Connectivism, in contrast, conceives it as a process, which is alive and moving, a shifting reality. As seen in the previous sections, the flow of information from one node to another gives some vitality to the network. But, what about the nodes and the connections? Connectivism sees both of them as moving objects. In other words, time should be considered as a dimension of knowledge: in one moment some nodes appear, others disappear; some connections are strengthened, others are weakened. So, as Siemens (2005) says, "While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision" (p. 4); the node itself may change its position by changing its connections and give place to another reality. To clarify this idea, consider a car driver who was driving a car in high speed. The road appeared to be empty and all coming information made him satisfied about his decision. Suddenly, a pedestrian jumped into the roadside and crossed the street. The car, at that moment, was about 50 meters away from the pedestrian. The right decision would to press the brake pedal. Unfortunately, the driver didn't take that decision. Two seconds later, the car was 10 meters away. The right decision, at that moment, was to steer the wheel. Pressing the brake pedal is no longer the right decision. In this example, there were three decisions (high speed, pressing the brake pedal and steering the wheel); each one was representing the best decision in a specific time fraction. However, when the incoming information is changing

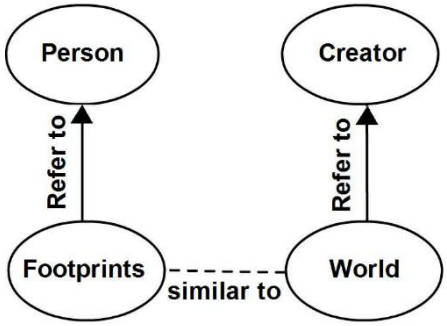
quickly, the best decision can suddenly become the worst. When things go faster, the lifetime of the decision gets shorter. That is exactly what is happening in the education scene: Sciences are developing very rapidly and the (reluctant) drivers' decisions are coming too late.

There are two main factors that make the node unstable: (1) node emergence/volatilization and (2) the node autonomy. Consider, for example, a book talking about using Microsoft Windows 98 in education. The book took about one year to be written. Then it followed a regular process of validation and distribution. This means two additional years. The book reached library's shelves after 4 years. By that time, new Microsoft Windows version was released and the book's value is now questionable.



In this example, Windows 98 itself was a node in the network. As any other commercial product, this node follows a product lifecycle of introduction, growth, maturity and decline. This node emerged and declined within 4 years (Microsoft, 2014). In the meantime, people connected to this node. The book is another node added to the network, which is trying to use Windows 98 node as a 'bridge' or as a hub to reach the people. Suddenly, a new node has jumped to the scene: Windows XP. Because "currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities" (Siemens, 2005, p. 4), most people leave the old node (Windows 98) and connect to the new one (Windows XP). Of course, this is bad news for all nodes using Windows 98 as a hub: dealers, programmers, authors and educators.

Node autonomy is the second factor of network instability. This can happen in all kinds of nodes: neural, conceptual and external. Neural cells, for example, are different from each other. Each group of neurons is responsible for a specific task. Adjacent neurons resist the signal, at first, unless the power and repetitions compel them to connect. Otherwise, if activating one neuron can easily activate all adjacent neurons, then activating one neuron will activate all brain's neurons and that, of course, is not true. Similarly, the conceptual network of a person resists new ideas unless that person has allies of concepts in his/her mind. The concept grows gradually by connecting to other concepts. Again, the concept itself has its autonomy to "accept" or to "reject" the connections with other concepts. That is why, according to Connectivism, people have different ideas, opinions and reasoning; connection between two concepts is simply the path for reasoning. For example, someone who saw human's footprints on the ground, inferred that someone else had passed there. The relationship between the person (cause) and the footprint (effect) is a causal nexus. At the same time, he saw the world, which is perfectly harmonized, similar to the footprint (effect); can't come by chance and there is a cause for this effect. Therefore, this leads him to the Creator. Other people couldn't see the relationship between 'Footprint' and 'World'. Thus, they reached to other conclusions.

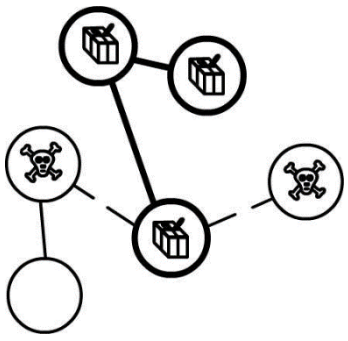


Learning as a Pattern Recognition

In Connectivism, the structure of the knowledge is described as a network. The network is a set of nodes connected to each other. These relationships/connections may not be seen as a singular link between two nodes. Instead, they are more like patterns: groups of relationships that come together as a single whole. The network is not static; it is dynamic and those patterns may change over time. Learning, according to Connectivism, is a continuous process of network exploration and patterns finding; it is a process of patterns' recognition. In the subsequent sections, the knowledge described as a network is explored in relation to the former theories. In other words, how the former theories act in a networked knowledge and how their proposed learning models are interpreted according to Connectivism. Finally, a Connectivism learning model is introduced as an alternative learning model, as connectivists say.

Former Theories

Behaviorism conceives knowledge as a physical object the learner should get and learning as a process of transferring facts to the learner's head through mechanisms of reward and punishment. According to Behaviorism, learning depends on the learner's innate like/dislike. It can be represented in a networked knowledge as the following: the teacher should put awards in the path, in which he/she think it is right and put obstacles in all other paths. Thus, the learner will find it interesting to follow the teacher's path. With repetition, the learner forgets all other paths.



Behaviorism is doing well in teaching animals such as dogs, monkeys and others. Some early school teachers still find this method useful once the awards and obstacles may speed up the process of transferring knowledge.

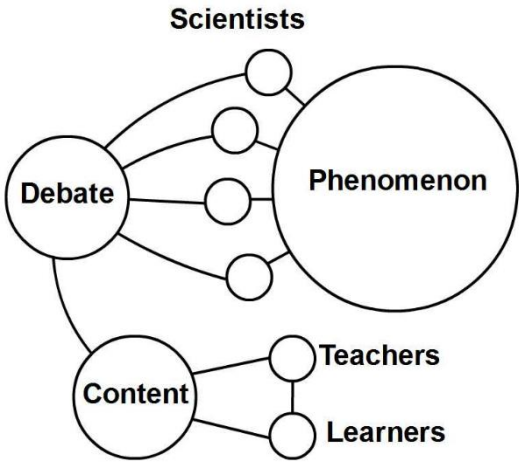
Cognitivism moved forward and says that the knowledge is not just as facts; it may include theories and opinions. Hence, learners should use their logical capacity to process information. The learning is negotiated through experience. In a networked knowledge perspective, the teacher should design for the learning experience in advance and prepare a narrow network where the learner has limited paths to try. Learners who follow the logical path will succeeded, the others may retry.

Constructivism, in specific, recognizes the complexity of the knowledge. "Constructivist principles acknowledge that real-life learning is messy and complex" (Siemens, 2005, p.2). The knowledge is inside the learner's mind built through the process of meaning-making. The teacher should design for learning experience to be rich and diverse. In networked knowledge perspective, the knowledge does not necessarily have one logical path to the right answer; there may be other paths. The learner should decide which path to follow.

Learning model in former theories

All previous theories follow the same education process. The knowledge is inspected, negotiated, filtered and presented as useful books. Teachers handle these books and arrange learning experiences according to one of previous theories: behaviorism, cognitivism, or constructivism. The best analogy for this process is the story told by El-Gazaly (n. d., p. 1359), an ancient Arabic educator. El-Gazaly resembled the knowledge as an elephant entered a village for the first time. A group of blind people heard about that big animal, so they went to inspect it and said: we will do our best to know what that animal looks like. When they arrived, one of them touched the elephant's leg, another touched its tusk and the last one touched its ear. Thereafter, they returned to village and ran a debate; the first said: the elephant is like a big tough cylinder (the leg), the second said: it is like a small smooth pipe (the tusk) and the last one said: it is like a thin skin (the ear). All of them were honest, but none of them was true. In spite of the debate, they wrote books about the elephant. The books were used later by teachers and students. The blind people represent the scientists who go and inspect new phenomenon. Each one of them sees the phenomenon from one side. Constructivism recognizes this issue. It emphasizes a negotiation between scientists to construct a pattern that best resembles the phenomenon. It also recognizes that the final construction is not exactly the same as as the phenomenon.

In general, former theories follow the same education process: phenomenon, scientists, debate, content, teacher and learner. The teacher may work as a transferring agent (Behaviorism) or as facilitator (Cognitivism, Constructivism).



In this model, the content plays the central role: it is the aim the scientists generate; and it is the product the learners consume or put in their mind. **This model worked well for a long time, but not anymore, according to connectivism.**

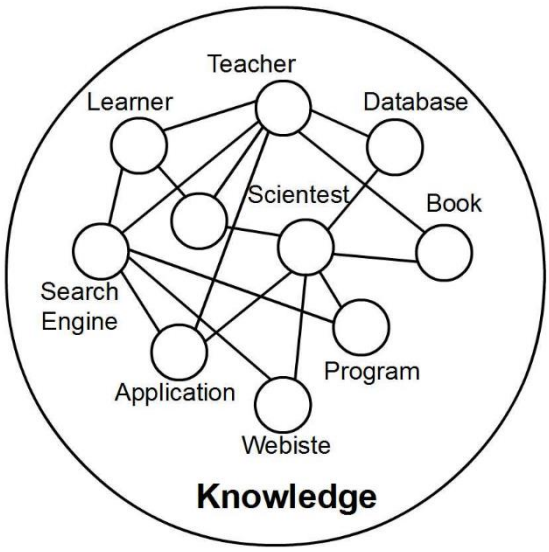
Connectivism learning model

Connectivism simply adds two important notes to the elephant story: (1) the elephant is not an elephant, it is a jellied creature, which changes its shape much often and (2) the investigators, the teachers, the learners, along with non-human agents are within the knowledge; they are partners not counterparts. Taking into account the Connectivist’s conceptual proposal and anticipating its

implications on the educational processes, many critical changes can be foreseen. First, if we consider the quick and numerous changes that sciences and society are witnessing, we can say that the methods and processes that we are using today, in teaching, take too long, i.e.; while the scientists inspect, run debate and write books, knowledge rapidly and significantly changes and soon expires. Second, the current educational approaches try to keep teachers and learners away from the controversy and the debate amongst scientists. The idea is to provide teachers and learners with a ready-for-use material but this, somehow, keeps teachers and learners as mere knowledge consumers, as passive agents.

As we could see throughout the author's attempts to clarify the Connectivist proposal, this new conceptual framework has a unique vision regarding the interaction between learners and content. The content is just a node in the network and learners are mainly not interested in putting it inside their minds. In contrast, learners are interested in using, copying and pasting this content to reach their aims. In Siemen's (2006b) words "We off-load many cognitive capabilities onto the network, so that our focus as learners shifts from processing to pattern recognition" (p. 43). Besides, learners are autonomous nodes in the network and they are different from each other in their aims and, therefore, in the way they use contents. According to Connectivism, the educational system should foster the learners' diversity and not their similarity.

Additionally, it proposes that learners are put in the same place as researchers: in front of the recent knowledge. That way, learners become content generators and not content consumers. Therefore, instead of giving learners a stable, ready-for-use and solved problem, Connectivism proposes giving them unstable, controversial, unsolved and real-life problems. That may increase students' tension and uncertainty, and maybe, the feeling of 'chaos'. The uncertainty will force them to search for answers, to ask help, to seek for patterns and, in other words, to form connections, in an attempt to solve the problem ahead. Here comes the role of the teacher, a mature learner, or a specialized node, someone who has already connected to a very good network in the field: other researchers, books, journals, websites, databases, mobile applications and others. Instead of being a bridge node to this network, the teacher should help new learners to plant themselves in the network, to be connected to its nodes and to be part of it.



In this process, technology represents the main connector in the network. Either by phone, e-mail, search engine or social network; technology makes it easier to reach the current, up-to-date information. However, "whether online, face-to-face or blended, learning and knowledge environments need to be democratic and diverse" (Siemens, 2006b, p. 47).

Discussion

Connectivism has been drawn from a long history of Artificial Intelligence findings. The idea of representing the knowledge as a network has been extensively used in AI research. Russell and Norvig (2010, p. 290) summarize, in a table, the languages used in AI along with their ontology (what the world contains) and epistemology (what the agent believes about ontology):

Table 1
AI languages and agent epistemology (Russell & Norvig, 2010)

Language	Ontology	Epistemology
Propositional Logic	facts	true/false/unknown
First-Order Logic	facts, objects, relations	true/false/unknown
Temporal Logic	facts, objects, relations, time	true/false/unknown
Probability theory	facts	degree of belief E(0-1)
Fussy Logic	facts with degree of truth E(0-1)	known interval value

The first time the ontology presented as a network was in a First-Order Logic. Temporal Logic adds time to the network. Connectivism, at least in its first version, corresponds to Temporal Logic where the ontology is a network that consists of objects and relations. In addition to them, the network has facts and time. The facts or the rules govern the network. The time makes difference in validating the facts. The agents in AI correspond to the learners in Connectivism. The learners have an epistemology that consists of the network in which they believe, disbelieve or do not know. This epistemology does not belong to one learner; instead, it is distributed among learners and things. This paper adds the degree of truth to Connectivism's ontology and epistemology.

It seems that most current researchers have realized that technology has impacted the way we understand knowledge and learning. However, they differ in their visions of this impact; some are still seeing previous learning theories valid and technology as another way in which a person stores his/her knowledge; like books, like databases. For them, "modern cognitive tools are nothing but an extension of the toolkit" (Verhagen, 2006, p. 4). Therefore, "we should forget about Connectivism" (Verhagen, 2006, p. 5). Others see technology impacts significant but they argue that Connectivism theory is not the right approach: naming Connectivism as learning theory "is a tall order for so young a theory" (Bell, 2011, p. 104) and "it does not seem that Connectivism's contributions to the new paradigm warrant it being treated as a separate learning theory in and of its own right" (Kop & Hill, 2008, p. 11). Therefore, they suggested alternatives: for example, Actor-Network Theory (Bell, 2011) and Cultural Psychology (Clarà & Barberà, 2013). Some other researchers see the value of Connectivism Theory and use it (Garcia, Brown & Elbeltagi, 2013; Barnett, McPherson & Sandieson, 2013; Blot & Saurel, 2014; Denzil, 2013; Dunaway, 2011) or try to integrate it with other theories such as Community of Practice, Design-Based Research and Activity-Theory (Boitshwarelo, 2011).

Among other things, Connectivism has been criticized:

- It does not address how learning take place; it is concerned about what is learned and why (Verhagen, 2006).
- It does not present new ideas; all of its principles have circulated somehow in Education literature (Verhagen, 2006).

- The ideas and principles used in AI and machine learning are-in no means-applicable to human learning as the human learning is not applicable for machine learning (Verhagen, 2006).
- Connectivism principles lack rigor and are not written in such way that can be tested (Bell, 2011; Verhagen, 2006).
- Connectivism's exponents do not provide a coherent view of the theory; some wrote ideas that are different from others (Bell, 2011).
- Any new theory should be built on older theories not discarding them; Connectivism does not (Kop & Hill, 2008).
- Connectivism is lacking sufficient empirical research (Kop & Hill, 2008).
- Connectivism does not present a solution for a learning paradox (Clarà & Barberà, 2014).
- Connectivism under-conceptualizes interaction. For example, the relationship between a teacher and two different students would be represented by just two connections. This oversimplifies a human relationship where the teacher may connect to one with a completely different relationship than the other (Clarà & Barberà, 2014).
- It can't explain concept development (Clarà & Barberà, 2014).

Downs and Siemens already discussed some of the issues listed above (Kop & Hill, 2008; Siemens, 2006a). This paper also tries to make things clearer and it may answer some of these issues. For example, we think that under-conceptualizing interaction can be explained by defining a relationship as graded. In addition, this paper may contribute in explaining the concept development using the principles of "every entity is composed of additional entities" (Downes, 2007) and flow of information.

One interesting issue from the list is that connectivists provide inconsistence in their view of Connectivism. In our opinion, this is a natural phenomenon, especially for a growing theory. Moreover, this paper may introduce a slightly different presentation than that presented by other connectivists.

Regarding the lack of empirical studies in supporting of Connectivism Theory, we can see that the process started and the results showed some positive feedback (Barnett, McPherson & Sandieson, 2013; Blot & Saurel, 2014; Dunaway, 2011). However, we notice that most of these empirical studies were done using online courses. This indicates that the researchers may find Connectivism suitable only for e-learning settings. Even though Connectivism is presented as a learning theory in educational settings and not exclusively for e-learning settings (Kop & Hill, 2008). Therefore, it is imperative to continue the process of validating Connectivism in all educational settings including school classrooms.

Conclusion

Conceiving knowledge using a network topology is ambiguous for some researchers. Even though this paper is not the first to talk about connective knowledge (Downes, 2007; Siemens, 2006b), it certainly adds a concrete sense of some abstract words. It moves step-by-step so a newcomer to the field of networks can easily understand what is really meant to define epistemology's structure as a network. The study shows how knowledge may be represented in a network consisting of nodes and relationships. The node can be neural, conceptual and external. The relationship has a direction and in most part is graded or interpreted. The relationship may not be seen as a single connection between two nodes; instead, it should be seen as a part of other connections, a pattern. Knowledge network is not static; it is alive and moving. In other words,

time is considered as one of knowledge dimensions: the flow of information plays a role to retain or drop down the connections; new nodes are added and others disappeared. Even though the former learning theories do not hold the notion of knowledge as a network, this paper tries to explain how their assumptions reflect on a network. Finally, the paper presents a Connectivism learning model which asserts on considering the rapid changes of knowledge and a new relation between all learners: students, teachers and researchers.

However, this paper does not claim that it covers all networked knowledge aspects. For example, distributed cognition and collective knowledge are not covered, but they still can be interpreted. In addition, this paper builds mainly on George Siemens and Stephen Downes works, but it sometimes borrows ideas from Artificial Intelligence.

After reviewing Connectivism interpretation of knowledge, we hold that a network is a fixable structure; it is dynamic and can cope with complicity and diversity of knowledge. However, defining learning as pattern recognition is not enough to interpret learning. The second step for Connectivism, we think, is to interpret 'how the pattern recognition is done? What are the mechanisms used for pattern recognition?' Even in AI research, it is not possible to build an agent by stopping in this stage. For example, in order for AI agent to recognize the pattern, it should be equipped with searching mechanisms (Breath-first, Depth-first, Greedy best-first and A* search), a store of axioms (knowledge base), logic and inference rules, learning algorithms and many others. Only then, educators can build learning networks that can make learners grow easily and very fast.

References

Barnett, J., McPherson, V., & Sandieson, R. M. (2013). Connected teaching and learning: The uses and implications of connectivism in an online class. *Australasian Journal of Educational Technology*, *29*(5), 685–698.

Bell, F. (2011). Connectivism: Its place in theory-informed research and innovation in technology-enabled learning. *The International Review of Research in Open and Distance Learning*, *12*(3), 98–118.

Blot, G., & Saurel, P. (2014). Pattern Discovery in E-learning Courses : a Time-based Approach. In *Control, Decision and Information Technologies (CoDIT), 2014 International Conference* (pp. 646–651). IEEE.

Boitshwarelo, B. (2011). Proposing an Integrated Research Framework for Theoretical Synergies. *International Review of Research in Open and Distance Learning*, *12*(2005), 161–179.

Clarà, M., & Barberà, E. (2013). Learning online: massive open online courses (MOOCs), connectivism, and cultural psychology. *Distance Education*, *34*(1), 129–136. doi:10.1080/01587919.2013.770428

Clarà, M., & Barberà, E. (2014). Three problems with the connectivist conception of learning. *Journal of Computer Assisted Learning*, (OCTOBER 2013). doi:10.1111/jcal.12040

Cormier, D. (2008). Rhizomatic Education : Community as Curriculum. *Innovate 4 (5)*. Retrieved September 19, 2014, from http://davecormier.com/edblog/2008/06/03/rhizomatic-education-community-as-curriculum/

Denzil Chetty. (2013). Connectivism: Probing Prospects for a Technology-Centered Pedagogical Transition in Religious Studies1. *Alternation*, *10*(Special Edition), 172–199. Retrieved from http://www.finance.ukzn.ac.za/docs/20.7/09 Che.pdf

Dirckinck-Holmfield, L., Jones, C., & Lindström, B. (2009). *Analysing networked learning practices in higher education and continuing professional development*. Sense Publishers.

Downes, S. (2007). An Introduction to Connective Knowledge. Hug, Theo (ed.) (2007): Media, Knowledge & Education-Exploring new Spaces, Relations and Dynamics in Digital Media Ecologies.

Dunaway, M. K. (2011). Connectivism: Learning theory and pedagogical practice for networked information landscapes. *Reference Services Review*, *39*(4), 675–685.

El-Gazaly, A. H. (n.d.). احياء علوم الدين. Retrieved September 28, 2014, from http://www.creativity.ps/library/datanew/cre5/16.pdf

Frohmann, B. (1995). Taking information policy beyond information science: applying the actor network theory. In *ANNUAL CONFERENCE OF CANADIAN ASSOCIATION FOR INFORMATION SCIENCE* (Vol. 23).

Garcia, E., Brown, M., & Elbeltagi, I. (2013). Learnig within a connectivist educational collective blog model: A case study of UK higher education. *The Electronic Journal of E-Learning*, *11*(3), 253–262.

Kop, R., & Hill, A. (2008). Connectivism: Learning theory of the future or vestige of the past? *International Review of Research in Open and Distance Learning*, *9*(3).

Lafferty, K. D., Dobson, A. P., & Kuris, A. M. (2006). Parasites dominate food web links. *Proceedings of the National Academy of Sciences*, *103*(30), 11211–11216.

Lakoff, G. (2009a). Frameworks, Empathy and Sustainability pt1 of 6. Retrieved September 21, 2014, from https://www.youtube.com/watch?v=T46bSyh0xc0&feature=em-subs_digest-vrecs

Lakoff, G. (2009b). Frameworks, Empathy and Sustainability pt2 of 6. Retrieved September 23, 2014, from https://www.youtube.com/watch?v=7piNmK-H55Y

Lodish, H., Berk, A., Zipursky, S. L., Matsudaira, P., Baltimore, D., & Darnell, J. (2000a). Cell Death and Its Regulation. In *Molecular Cell Biology* (4th ed.). New York: WH Freeman. Retrieved from http://www.ncbi.nlm.nih.gov/books/NBK21716/

Lodish, H., Berk, A., Zipursky, S. L., Matsudaira, P., Baltimore, D., & Darnell, J. (2000b). Overview of neuron structure and function. In *Molecular Cell Biology* (4th ed.). New York: WH Freeman. Retrieved from Available from: http://www.ncbi.nlm.nih.gov/books/NBK21535/

Microsoft. (2014). Microsoft Product Lifecycle Search. Retrieved December 12, 2014, from http://support2.microsoft.com/lifecycle/search/?alpha=Windows 98

O'Connor, T., & Wong, H. Y. (2002). Emergent Properties. *The Stanford Encyclopedia of Philosophy (Spring 2012 Edition)*. Retrieved from http://plato.stanford.edu/entries/properties-emergent/

Planck, M. (2013). *Treatise on thermodynamics*. Courier Dover Publications.

Purves, D., Augustine, G. J., Fitzpatrick, D., Katz, L. C., LaMantia, A.-S., McNamara, J. O., & Williams, S. M. (2001). Neuroscience (2nd ed.). Sunderland(MA): Sinauer Associates. Retrieved from http://www.ncbi.nlm.nih.gov/books/NBK10920/

Risan, L. C. (1997). *Artificial Life: A Technoscience Leaving Modernity? An Anthropology of Subjects and Objects*. TMV-senteret. Retrieved from http://www.anthrobase.com/Txt/R/Risan_L_05.htm#0.01 A brief introduction to the field of Artificial Life research

Russell, S., & Norvig, P. (2010). *Artificial Intelligence: A Modern Approach* (Third Edit.). New Jersey: Prentice Hall.

Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning*, *2*(1), 3–10.

Siemens, G. (2006a). Connectivism: Learning theory or pastime of the self-amused. *Manitoba, Canada: Learning Technologies Centre*.

Siemens, G. (2006b). *Knowing knowledge*. Lulu. com.

Siemens, G. (2008). CCK08_Wk5-Groups and Networks : Connectivism and Connective Knowledge. Retrieved June 11, 2014, from http://elearnspace.org/media/CCK08_Wk5/player.html

Siemens, G., & Tittenberger, P. (2009). *Handbook of emerging technologies for learning*. Manitoba,, Canada: University of Manitoba. Retrieved from http://elearnspace.org/Articles/HETL.pdf

Stufflebeam, R. (2008). Neurons, synapses, action potentials, and neurotransmission. *Consortium on Cognitive Science Instruction*.

Verhagen, P. (2006). Connectivism : a new learning theory ? *University of Twente*, *2*(1), 3–10. Retrieved from http://elearning.surf.nl/e-learning/english/3793

About the authors

Alaa A. AlDahdouh is PhD candidate in the Institute of Education of University of Minho, Portugal. His research interests are primarily in technological impacts in learning behavior. His work focuses on investigating new educational theories such as connectivism and their role to enhance educators' understanding of learning process.

E-mail: AlaaAldahdouh@gmail.com

Corresponding author

António J. Osório is Associate Professor with aggregation in the University of Minho (Portugal) and member of the Department Curriculum Studies and Educational Technology of the Institute of Education. Researcher in the Centre for Research in Education. Coordinates various national and international research projects, in the area of Information and Communication Technology in Education. Director of master degree courses and supervisor of several master and doctoral projects.
E-mail: ajosorio@ie.uminho.pt

Susana Caires has a Phd in Psychology, specialty in Educational Psychology. Assistant professor at the Institute of Education of University of Minho. Member of the Department of Educational Psychology and Special Education. Teaches in master degree and PhD courses in Education in areas such as motivation, learning and development; and research methods.
E-mail: caires@ie.uminho.pt

Return to Table of Contents

Return to Table of Contents

Editor's Note: This is a study about transition from traditional methods of teaching and learning to a student-centered approach with elearning based on a substantial body of research, theory and practice..

Students' perception of the potential of elearning practices at the University of Guyana

Kerwin A. Livingstone
Guyana

Abstract

The University of Guyana, up to the present time, continues to embrace a traditional learning and teaching approach in its educational practices. Face-to-face contact is the principal mode of instructional delivery. Further to this, the conventional Distance Education, via the print-based correspondence mode, is still the current trend. Such a method favours but a handful of students. As has been revealed by research, such an approach, even if it might engage students, is still teacher-directed and rejects an emancipative, student-centred approach to learning. Elearning, however, seems to be gaining momentum as the instructional delivery mode in many educational institutions in both developed and developing countries. This supposedly fosters student engagement and emancipation. Considering the afore-mentioned, the present study focuses on students' perception of the potential of elearning practices at the University of Guyana. In relation to the aim, objectives and research questions of this paper, a survey about elearning was constructed, through a purposive sampling technique, aimed at University of Guyana students. Subsequent to its design, it was implemented with a view to highlighting, through respondents' answers, the practicality of espousing technology-based education for the higher education institution. The data was analysed empirically, through a mixed method approach, and by means of data triangulation. The findings illuminate that the students are, by and large, generally ready for elearning and are prepared for this new educational initiative. Recommendations are made for this instructional delivery mode to be adopted and incorporated into the learning-teaching process.

Keywords: elearning; elearning practices; technology; technology-based education; higher education; instructional delivery mode.

Introduction and contextualisation

Guyana, known as the 'land of many waters', is the only English-speaking country found in the continent of South America, is home to a population of approximately 780,000. While 90 percent of the population occupies the narrow and relatively easily accessible coastal plain, the remaining population is sparsely distributed in the mountainous and forested hinterland which, more than any other part of the country, is affected by limited trained human resources.

In terms of tertiary level education, the University of Guyana (UG) is the only higher education (HE) institution in Guyana. It is located on the coast of the capital city, Georgetown. Established in April 1963, the University currently has a student population of approximately 6,300 students with a yearly intake of about 1,500 (UG Registry, 2014). The staff population is approximately 924 (UG Personnel Office, 2014).There are 14 Statutory Officers who comprise UG's core leadership (UG Website, 2013), 514 lecturers (UG Personnel Office, 2014), and the remainder, other University staff members.

The UG has two campuses – the Turkeyen Campus and the Berbice Campus (UG Website, 2013). The Berbice Campus, opened in November 2000, was established to provide university education

access to persons in that region who were unable to attend the Turkeyen Campus, located in the capital city, Georgetown. Owing to the lack, or unavailability, of skilled teaching faculty in the Berbice region to deliver its programmes at the Berbice Campus, lecturers from the Turkeyen Campus would normally travel there to take care of these needs. A map of Guyana showing the UG's two campuses is presented in Figure 1. The Turkeyen and Berbice Campuses are located at 1 and 2 on the map, respectively.

Figure 1: Map of Guyana showing UG's campuses.
[Source: www.guyana.org]

The University's curriculum has not been modified for approximately 30 years (Livingstone, 2013). The existing didactic modes are the traditional face-to-face (F2F) interaction and distance education (DE) via print-based correspondence. From personal observation, all learning is teacher-controlled. Diversified learning and teaching with technology is not promoted (Livingstone, 2013). An important issue which needs to be addressed is institutional modernisation through quality enhancement. In this era, where technology has become ubiquitous, and where a large number of students are technology savvy, the UG needs to shift its focus towards embracing technologies in education, in order to become more marketable and compete with other universities abroad that offer online courses and programmes. This shift will be a stepping stone towards the delivery of cutting edge higher education.

Elearning has the potential to significantly accommodate different learning styles and needs (Laurillard 2007, 2008). The objective is to get students to separate themselves from the full F2F classroom setting, favouring a flexible virtual environment. Goold, Craig and Coldwell (2007) indicated that elearning enables a greater number of students of diverse educational and cultural backgrounds, as well as of modes of study, to come together within the one virtual classroom. Given this is the age of technology, and many universities are integrating it into the pedagogical process, it would not be unjust to say that the pedagogical scenario at the UG would be boosted significantly if it were to integrate elearning practices.

Theoretical framework and literature review

The theories selected that orient this study are (1) *constructivism* [social constructivism], (2) *transactional distance* [independence and autonomy; interaction and communication] and, (3) *connectivism*. Each of these is discussed briefly, in the light of this study, justifying their necessity for quality educational practices at the UG.

Constructivism

In recent times, there has been a shift to *constructivism* (Ally, 2004). *Constructivist theorists* (Piaget 1928; Vygotsky 1930; Dewey, 1938; Bruner, 1973; Jonassen, 1999) claim that learners interpret information and the world based on their personal reality, and that they learn by observation, processing, and interpretation, and then personalise the information into personal knowledge. In other words, learners learn best when they can contextualise/situate what they learn for immediate application and to acquire personal meaning. Constructivists see learners as being active protagonists of their learning (Cooper, 1993; Wilson, 1997; Tapscott, 1998). The learner is the centre of the learning, with the teacher playing an advisory and facilitative role. Duffy and Cunningham (1996) postulate that learners should have the opportunity to construct knowledge instead of being the receivers of knowledge through instruction. It therefore follows that learning must move away from teacher-centred instruction to knowledge discovery and construction.

Social Constructivism

Social constructivism was developed by Vygotsky (1978), a post-revolutionary Soviet psychologist. Its emphasis is on the collaborative nature of learning. Vygotsky, though being a cognitivist at the time, discarded the hypothesis made by other cognitivists like Piaget (1932) that separating learning from its social context was possible. He defended his stance that all cognitive functions originated in society, and should therefore be explained as products of social interactions, since learning was not simply the assimilation and accommodation of new knowledge by learners; in fact, it was the process by which learners were integrated into a *knowledge community*. In other words, these social interactions among individuals can blossom into a community of learners, or learning community, where this is mutual interdependence.

Vygotsky's (1978) four principles of *social constructivism* are: (1) learning and development in a social, collaborative activity; (2) school learning should occur in a meaningful context and not be separated from learning and knowledge children develop in the 'real world'; (3) out of school experiences should be related to the child's school experience and, (4) Zone of Proximal Development. It is important to mention that these principles highlight the critical weight of culture and the significance of the social context which is largely responsible for the development of students' cognitive skills. His *'Zone of Proximal Development'* is perhaps his best-known theory, which argues that, with assistance from adults or more advanced learners, less advanced students can master concepts and ideas that, on their own, might pose challenges to them.

The constructivist approach to learning and teaching is absent from the pedagogical practices at the UG. Educational practices there are still based on the traditional approach **(**Livingstone, 2014). Teacher-centred strategies are still employed, where the teachers impart knowledge and students absorb it. Students are not the centre of learning; in fact, they are passive learners. It is a very daunting situation, as students are not given the opportunity to have autonomy over their learning. Most learning-teaching activities at the University are still largely individual. There is not much interaction and communication to complete assigned tasks.

Since learning is not static, learning theories must change to suit the broader educational context in which they are found. 'Quality learning', as noted by Biggs and Tang (2011), is all about ensuring that learners use the appropriate cognitive skills required to construct knowledge and

negotiate meaning during task completion, thus paving the way for *creativity*, *application* and *life-long learning*. They must be provided with a broad-based learning and with a repertoire of learning tools and sources. Employing the social constructivist approach will ensure quality learning for all students at the UG.

Integrating elearning practices into the learning-teaching process at the UG will definitely support constructive learning. Learner-centered, interactive and collaborative practices will be experienced. In these innovative learning environments, learners will have the opportunity to be independent and autonomous over their own learning process. In addition to these, by the integration of Internet to educational settings, traditional forms of distance education at the UG will be modified, allowing the new medium for distance education practices – the Internet – to take root.

Transactional distance

Within the last thirty years, there has been a formalisation of DE as a discipline. A familiar characteristic of DE is its ability to deliver educational material to students with differing geographical and sociological realities (Anderson & Thomas, 2001). This declaration is true, as the whole purpose of DE is to cater for the needs of students who may be unable to attend F2F classes, for one reason or another. With the advent of technology and the Web, the definitions of DE have been altered to suit the current age. As computers began to inject themselves into the educational context, a proposed definition identified the delivery of instructional materials using both print and electronic media (Moore 1990, 1991).

This naturally aroused a need to develop a new learning theory for all those involved. Moore (1991) states that the first attempt in English to define DE and to articulate a theory appeared in 1972 and in 1980 called the *theory of transactional distance*. Looking more carefully at the concept of transaction, he explained that it connoted the interplay among the environment, the individuals and the patterns of behaviours in a situation. This transaction *is* distance education. Moore (1997) explains that when referring to DE, there is more than a geographic separation of learners and teachers; there is also a distance associated with understanding and perception also partially caused by geographic distance. Therefore, this 'psychological and communications space' is what is known as the transactional distance. Gokool-Ramdoo (2008) puts forth that the degree of transactional distance is dependent on three variables: dialogue, structure, and learner autonomy. Each of these is of paramount importance to the successful transaction of that distance.

Since the UG still embraces traditional learning and teaching, DE at that HE institution has not evolved over time, and it is executed via the traditional print/correspondence mode. In this mode, learner needs are not carefully considered. Course content is sent to students, and they are expected to cover all of the areas within a given time, with little input from the instructor. This is what needs to change and, in fact, technology-enhanced DE will create a paradigm shift, moving the focus from teaching to learning, enabling effective transactions among all parties involved.

In other words, due to transactional distance, the teaching/learning process will be a shared responsibility that occurs through a dialogue between teacher and student. The learner will be aware of the learning activity and think about what is being learned (meta-cognition). The learner will also utilise critical thinking skills to develop a true awareness of the learning process. This will come about with the use of reflective practices, which can be created through dialogues with the instructor and with other students. Extremely important concepts, relevant to transactional distance, are *independence and autonomy* and *interaction and communication*.

Independence and autonomy

In Moore's (1972) *Theory of Independent Study*, he addresses learner autonomy. He notes that in traditional school settings learners are very dependent on teachers for guidance and that in most

programmes, conventional and distance, the teacher is active while the student is passive. In distance education, there is a gap between teacher and student, so the student must accept a high degree of responsibility for the conduct of the learning programme. The autonomous learner needs little help from the teacher, who may be more of a respondent than a director. His definition of independent study provides a clue for understanding the concept of 'learner autonomy'. The learner studies independently in his own environment free from the constraints of inappropriate 'class placing' and develops in himself a capacity and maturity that enables him to carry on 'self-directed learning'.

Wedemeyer (1981) considered the independence of the student as the essence of distance education. He preferred the term 'independent study' for DE at the college or university level. He was critical of contemporary HE patterns. He believed that outdated concepts of learning and teaching were being employed, and that these concepts failed to utilise modern technologies in ways that could alter an institution. He challenged university administrators to expand access and opportunity to autonomous learners. He set forth a DE system that emphasised learner independence, and technology adoption as a way of implementing it. Since these four common elements were present in every learning-teaching situation-a teacher, a learner, a communications system or mode, and content-he proposed a reorganisation of these elements to accommodate physical space and allow for greater learner freedom.

At the UG, there is a dire need for student independence and autonomy. All learning is teacher-dependent and non-autonomous, since these are characteristics of a traditional pedagogical approach still in vogue at this educational institution. In a teacher-directed setting, independence and autonomy are non-existent, as all learning experiences are chosen for the students. What is required of them is to simply follow the instructions in order to 'learn'. ICTs integrated into the learning process of students will foster learner independence and autonomy, and engender students with more significant learning experiences. It is all about making learning constructive, where students will be the protagonists of the learning process. This is another very important theory to consider, if the UG is to implement E-Learning.

Interaction and communication

Interaction (or interactivity) serves a variety of functions in the educational transaction. Sims (1999) has listed these functions as allowing for learner control, facilitating programme adaptation based on learner input, allowing various forms of participation and communication, and acting as an aid to meaningful learning. In addition, interactivity is fundamental to the creation of learning communities (Lipman, 1991; Wenger, 2001). The value of another person's perspective, gained through interaction, is a key learning component in constructivist learning theories (Jonassen, 1991), and in inducing mindfulness in learners (Langer, 1989).

Interaction has always been valued in DE, even in its most traditional, independent study format. Holmberg (1989) argued for the superiority of individualised interaction between student and tutor when supported by written postal correspondence or by real-time telephone tutoring. He also introduced the idea of simulated interaction that defines the writing style appropriate for independent study models of DE. Many authors highlight the critical interactional relationships between content, student and teacher (Garrison and Shale, 1990; Laurillard, 1997; Anderson, 2004)

Interaction and communication are critical for meaningful learning, and this is where the instructional practices of the UG are falling short. Learning diversification is absent. There is little or no interaction in the traditional face-to-face sessions, possibly because some students are fearful of ridicule, or perhaps they are not bold enough to share their ideas in public, or even perhaps they have nothing to say, at that specific moment. Whatever the case may be, interaction

is not necessarily encouraged. Teachers make students understand that they are the experts, the 'sage on the stage', and that students are to accept what they say, without inquiry.

If students are to develop creative, critical and complex cognitive skills, then they must be able to construct knowledge for themselves, querying and inquiring as they negotiate meaning and derive functioning knowledge. This can only happen when they interact and communicate. Technology-Based Education can provide students with the interaction necessary to have transformative learning experiences by creating strong learning communities and establishing collaborative learning as a powerful tool for maximising student learning outcomes.

Connectivism

Connectivism is a theoretical framework that helps to understand learning. It is mainly concerned with cognitive development. Learning begins when learners join together in a learning community, and knowledge is then put into action by discussing, sharing, and thinking (Downes, 2012). Knowledge comes from a variety of domains and disciplines and access to the Web, which makes this easier. Siemens (2008) stresses that the ability to make connections between fields, ideas, and concepts is a core skill. Knowledge does not fit in a pre-packaged curriculum, although formalised education must deliver it to a degree. However, as learners become autonomous and seek information on their own, they come to understand the existence of an endless world of knowledge. Considering the wealth of information available on the Web, it is crucial for learners to be able to filter through information and to ensure it is from a valid, reliable source. As stated by Siemens (2004), the capacity to know is more critical than what is actually known.

The traditional approach to learning and teaching, espoused by the UG, does not embrace a connectivist approach. The kinds of learning tasks that students are required to perform do not always cause them to use the appropriate cognitive skills to complete them, because tasks are sometimes disconnected from their realties. Learning is a connected process. It does not exist by itself, as meaning is derived from the relationships between concepts and ideas. Connectedness within the learning process helps students to make sense of the realities which surround them. It is in this light that this theory must also be embraced as relevant to E-Learning in these times. Such a theory can only thrive when students are given autonomy to explore the various connections that are involved in the pedagogical process, to the extent that they themselves derive meanings of these connections and seek to foster *creativity*, *application* and *life-long learning*.

It is important to note that at the UG, the role of the tutor will have to change, where some of amount of control over the classroom situation will have to be relinquished. Students need to move from an environment controlled by the teacher and the institution, to an environment where they direct their own learning, find their own information, and create knowledge by engaging in networks away from the formal setting. They still communicate with other, however their personal interests and preferences – rather than institutional requirements and choices – are the main drives for their engagement with more knowledgeable others in their learning.

Accessibility and equality in education

In the last three decades there have been great changes in the HE landscape in both developed and developing countries. Increasing access to HE has resulted in a diversification of student populations that come with a wide range of learning styles and needs different from the traditional student populations. While the numbers are steadily increasing, there is still a large number of students who are not able to attend HE institutions due to problems of *accessibility*. As noted by the United Nations (2014), education is a basic human right and each individual should have equal access to it. This access paves the way for *equality*/*equal opportunity* in education. Equality in Education is another very fundamental concept which should not be divorced from accessibility. In other words, if education is accessible to all, then it would be safe to say that

there is educational equality. In simple terms, educational equality, according to the American Library Association [ALA] (2014) is dependent on two main things: *fairness* (one's personal conditions should not impede one's potential for academic success) and *inclusion* (a comprehensive standard that is applicable to everyone in an educational context).

Elearning

The rapid growth of elearning worldwide has changed the learning environment for both students and teachers (Lapointe & Reisetter, 2008; Williams & Williams, 2010; Laurillard, 2012). One area that has experienced phenomenal changes as a result of the use of Internet technology is the area of Education. The concept of elearning is facilitating the teaching and learning experience using new channels and technologies. It is in this light that many tertiary institutions are heading in the direction of incorporating technology in on-campus and off-campus education delivery, and there must be reasons for this move. According to Jamlan (2004), these are: (1) The growth of information technology: elearning has become an ideal delivery vehicle for education and learning; (2) It is information rich: elearning offers both teachers and learners access to anywhere, anytime "information rich" resources; (3) Alternative learning strategy: elearning can reach those previously denied access (e.g., students with physical disabilities) and, (4) Blended learning: elearning can augment traditional classroom offerings, thereby freeing up valuable resources and expanding the offerings to greater numbers of campus-based students.

Methodology

In fulfillment of the aim, objectives and research questions of this study, a survey was carried out, using a *mixed method approach* (Creswell, 2009), to determine the suitability and viability of employing technology based-education based on the responses from the participants of this research. A *purposive* sampling technique (Palys, 2008) was used for this study, since the group of respondents was best able to answer the research questions.

Aim/questions/objectives

The aim of this study is to explore the potential of using technology in educational delivery and its implementation at the University of Guyana. The specific research questions of this study are the following: (1) Are students ready to embrace technology-based education? (2) What form of elearning do students desire? The objectives of this study are to: (1) Analyse student satisfaction of current pedagogical practices at the University; (2) Investigate the use of technology in educational practices at the University; (3) Establish the form of elearning for University students; (4) Recommend technology-based education for tertiary learning and teaching.

Investigative site

The investigative site for this research was the UG, which is a tertiary education provider located in Guyana, in the continent of South America. This University was chosen specifically because of the researcher's connections to it, and given the fact that the traditional approach to learning and teaching is still being employed there.

Student population

The University has a student population of 6, 300 students spread across its two campuses (UG Website, 2013; UG Registry, 2014). The majority of the students attend the Turkeyen Campus, the larger of the two campuses located in the capital city, Georgetown. The remaining students who reside in the Berbice Campus environs attend there. Students pursue a wide range of certificate, degree and diploma programmes for which they must attend the F2F sessions.

Instrument

The research instrument was an online survey, which consisted of 10 open-ended and closed-ended questions, hinging around the two research questions. Four of the questions utilised the '5-

point Likert Scale system', which also required further explanation to the chosen answer; three of the questions were one-answer multiple choice questions with one of them requiring further clarification; two of the questions were essay-type, and the final one required a specific selection and a subsequent justification for that choice which provided opportunity for triangulation. The questions centred on the current student location; student satisfaction of current pedagogical practices at the institution; students' familiarity with, feelings about and understating of elearning; students' view of implementing elearning at the University, their preferred form of elearning and a reason for their choice. The determined sample target for UG students, in accordance with Leedy and Ormrod (2010, 2013), was 400. Additionally, the survey bore the research ethics approval number, a definition of 'elearning', an explanation of the 'Purpose of the Research', and a 'Confidentiality Statement'.

Implementation of instrument

The survey link was officially sent out on May 14, 2014 via the UG Students' mailing list. Though they were not told in the email messages, respondents were given a period of 24 days within which to complete the survey. Reminders were sent to respondents twice weekly, and in some cases thrice weekly, from the start to the end of the data collection process. The online survey was officially closed on June 7, 2014. The total number of surveys answered was 412. In terms of survey responses from respondents, the following information is deposited in Table 1:

Table 1
Response rate for elearning survey

Sample Target (N)	Return Rate	% Return Rate
400	412	103%

In terms of complete and partial survey responses, the following is revealed in Table 2:

Table 2

Complete/incomplete responses for elearning survey

Sample (N)	Complete Surveys	Incomplete Surveys
412	358	54

Results

The survey which was carried out, in accordance with the research aim, questions and objectives, revealed favourable findings. These findings are presented, analysed and discussed below.

Question 1

Question 1 focused on whether or not students were from the capital city of Guyana (Georgetown). Figure 2 presents the responses to this question.

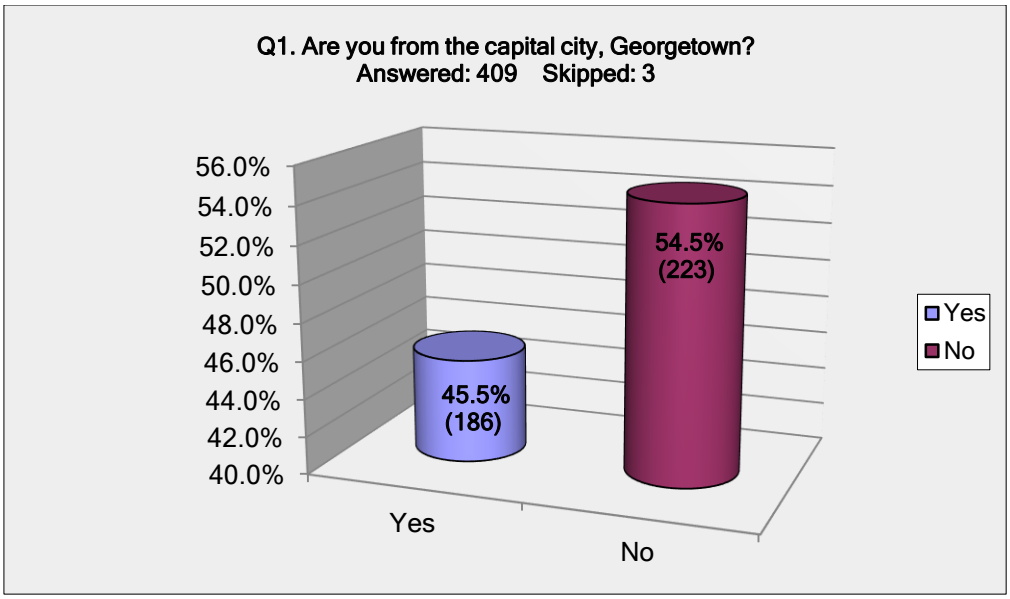


Figure 2: Number of students who are/are not from Georgetown.

Question 2

Question 2 wanted to find out the number of students who resided in Georgetown. Figure 3 obviates the answer to this question.

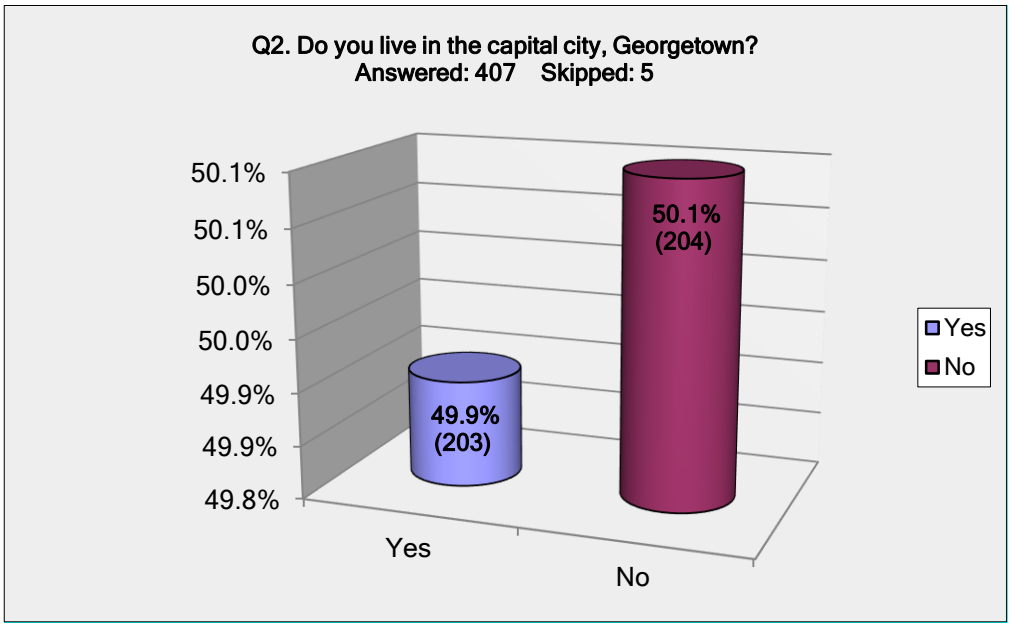


Figure 3: Number of students who do/do not live in Georgetown.

Question 3

Question 3 dealt with accessibility of education at UG for students. Figure 4 highlights the various answers to this question.

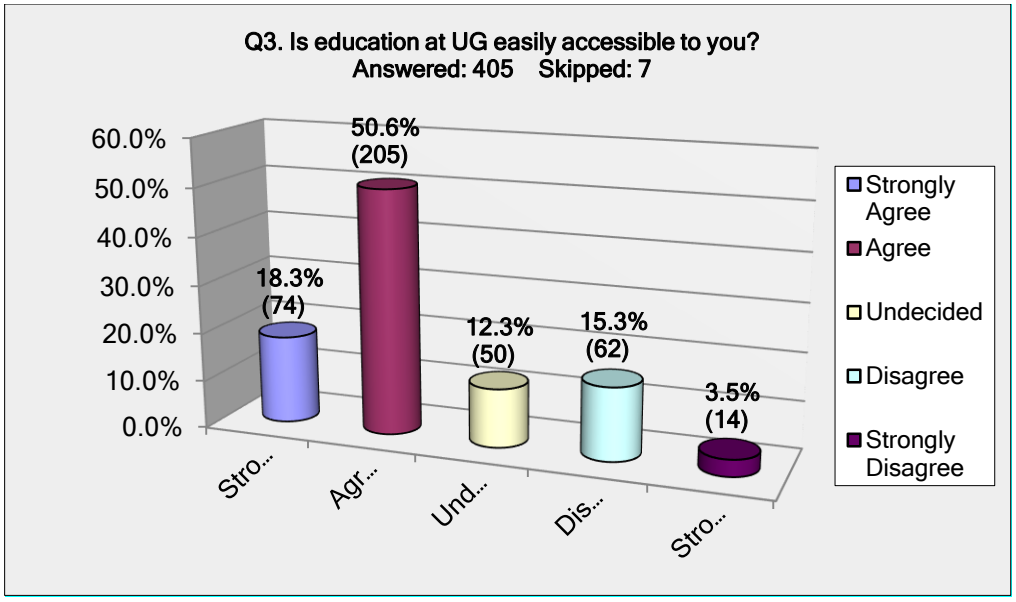


Figure 4: Accessibility/non-accessibility of education at UG.

Question 4

Question 4 hovered around the learning-teaching quality at the UG. Figure 5 indicates the various answers deposited by students.

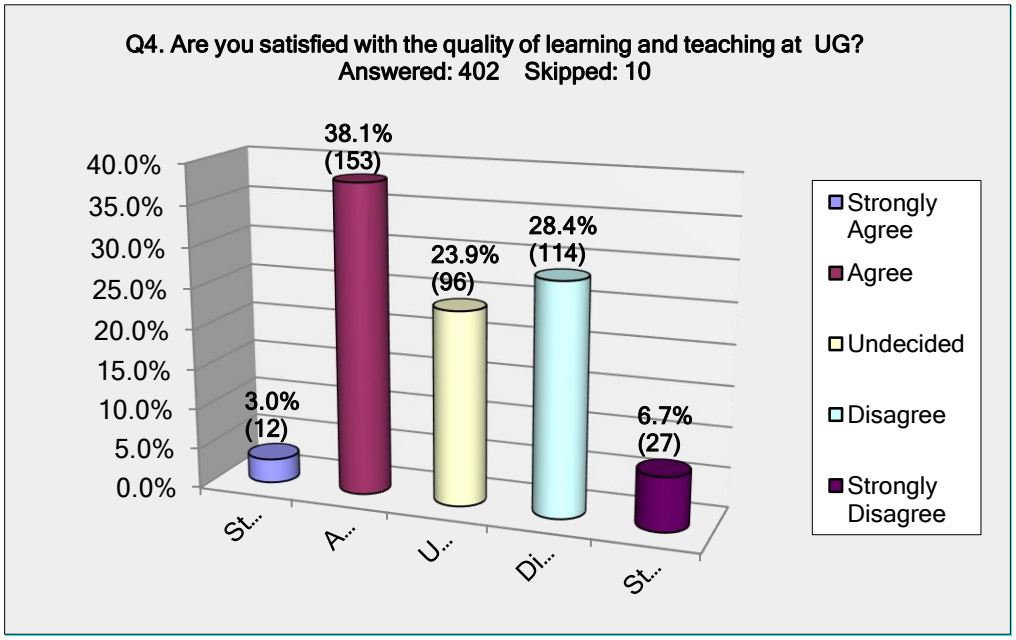


Figure 5: Learning and teaching quality at UG.

Question 5

Question 5 centred on what students feel could be done to improve learning and teaching at UG. The specific question was the following: "*What do you think can be done to improve learning and teaching at UG?*" This was an open-ended question and, in some regards, was a follow-up to the previous one (Question 4), which sought to gain insights on students' perceptions of quality learning and teaching. From the **80.3%** who did respond to this question, most of them are concerned with four main issues: (1) lecturer-student-content interaction; (2) active student participation; (3) their different learning needs, and (4) the learning-teaching tools and facilities.

Question 6

Question 6 hinged on students' familiarity with elearning/technology-based education. Figure 6 represents the students' answer to this question.

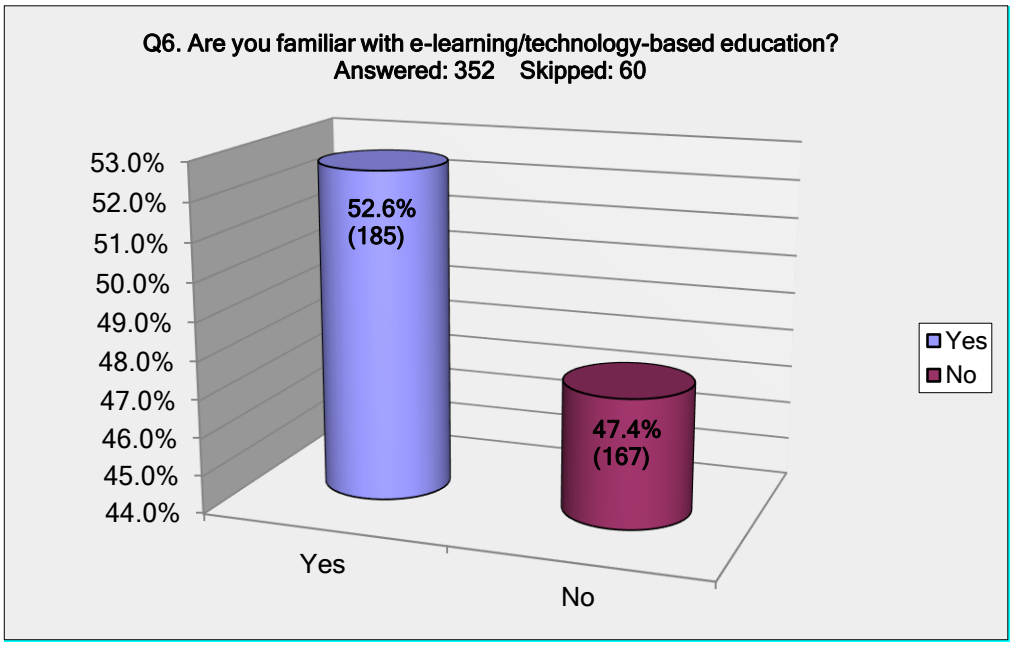


Figure 6: Students' familiarity/non-familiarity with elearning.

Question 7

The emphasis of Question 7 was on students' feelings about elearning/technology-based education. The specific question was the following: "*How do you feel about e-learning/technology-based education?*" This was an open-ended question and, in some regards, was a follow-up to the previous one (Question 6), which sought to gain insights on students' stance on elearning. From the **70.1%** who did respond to this question, the main issues highlighted by students are (1) accessibility, (2) cost effectiveness, (3) effective teaching tool, (4) improvement of student outcomes, and (5) flexibility.

Question 8

The focus of Question 8 was on whether or not students thought that elearning could actually enhance learning and teaching at UG. Bearing in mind their responses to Questions 6 and 7, it was now time for them to decide. Figure 7 portrays the responses to this question.

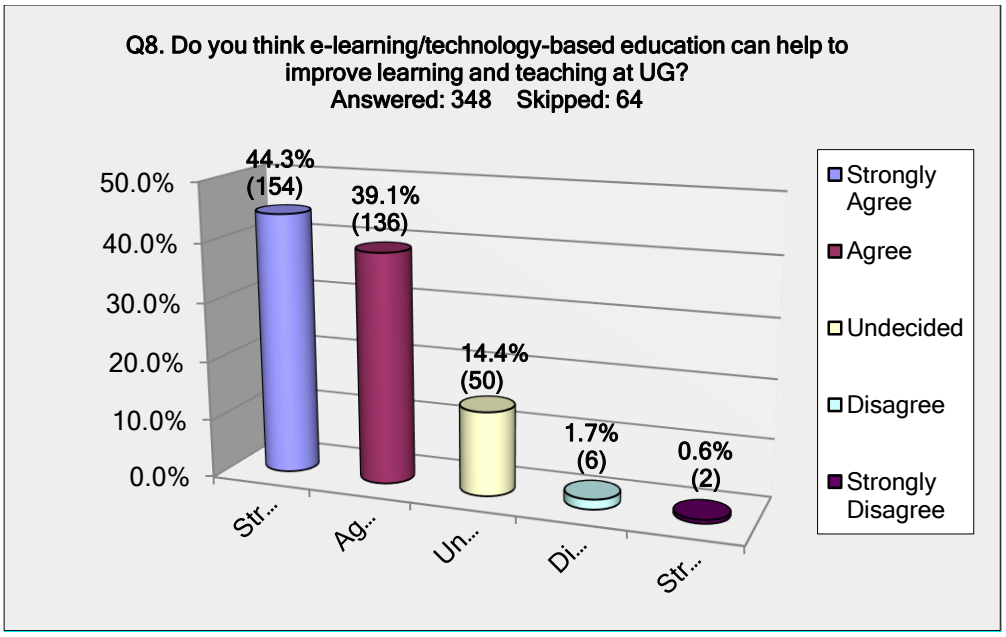


Figure 7: Students' convictions on elearning for the UG.

Question 9

The centre of attention for Question 9 was to determine whether or not students were ready for elearning. Figure 8 portrays those answers to this question from only **185** students (*see Analysis and Discussion section for explanation*).

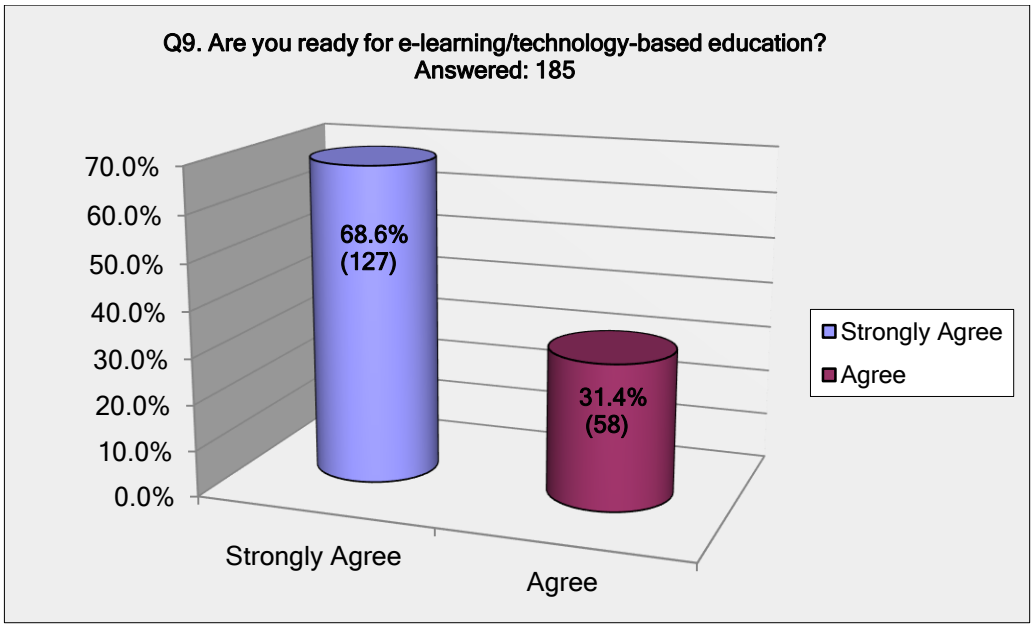


Figure 8: Students' readiness for elearning at the UG.

Question 10

The focal point of Question 10 was to authenticate what form of elearning students desired. Figure 9 shows evidence of those responses from the sub-sample (185 students).

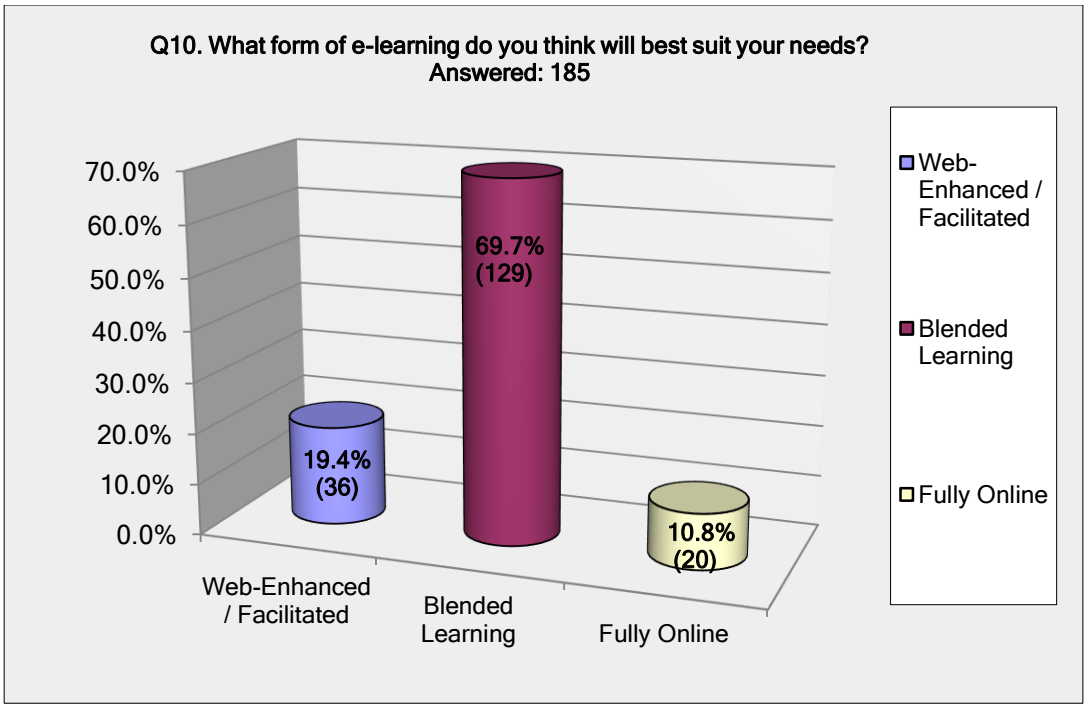


Figure 9: Students' preference for form of elearning .

Analysis and discussion

In Question 1, as can be seen from Figure 2, the statistical results are very important, clearly showing that the majority of the students within the given sample are not from the capital city. This can either mean that these students have to travel on a daily basis to get to the University, or that students have to move to the capital city – either to stay with family or to rent suitable accommodation – to be able to get to classes easily.

In Question 2, as can be observed from Figure 3 above, and similar to Figure 4, the majority of the students in the given sample do not live in Georgetown. This therefore means that these students have to travel on a daily basis to get to the University. Comparing the information presented in Figures 1 and 2, that since 54.5% of the students are not from Georgetown (Figure 2), and 50.1% of them do not live in Georgetown (Figure 3), it can be assumed that **4.4%** of them have moved to Georgetown to access the University. This percentage difference is reflected in the percentage of students who are from Georgetown (45.5%) (Figure 2), as against the percentage of those who are living in Georgetown (49.9%) (Figure 3).

In Question 3, as highlighted in Figure 4, while it is obvious that the majority of the respondents find education at the UG easily accessible, the fact cannot be erased that a considerable portion of students does not share this view or is uncertain about this. This can only mean that all students at the UG do not have equal access to education. Accessibility is a pre-requisite for good educational practices (ALA, 2014).

The second part of Question 3 required students to elaborate on their chosen answer. From the **69.6%** who did respond to this second part of the question, the main issues addressed are (1) easiness of accessibility, and (2) difficulty of accessibility.

It is important to highlight that the issues of 'accessibility' and 'distance' are very important to this study, and to the delivery of quality education, as highlighted in the literature reviewed. In Guyana's educational context, many students who attend the University do not live in

Georgetown, where the main campus is, while some even live in the hinterland areas. Being at such a considerable distance from the campus, where F2F instruction is the rule of law, students' learning process can be frustrated. The findings above do validate this position, in conjunction with the responses from students, suggesting that there is room for improvement with regard to making education accessible to all students. In these enlightened times, ICTs can be used as the vehicle to transmit this education at a distance, making it accessible to all.

Since no previous study has been done on learners' satisfaction of pedagogical practices, Question 4 and its corresponding responses are very significant. As is evidenced from Figure 5, it can safely be posited that the majority of students in the given sample are not satisfied with the quality of education at the UG, which is cause for concern and the impetus to promote change.

The second part of Question 4 had to do with students expanding on their answer selection. From the **71.4%** who did respond to this second part of the question, the prevailing themes obviated are (1) satisfaction about learning-teaching quality, (2) doubts about learning-teaching quality, and (3) dissatisfaction about learning-teaching quality.

It is worthwhile to note that the learning and teaching quality within an educational institution can only be enhanced if there is commitment on the part of teachers (Biggs & Tang, 2007). This pledge involves continual growth and development in their areas of specialisation (Mizell, 2010) through transformative reflection (Ramsden, 2003). For students to learn successfully, teachers much teach successfully. For this to happen, there must be a mutual collaboration for improved pedagogical practices. The findings do suggest that there is room for development of the learning and teaching quality at the UG. If students are to improve their learning outcomes, then the quality of education delivery must be very high (Hattie, 2009; Biggs & Tang, 2011).

Question 5 revealed four issues that were of particular concern to students. With regard to 'lecturer-student-content interaction', it wouldn't be unfair to say that these are the three protagonists of the learning-teaching process. The fact that respondents have highlighted this issue indicates that it is of concern to them. For students to improve their learning outcomes, and be able to engage in knowledge application, there must be an alignment among these principal actors (Laurillard, 1997; Moore, 1997; Wenger, 2001; Anderson, 2004).

With respect to 'active student participation', students have also signalled this as a burning issue. In the real world, students are expected to be engaged in team tasks in order to construct knowledge and negotiate meaning. This is in keeping with 'constructivism' (Piaget 1928; Vygotsky 1930; Dewey, 1938; Bruner, 1973; Jonassen, 1999). It is in this light that Vygotsky (1978) developed 'social constructivism'. All learning is social. For students to learn better, they must interact with each other. By interacting with each other, they will construct knowledge and derive meaning from the world around them. In the current learning and teaching settings at the UG, there is not sufficient opportunity for enhancing interaction, considering that teachers and learners can only do so much during their F2F interaction time.

With reference to 'diversity of student learning needs', this is yet another important plea from respondents. Students are given tasks and they are expected to complete them, whether they 'understand' or not. Such a practice is counter-productive to student learning, and will have direct impact on their learning outcomes (Biggs & Tang, 2007). Constructivism (Wilson, 1997; Tapscott, 1998; Vygotsky, 1978; Biggs & Tang, 2011) can respond to student learning needs and address student learning diversity.

Concerning 'facilities/learning-teaching tools', Ramsden (2003) affirms that there must be appropriate facilities for engaging with students at their level of understanding. To optimise student learning, consequently, there must be an immediate improvement to the UG's facilities

and to learning and teaching. The findings highlight that students are very concerned about the quality of learning and teaching, and steps should be taken to address these issues.

Question 6 was a very important question for students, since the emphasis of this research paper is on implementing elearning practices at the HE institution. As can be seen in Figure 6, while there are a greater percentage of students who possesses knowledge of elearning, the percentage of students who do not have this familiarity does not contrast sharply, only by a difference of **5.2%** (18). Even though the percentage of the sample familiar with elearning is very encouraging, the percentage who does not know of it is of great concern. It could also mean that those who responded negatively simply had a basic understanding of elearning, but no hands-on experience with it. Such findings only underscore the need for students to have prior knowledge of any new educational initiative before it is adopted and implemented.

The second part of Question 6 centered on students providing examples of their understanding of elearning. From the **44.9%**who did respond to this second part of the question. The two main areas highlighted are (1) familiarity with elearning, and (2) non-familiarity with elearning.

Since the aim of this research is to explore the potential of using technology in educational delivery and its implementation at the University of Guyana, all of the responses given are of paramount significance. They ratify the need for all concerned parties at the UG to ensure that students are familiar with the use of technology and its tools to aid learning (Lam & Bordia, 2008), if a successful implementation of elearning practices is to be engendered.

Question 7 revealed five issues that were of primary concern to students. The issues of 'accessibility' and 'flexibility' (Moore 1991, 1997; Raturi et al, 2011b) have been highlighted as one of the benefits of elearning by respondents. Considering, from the myriad of answers, that many students are geographically distant from the University, and that a very large number of them are part of the working class, they would prefer for education to not only be accessible to them, but also flexible. Such a claim is in accordance with what is embraced by Moore (1991, 1997) concerning 'transactional distance'.

A 'cost effective' education is highlighted by learners in many studies in HE (Lee & McLoughlin, 2010; Lai, 2011; Raturi et al, 2011b). Many students today cannot afford to pay for HE, and this is also the current situation at the University. Many students access student loans in order to cover their tuition (UG Registry 2010, 2014). Given the economic situation within the country, a 'cost effective' education would be a welcome reality, and such a gesture could see an influx of students registering for tertiary education.

Respondents believe that elearning is an 'effective teaching tool', and they are not mistaken. This is a fact, based on empirical evidence from studies done about the transfomative potential of elearning to engender significant educational experiences (Lai, 2010; Raturi et al, 2011a; Raturi et al, 2011b; Gaffar, Singh & Thomas, 2011; Laurillard, 2012). The fact that many educational institutions are quickly adopting an elearning initiative is proof that it is efficient. Since elearning is effective, as endorsed by the literature, students also believe that it will lead to an 'improvement of student outcomes'. Constructivism does support ICTs in educational practices (Biggs & Tang, 2011). In elearning, students are also given the freedom to be involved in knowledge construction and application (Lam & Bordia, 2008; Hattie, 2009).

In Question 8, the findings are significant because they corroborate the previous two questions (Questions 6 and 7) that students feel very strongly about having elearning practices integrated into the didactic process at the UG. From the data, the highest percentage recorded is for those who strongly agree, followed by those who agree, those who are undecided, those who disagree, and lastly by those who strongly disagree. More than likely, from the way that Questions 6 and 7 were answered, it would not be unfair to suggest that those students *who* have misgivings about

technology in the learning environment were those that responded to 'Undecided', 'Disagree', and 'Strongly Disagree'. In essence, there is a general positive perception towards elearning. In other words, the respondents for this question (Question 8) have signalled that elearning can certainly have a positive impact on the pedagogical processes at the UG. Such revelations are valid.

In Question 9, the point must be emphasised that this question was a very important question for students to answer, since it is one of the research questions for this study. 347 students answered this question. Based on the figures obtained, 72.0% of the respondents (250) are ready (strongly agree/agree) for elearning, 5.7% of them (20) are not yet ready for it (strongly disagree/disagree), and 22.2% of them (77) remain unsure as to whether or not they are ready for it. These findings, though, are 'inconclusive'. A careful examination of Question 6, which focused on students' elearning familiarity, exposes that only **52.6%** of participants (**185**), replying to that question, expressed familiarity with elearning, while the remaining 47.4% of them responded in the negative. As only **185** students confirmed their familiarity with technology-based education, it therefore means that only they can signal their readiness for elearning. Figure 8 portrays those answers to this question from the **185** students. For this specific sample, though quite small, it is clear that are all in one accord for the advent of technology-based education at the UG.

These findings are significant since they answer the research question, substantiating that students who are familiar with elearning consider it valuable; it is not surprising, therefore, that these students are ready for elearning at the UG. It cannot be ignored that these respondents are prepared to have technology integrated into the educational process. That is major. The above results, concerning elearning readiness of the 185 students, as considerable as they may be, are also inconclusive, because they only capture the selections of a sample from within that sample target (hereinafter referred to as *sub-sample*) (Leedy & Ormrod, 2013). In order to make these findings 'conclusive', it would be advisable to ask such a question within the next three years or so from now, with the objective of authenticating students' understanding of, and readiness for, elearning. They would now be in a better position to take an informed decision about their readiness for it.

The second part of Question 9 hinged on students depositing reasons concerning their readiness for elearning. Once again, only the **185** students who claimed familiarity with elearning (Question 6) can give valid reasons to support their claim. Given that the purpose of this study is to explore the potential of using technology in educational delivery and its implementation at the University of Guyana, each of the answers deposited is pertinent towards this end. In fact, it is quite clear that students are desirous of moving into the 21st century with sound educational practices. With specific references to those students who claim readiness for elearning, there's a longing for a connection and connectivity (Siemens 2004, 2008) with their learning and their real-life experiences. This is yet another very important concept in the learning-teaching process which has found relevance in elearning. Learning is all about understanding the world around us and making connections with them (Downes, 2012). Elearning and the WWW create networks and learning communities in which students can connect with each, thus experiencing a richer learning experience (Siemens, 2008; Downes, 2012).

Question 10, similar to Question 9, was another essential one for students to answer, since it is another of the research questions for this. In view of the fact that the primary axis of this research is to investigate the practicality of elearning at the UG, it is only wise to determine the form of elearning that would best meet students' needs. Since the sub-sample of **185** students pointed out their acquaintance with elearning/technology-based education, it therefore meant that only they were capable of deciding on the form of elearning that best suited them. For this specific sub-sample, it therefore follows that for their preference for the form of elearning, their first choice is 'Blended Learning', followed by 'Web-Enhanced/Facilitated', then by 'Fully Online'.

The percentage of students who chose 'Blended Learning' is considerably higher than those who chose 'Web-Enhanced/Facilitated' and 'Fully Online'. In fact, the percentage of students in support of 'Blended Learning' is almost four times that of those who opted for 'Web-Enhanced/Facilitated', and almost seven times that of those who selected 'Fully Online'. These results are important because they answer the research question, corroborating that at least some students are indeed ready for a specific form of elearning at UG. Even though they may seem to prefer one specific form over another, the fact cannot be effaced that they all have signalled their desire to have technology incorporated into the learning-teaching process. That is significant.

Stemming from the above results, concerning the preference of elearning form of the 185 students, they are also 'inconclusive' as weighty as they may be. They are inadequate because they do not give a panoramic view of the choices of the entire sample target, but that of a sub-sample (Leedy & Ormrod, 2013). To make these results 'conclusive', another survey could be carried out, at a later date. Students would now be in a better position to choose, and have consensus for, an elearning form.

The second part of Question 10 hovered over students explaining why they chose one form of elearning over another. All **185** respondents did answer this question. Based on the responses, the students are even more eager to embrace 'Blended Learning', since they feel that the F2F component should not entirely be thrown out the window. Their claim is justified because F2F teaching is still a powerful means of stimulating learning (Bershin, 2004; Sheridan, 2009; Raturi et al, 2011b; Livingstone, 2013). Since theory is synonymous with practice, in today's educational context, given that many programmes are practice-based, 'Blended Learning' would be highly favoured and considered a welcome reality. Some prefer to start out with 'Web-Enhanced/Facilitated Learning', citing that this would help them to get comfortable with the virtual environment, motivating them to make the eventual transition. Yet still, some prefer 'Fully Online', because they wish to avoid the hassle of travelling to campus, especially in cases where they show up for classes, only to find out that they have been cancelled. Taking into consideration that the intention of this research, each of the replies provided, towards this end, is relevant.

A summary of the findings of this study is given below:

1. **54.5%** of respondents are not from the capital city, Georgetown.
2. **50.1%** of the participants do not live in the capital city, Georgetown.
3. **68.9%** of the respondents claim that education is easily accessible to them.
4. **41.1%** of the students are satisfied with the quality of learning and teaching at the UG, **35.1%** disagree, and **23.9%** are undecided.
5. A number of issues must be addressed to improve the learning-teaching process.
6. **52.6%** of the participants are familiar with elearning, while **47.4%** are not.
7. **70.1%** of the students welcome it, while **29.9%** have reservations, or are unsure.
8. **83.4%** of the respondents agree that elearning can improve the pedagogical situation at the UG.
9. **100%** of the sub-sample is ready for elearning.
10. **69.7%** of the sub-sample, who expressed familiarity with elearning, prefer 'blended learning', while it is **19.4%** for 'web-enhanced/facilitated', and **10.8%** for 'fully online'.

Concluding remarks

This research has centred its attention on students' perception of the potential of elearning practices at the University of Guyana. With reference to the research questions, aim and objectives of this study, the results have shown that the students are generally ready for elearning by blended mode. Further to these results, other important findings arising from the data collected reveal the following: while some students appear to be more satisfied than others, in terms of the learning-teaching quality, most of them concur that the situation can be improved and achieved through the use of technology; students would like to be able to study at their own pace and time, given their busy schedules; many students from the hinterland and interior regions of the country have been forced to move to the capital city in order to access education; those who cannot make the transition have to travel, on a daily basis, to get to campus; students complain that they sacrifice so much to get to classes, only to find out that the class has been cancelled.

All of the above issues can be addressed through the adoption of elearning practices at the UG: the quality of education is likely to be improved with the integration of technology; students will get their money's worth; they will be able to control the pace of their learning; they will be able to access their learning tools and resources without even setting foot outside of their homes, allowing them to save on transportation costs, and sparing them the hassle of running to classes.

These are the issues that confront students and these are the possible solutions that can be achieved through the incorporation of technology into the pedagogical practices of the UG. For this to happen, all stakeholders have to get on board and create the necessary policies and plans to design, implement, institutionalise, and sustain this new initiative to suit the UG's educational context. It is now left up to the administrative body of the University to create a revolution in its educational practices and pave the way for high-quality learning, accessible to all students.

Significance of the study

This study is significant, since it is the *first of its kind* to be done about the UG. While the latest research done in the area of elearning at UG (Gaffar, Singh & Thomas, 2011; Singh & Gaffar, 2013) sheds light on the degree of lecturers' readiness for the adoption of Web 2.0 in their pedagogical practices, there is currently no documented research about the UG, in Guyana, that (1) underscores students' position about accessibility and equal opportunity in education; (2) highlights the extent of students' satisfaction of current pedagogy and why there should be improvements; (3) brings to light students' feelings about elearning and what it would mean for them, and (4) underlines student preference for a specific instructional delivery mode. Such findings, once carefully considered, can only have positive far-reaching consequences for the HE institution.

Limitations

One notable limitation was that some of the respondents did not answer certain parts of the two-part questions; in fact, quite a number of them refrained from answering, the highest being in excess of 100. It would have been worthwhile had they all responded. Another limitation of this study was due to a lack of awareness regarding elearning (Question 6). Some students could not respond, in an informed way, to the form of elearning they desired. Based on the findings revealed, nearly half of those who answered the question on elearning familiarity (47.4%) claimed that they were not acquainted with elearning. Due to this deficiency, their judgement about the kind of elearning was impaired. Further, even though the students' response rate superseded the sample target, it would have been good if a lot more students had participated, thus giving an even better picture of their readiness for elearning.

Recommendations

One recommendation would be to have a 'Centre for Leaching and Teaching' and a 'Quality Enhancement Team/Department/Committee' with responsibility for all areas of the elearning initiative: design, implementation, institutionalisation, and sustenance, and sensitization, training and support for students, among others. Another recommendation would be to adopt *Moodle* (a free and open source software) as the preferred LMS, since this would best suit the UG's educational context. This is the recommended LMS for developing countries (Whelan & Bhartu, 2007; Hogan & Kedrayate, 2009; Raturi et al 2011a, 2011b). In relation to the suggested LMS, it would be advisable to begin the process with 'web-enhanced/facilitated learning', before officially adopting 'blended learning' as the preferred form, since 47.4% of students indicated their lack of familiarity with elearning (Question 6). A gradual transition from 'web-enhanced/facilitated learning' to 'blended learning', after some time, would only serve to strengthen students' and lecturers' confidence in such an environment.

Further research

Two of the many areas that could be further researched are: (1) The focus could be on the type of LMS to be used, and the kind of Web 2.0 technology features that students would like the LMS to possess, and (2) Since 47.4% of the respondents are not familiar with elearning, it would be worthwhile to conduct a longitudinal study, at a later date, over a 5-yr period, not only to ascertain their familiarity, but also to ascertain what would be their preferred instructional delivery mode (web-enhanced/blended/fully online).

This research can form part of the existing empirical evidence about integrating ICTs in education, and the need to transform HE learning and teaching. It can be used as a guide for those Universities in developing countries which are considering implementing elearning, and those which are yet to do so.

Acknowledgements

The author wishes to acknowledge the administrative body of the University of Guyana, for having granted him the requisite approval to conduct the study with its students, as well as to thank the students who participated in the study. Additionally, the author also would like to thank his former supervisor, Mrs. Shikha Raturi from the University of the South Pacific (USP) Fiji, for having supervised his M.Ed. research project from which this article has stemmed.

References

Ally, M. (2004). Foundations of Educational Theory for Online Learning. In Anderson, T & Elloumi, F. (Eds.), *Theory and Practice of Online Learning* (pp. 3-31). Athabasca: Athabasca University Press.

American Library Association. (2014). *Equality and Equity of Access: What's the Difference?* Retrieved April 25, 2014, from http://www.ala.org/offices/oif/iftoolkits/toolkitrelatedlinks/equalityequity

Anderson, T. (2004). Towards a Theory of Online Learning. In Anderson, T & Elloumi, F. (Eds.), *Theory and Practice of Online Learning* (pp. 33-60). Athabasca: Athabasca University Press.

Anderson, L. & Thomas, D. (2001). Supporting Guyanese Distance Education Audiences: Challenges for Providers in a Small State. In *Distance Education in Small States 2000 Conference Proceedings, Ocho Rios, Jamaica, University of the West Indies and Commonwealth of Learning*. Retrieved March 16, 2014, from http://www.col.org/SiteCollectionDocuments/2_conf_proc_Anderson.pdf

Bershin, J. (2004). *The blended book of learning*. San Francisco, USA: Pfeiffer Publications.

Biggs, J. & Tang, C. (2011). *Teaching for Quality Learning at University* (4thed.). Maidenhead: McGraw-Hill/Open University Press/Society for Research into Higher Education.

Biggs, J. & Tang, C. (2007). *Teaching for Quality Learning at University.* (3rded.). Maidenhead: McGraw-Hill/Open University Press/Society for Research into Higher Education.

Bruner, J. (1973). *Going Beyond the Information Given*. New York: Norton.

Cooper, P. A. (1993). Paradigm shifts in designing instruction: From behaviorism to cognitivism to constructivism. *Educational Technology*, *33(5)*, 12-19.

Creswell, J, W. (2009). *Research Design: Qualitative, Quantitative and Mixed Method Approaches* (3rded.). CA: SAGE Publications.

Dewey, J. (1938). *Experience and Education*. Boston, MA: Houghton Mifflin Company.

Downes, S. (2012). *Connectivism and Connective Knowledge, Essays on meaning and learning networks*. Retrieved March 4, 2014, from http://www.downes.ca/files/Connective_Knowledge-19May2012.pdf

Duffy, T. M. & Cunningham, D. J. (1996). Constructivism: Implications for the design and delivery of instruction. In Jonassen, D. H. (Ed.), *Handbook of research for educational communications and technology* (pp. 170-198). New York: Simon & Schuster Macmillan.

Gaffar, K., Singh, L. & Thomas, T. (2011). Are We Ready for Web 2.0? Evidence from a Caribbean University. *Caribbean Teaching Scholar 1 (2),* 129-146.

Garrison, D. R. & Shale, D. (1990). A new framework and perspective. In Garrison, D. R. & Shale, D. (Eds.), *Education at a distance: From issues to practice* (pp. 123-133). Malabar, FL: Robert E. Krieger.

Gokool-Ramdoo, S. (2008). Beyond the Theoretical Impasse: Extending the applications of Transactional Distance Theory. *International Review of Research in Open and Distance Learning*, *9 (3)*, 1-17.

Goold, A., Craig, A. & Coldwell, J. (2007). Accommodating culture and cultural diversity in online teaching. *Australasian Journal of Educational Technology, 23(4),* 490-507.

Hattie, J. (2009). *Visible Learning: A synthesis of 800+ Meta-analyses on Achievement*. London: Routledge. Hogan, R. & Kedrayate, A. (2009). *E-Learning: A Survival Strategy for Developing Countries*. Retrieved June 15, 2014, from http://sta.uwi.edu/conferences/09/salises/documents/R%20Hogan.pdf

Holmberg, B. (1989). *Theory and practice of distance education.* London: Routledge.

Jamlan, M. (2004). Faculty opinion toward introducing e-learning at the University of Bahrain. *The International Review of Research in Open and Distance Learning, 5*(2), 1-14.

Jonassen, D. H. (1999). Designing constructivist learning environments. In Reigeluth, C. M. (Ed.), *Instructional design theories and models: A new paradigm of instructional theory* (pp. 215-239). London: Routledge.

Jonassen, D. (1991). Evaluating constructivist learning. *Educational Technology*, *31*(10), 28-33.Lai, K. W. (2011). Digital technology and the culture of teaching and learning in higher education. *Australasian Journal of Educational Technology, 27 (8),* 1263-1275.

Lai, K. W. (2010). School readiness for using ICT adapted to student needs. In Gibson, D. &Dodge, B. (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2010* (pp. 1487-1490). Chesapeake, VA: AACE.

Lam, P. & Bordia, S. (2008). Factors affecting student choice of eLearning over traditional learning: Student and teacher perspectives. *International Journal of Learning, 14(12),* 131-139.

Langer, E. (1989). *Mindfulness.* Reading, MA: Addison-Wesley.

Lapointe, L. & Reisetter, M. (2008). Belonging online: Students' perceptions of the Value and efficacy of an online learning community. *International Journal on ELearning, 7(4)*, 641-665.

Laurillard, D. (2012). *Teaching as a Design Science: Building Pedagogical Patterns for Learning and Technology*. NY: Routledge.

Laurillard, D. (2008). *Digital technologies and their role in achieving our ambitions for education*. London: Institute of Education, University of London.

Laurillard, D. (2007). Technology, pedagogy and education: Concluding comments. *Technology, Pedagogy and Education, 16*, 357–360.

Laurillard, D. (1997). *Rethinking university teaching: A framework for the effective use of educational technology.* London: Routledge.

Lee, M. J.W. & McLoughlin, C. (2010). Social software as tools for pedagogical transformation: Enabling personalization, creative production, and participatory learning. In Lambropoulos, N. & Romero, M.(Eds.), *Educational Social Software for Context-Aware Learning: Collaborative Methods and Human Interaction*, (p. 1-22). Hershey, PA: Information Science Reference.

Leedy, P. & Ormrod, J. (2013). *Practical Research: Planning and Design* (10th ed.). Upper Saddle River, NJ: Pearson Education Inc.

Leedy, P. & Ormrod, J. (2010). *Practical Research: Planning and Design* (9th ed.). Upper Saddle River, NJ: Prentice-Hall.

Lipman, M. (1991). *Thinking in education.* Cambridge: Cambridge University Press.

Livingstone, K. (2014). Improving Curriculum Design and Development. A Case Study from the University of Guyana. *Blue Ocean Research Journals – Journal of Business Management and Social Sciences Research (JBM&SSR) 3(5),* 1-17.

Livingstone, K. (2013). Implications of introducing a hybrid learning approach at the University of Guyana. *Baraton Interdisciplinary Research Journal 3 (2)* 53-62.

Mizell, H. (2010). *Why Professional Development Matters*. Ohio: Learning Forward Publishers Ltd. Retrieved April 20, 2014, from http://learningforward.org/docs/pdf/why_pd_matters_web.pdf?sfvrsn=0

Moore, M. (1997). Theory of transactional distance. In Keegan, D. (Ed.), *Theoretical Principles of Distance Education* (pp. 22-38). New York: Routledge. Retrieved

Moore, M. (1991). Distance Education Theory. *The American Journal of Distance Education*, *5(3)*, 1-6.

Moore, M. (1990). *Background and overview of contemporary American distance education. Contemporary issues in American distance education* (pp. xii−xxvi). New York: Pergamon Press.

Moore, M. (1972). Learner Autonomy: The Second Dimension of Independent Learning. *Convergence*, *5(2)*. Retrieved April 23, 2014, from http://www.ajde.com/Documents/learner_autonomy.pdf

Palys, T. (2008). Purposive Sampling. In Given, L. M. (Ed.), *The SAGE Encyclopedia of Qualitative Research Methods* (Vol 2) (pp. 697-698). Thousand Oaks, CA: SAGE Publications Inc.

Piaget, J. (1932). *The Moral Judgment of the Child*. London: Routledge & Kegan Paul.

Piaget, J. (1928). *The Child's Conception of the World*. London: Routledge & Kegan Paul.

Ramsden, P. (2003). *Learning to teach in higher education* (2nd ed.). London: Routledge Falmer.

Raturi, S., Hogan, R. & Thaman, K. H. (2011b). Learners' Preference for Instructional Delivery Mode: A Case Study from the University of South Pacific (USP*). International Journal of Instructional Technology and Distance Learning, 8 (6),* 17-30.

Raturi, S., Hogan, R. & Thaman, K. H. (2011a). Learners' access to tools and experience with technology at the University of the South Pacific: Readiness for elearning. *Australasian Journal of Educational Technology*, *27(3),* 411-427.

Sheridan, R. (2009). Hybrid and blended learning approaches for Internet-based online education. *Wilberforce University Faculty Journal, 10*, 18-19.

Siemens, G. (2008). *Description of connectivism. Connectivism: A learning theory for today's learner*. Retrieved March 16, 2014, from http://www.conncectivism.ca/about.html

Siemens, G. (2004). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning, 2(1)*, 3-10.

Sims, R. (1999). Interactivity on stage: Strategies for learner-designer communication. *Australian Journal of Educational Technology*, *15(3)*, 257-272.

Singh, L., & Gaffar, K. (2013). On the Formal Use of Facebook in Education. In Deutsch, N.(Ed.), *Connecting Online for Instruction and Learning: International Perspectives* (pp. 125-152). Charleston: Create Space.

Tapscott, D. (1998). *Growing up digital: The rise of the Net generation.* New York: McGraw-Hill.

UG Personnel Office. (2014). *Total number of lecturers at UG*. Georgetown: University of Guyana.

UG Registry. (2014). *The total student population at UG*. Georgetown: University of Guyana.

UG Registry. (2010). *UG desperately short of lecturers, salary differential fingered*.

Retrieved April 29, 2014, from http://www.kaieteurnewsonline.com/2010/10/14/ug-desperately-short-of-lecturers-salary-differential-fingered/

University of Guyana. (2013). *About the University*. Retrieved March 16, 2014 from http://www.uog.edu.gy/?q=about

United Nations. (2014). *Education For All: Overview*. Retrieved April 25, 22014, from http://www.un.org/en/globalissues/briefingpapers/efa/

Vygotsky, L. (1978). Interactions between learning and development. In *Mind in Society* (pp. 79-91). Cambridge, MA: Harvard University Press.

Vygostky, L. (1930). The socialist alteration of man. In Van Der Veer, R. & Valsiner, J. (Eds.) (1998), *The Vygostky Reader* (pp. 175-184). Oxford: Blackwell.

Wedemeyer, C. A. (1981). *Learning at the Back Door: Reflections on Non-Traditional Learning in the Lifespan*. Madison, WI: University of Wisconsin Press.

Wenger, E. (2001). *Supporting communities of practice: A survey of community-orientated technologies* (1.3 ed.) (Shareware). Retrieved March 16, 2014, from http://www.ewenger.com/tech.

Whelan, R. & Bhartu, D. (2007). *Factors in the deployment of a learning management system at the University of the South Pacific*. Retrieved June 15, 2014, from http://www.ascilite.org.au/conferences/singapore07/procs/whelan.pdf

Williams, M. & Williams, J. (2010). Evaluating a model of business school students' acceptance of web-based course management systems. *The International Journal of Management Education, 8(3)*, 59-70.

Wilson, B. G. (1997). Reflections on constructivism and instructional design. In Dills, C. R. & Romiszowski, A. J. (Eds.), *Instructional development paradigms* (pp. 63-80). Englewood Cliffs, NJ: Educational Technology Publications.

About the author

Kerwin A. Livingstone has been a Spanish and French language teacher since 2004. He has also taught courses in English as a Foreign/Second Language (EFL/ESL). Mr. Livingstone is passionate about the use of ICTs in educational practices and in foreign language learning and teaching. Since 2009, Mr. Livingstone has been an academic staff at the University of Guyana. He is a Master in Applied Linguistics (Second and Foreign Language Pedagogy) and a Master of Education (Technology-Based Education/E-Learning). Mr. Livingstone also has a Postgraduate Certificate in Tertiary Teaching and a Postgraduate Diploma in Education (Tertiary Teaching). He is currently a PhD Candidate in Language Sciences/Language Didactics at the University of Porto, Portugal.

It is Mr. Livingstone's desire to see the integration of technology-based education/elearning in all pedagogical practices throughout the University of Guyana.

Email: profesordelenguasmodernas@yahoo.es

Website: https://www.researchgate.net/profile/Kerwin_Livingstone

Return to Table of Contents

Return to Table of Contents

Editor's Note: This is a useful case history of transformation from traditional methods of teaching and learning to take advantage of new instructional communication technologies including e-learning and the internet.

The implementation of e-learning in higher education in Saudi Arabia: U.B.T.-a case study

Abdelrahim .M, Al-Zabadi and Mohammad saleem alshura
Saudi Arabia

Abstract

This preliminary study discusses the implementation of an e-learning program at the University of Business and Technology (U.B.T.) in Saudi Arabia – Jeddah. The program originally aimed to establish a virtual university which offers totally online courses but due to a number of reasons there had to be some changes in the implementation process as well as the changes and challenges faced by U.B.T. in implementing its e-learning program from an Information System (I.S.) project management point of view. Findings suggest that implementing such projects needs careful consideration of a variety of issues to ensure that the objectives are achieved. The case provides rich insights to other educational institutions wishing to implement such projects. The outcomes will assist in its continuing implementation at Saudi Arabian Universities.

Introduction

E-learning has been a topic of increasing interest in recent years. It is often perceived as a group effort, where content authors, instructional designers, multimedia technicians, teachers, trainers, database administrators, and people from various other areas of expertise come together in order to serve a community of learners.

The emergence and proliferation of new information and communication technologies (ICT), had introduced an unstoppable revolution into education particularly in the areas of teaching and learning. The Internet and the Web have further raised the revolutionary tempo especially through the enhancement of e-learning. For most open and distance learning providers – learning had added another dimension to the issue of success (Ip**aye,** 2004**)**.

As the technology is advancing, the demand of online learning is also increasing. The technologies, tools, techniques, methodologies and standards are advancing in such a way that it has overwhelmed the ability of educationists to isolate, study, and report on the best methods to be used for any given audience.

All these provide strong evidence that Internet – based technologies have transformed traditional in-class learning to a new way of learning called e-learning, defined by the Instructional Technology Council (ITC, 1998) as well as Center for Education Statistics (Waits & Lewis , 2003) as the process of extending learning or delivering instructional materials to remote sites via the Internet, intranet/extranet, audio, video, satellite broadcast, interactive TV, and CD-ROM. With all these advances, the prospects for e-learning makes the learning procedure more flexible, user friendly, clearly bright for many.

Essential components of e-learning include: (a) the use of online technologies including Internet and Web tools in learning process; (b) the use of learning technologies to enhance the learning experience for all; (c) the use of digital tools for curriculum delivery and assessment; and (d) the use of digital tools for ongoing professional development, interaction and collaboration (Jansen, 2002).

Universities need to consider cost – effective and efficient methods of operations if they are to survive. The benefits of utilising technology, particularly for developing online collaborative activities are well documented (Redfern and Naughton, 2002) . Relationships can also be fostered within the context of an online environment. Technology is a powerful medium particularly for part time work based students who find erratic attendance requirements and study difficulty (O'Donoghue et al, 2003).

The implementation of e-learning, institutions will bear the risk of destroying those processes that offer important forms of support to students (Pollock and Conford , 2000). Ultimately, it is possible that standardising a number of informal support systems will create competitive advantage – exactly the opposite to what the process sets out to achieve. Thus, HE institutions need to consider the implementations for everyone involve before implementing any new e – learning strategies.

Because of the flexible nature of e-learning and since it provides the right information in right time and in right place, students are now more familiar and feel more comfort in this new education system. Saudi universities compete to provide a rewarding learning experience for their students, and some of them have set the path to include distance students as well. A long with the new regulated approach of approving online courses by the ministry of higher education, U.B.T has to adopt and apply e-learning to enhance the educational experience inside its campuses and outside as well.

This paper discusses the implementation of an e-learning project at U.B.T in Jeddah city. At this stage we are not attempting to evaluate the outcomes of this program as it is in its early stage, rather, we focus on the process by which it is being implemented from a project management point of view. The case study approach is argued to be the suitable approach if the questions being answered are how and why questions (O'Donoghue and Singh, 2001)**.**

This case study can be classified as an ‘interpretive case study’, the purpose of which is not to tell the ‘truth’, but to tell a story which consists of the researcher’s thoughts and ideas concerning the phenomenon in question **(Walsham, 2001)**. One of the constraints associated with case studies is the difficulty in generalizing the results when using this methodology. Nonetheless, (Walsham, 2000) argues that there are four types of generalization from interpretive case studies, the development of concepts, the generation of theory, the drawing of specific implications and the contribution of rich insights.

The rest of this paper is organized as follows: The next section introduces some literature review on e- learning, change management and IS project, data collection and theoretical framework; it is followed by a mission and vision for web-based e-learning system within the context of the UBT. Finally, discussion, conclusions of this paper are discussed, recommendations and future researches is drawn in the last section.

E-learning: an overview

Researchers believe that the goals of introducing e-learning process, either by facilitating many of the challenges that face instructors and learners daily; or by presenting opportunities that might have not existed before (Sicilia, 2007) .

Information and Communication Technologies (I.C.Ts) are transforming the educational experience by affecting education in many ways (O'Donoghue et al., 2003) .Therefore, the use of technology in the learning and teaching process is spreading widely at all levels of education both in developing and developed countries. The ease of access to education provided by ICTs makes it a viable option to provide better education to people who may have been otherwise deprived from such opportunities (Casal, 2007)**.**

E-learning is fully part of our learning environment and no longer an add-on to traditional pedagogies. It is integrated in the way we live, work, and teach and has been so since mid- 2000 as Web 2.0 – the Read Write Web (O'Reilly, 2005). (Pollock and Conford , 2000) , acknowledged that in implementation of e-learning, institutions will bear the risk of destroying those processes that offer important forms of support to students. Ultimately, it is possible that standardising a number of informal support systems will create competitive advantage - exactly the opposite to what the process sets out to achieve. Thus, higher education institutions need to consider the implementations for everyone involve before implementing any new e-learning strategies.

E-learning includes all forms of electronically supported learning and teaching, including Edutech. The information and communication systems, whether network learning or not, serve as specific media to implement the learning process (Tavangarian et al, 2004) .The term will still most likely be utilized to reference out-of-classroom and in-classroom education experiences via technology, even as advances continue in regard to devices and curriculum. Abbreviations like CBT (Computer Based Training), I.B.T (Internet based Training) or W.B.T (Web Based Training) have been used as synonymous to e-learning.

E-learning is described as the use of electronic technologies in learning, teaching, and research.it provides a set of different tools to enhance the learning experience, such as LMS (Learning Management System), CMS (Content Management System), interactive courses content, digital libraries and virtual classrooms. Learning can be applied in classroom based, instructor lead learning or computer/internet based learning, or both classroom and computer (blended learning).

Recent literature in this area has discussed a number of issues related to e-learning. For example, indications of a bias show in student evaluation of teaching against online instruction compared to face-to-face instruction (Kelly et al , 2007**)**. Other studies discussed issues that are important for student satisfaction within online instruction such as: interaction among students, quality and timely interaction between students and professors, consistent course design across courses, technical support availability, flexibility of online courses (Al-Smadi & Al - Shboul, 2008), in addition to providing support for lecturers in implementing computer-supported learning strategies within their classes (Koubek and Jandle, 2000).

E-learning will ideally be employed by higher education institutions to enhance individualization of instructions, improve educational quality, increase access, reduce costs and sustain innovations (Twigg, 2001). E-learning is designed to create an environment rich in interactive applications. It is based on computer technologies and the World Wide Web (WWW) for information, and enables the learner to access learning resources at any time and from any location. Many proponents of e-learning believe that everyone must be equipped with basic knowledge in technology, as well as use it as a medium to reach a particular goal.

Many different definitions of e-learning appear in the literature. E-learning has gone through stages of acceptance by higher education to become a viable alternate to the traditional education model (Kelly et al , 2007). Also, e-learning has different forms, asynchronous e-learning (pre-recorded), a less common form, synchronous (live) e-learning, as well as a blended form combining technology and classroom based learning **(**Twigg**,** 2001**)**.

E-learning refers to the use of information and communication technologies (ICTs) to enhance and / or support learning in tertiary education. Such use of technology varies from tools that facilitate information delivery to the offering of online degrees. **(**Caudron**,** 2001**)**defines e-learning as the use of technology in preparation, delivery, or management of learning or training.

Now the word e-learning has transcended the traditional definition of "education through internet only". The e- learning process is like an umbrella, under which lots of things are arranged to make the global education system more uniform, cost-effective and quality-rich. Broadly speaking e-learning is a process of training for all types of learners in their required fields using Information Technology (IT) techniques.

The e-learning process includes courses from technology to the art of living. There are a number of e-learning companies around the world. The scope and objective of e-learning for all of these companies vary and it largely depends upon the types of service offered by the e-learning process. We are going to discuss some features of this process (Morgan, 2003). As a result, institutions of higher education have taken positive steps to focus on electronic learning (e-learning) technology to improve educational efficiency and effectiveness.

E-learning in Saudi Arabia

The Saudi Government remains the major contributor to the development of the country's higher education infrastructure and is continuously raising the budget to be spent on the education sector**.** This in turn has led to the growth of e-learning across enterprises and educational institutions in the Arab World. Also contributing to this expansion is the acceptance of e-learning by a large number of employees, students and instructors.

Saudi Arabia has witnessed a rapid increase in the need and demand for e-learning. The demand for e-learning modules is being driven by factors like rising investment in e-learning, which is emerging as a substitute for “distance education”. The size of the e-learning market in Saudi Arabia is likely to reach 670 Million US$ by 2014. To demonstrate its belief in making "*investment in talent and intelligence* "a top priority, Government has declared it will open new universities across the Kingdom. These universities are expected to significantly increase their focus on e-learning and plan to replace their entire curricula by e-learning materials or blend significant e-learning resources into their existing curricula.

The Saudi Government has been instrumental in unifying national e-learning strategy to bridge the gap between the national ICT plan and unilateral developments to encourage e-learning in Saudi schools, universities, colleges and vocational centers. As a result, MoHE (Ministry of Higher Education) has recognized that it is time to take advantage of these developments and set up a National Center for E-learning and Distance education (NCELDE) to promote e-learning and distance learning education programs across the kingdom. The Higher Education Ministry has also setup a repository for e-learning material to help universities adopt e-learning smoothly.

E-learning entered Saudi Arabia to meet various needs. Educational capacity and the growing Saudi population is one of the problems that faces education year by year. According to a study by King Fahd University (KFU) in 2003, there is a strong relationship between the need for e-learning and size of the Saudi population. Another reason is to serve the population in remote areas. Because Saudi Arabia has a wide area, the government can’t establish universities in areas with little population. In addition, if people who live in these areas move to the cities, this creates another kind of problem (Sayed et. al, 2003).

Although there are many advantages and great benefits associated with e-learning, Saudi educational institutions still face many obstacles and difficulties that impede the application of e-learning systems to education. These obstacles are associated with human resources, technical equipment, and financial, organizational and administrative obstacles. The main problem is based on the nature of Saudi society that believes on their traditional systems and refuses new that may change their traditional methods of teaching and learning. Moreover, Saudi Arabia is new in the technology revolution and doesn’t have a long history in successful use of technology based communications in education (A'eshah Al - Omari., 2007)**.**

Sayed, in his study of a group academic employees involved in e-learning in Saudi Arabia, found the first obstacle that confronts implementing and improving e-learning in Saudi academic institutions is the technical and telecommunication infrastructure. The second difficulty is insufficiency of funds dedicated to E-learning and thus the lack of many requirements such as equipment, books and staff. Some participants pointed out a very interesting issue which is the perception of e-learning as a second-class education to the traditional education (Sayed et. al, 2003).

The ministry of higher education and the ministry of education in Saudi applied e-learning in some Saudi universities and schools, but the effectiveness of this step on students was controversial. There are various opinions on the effects of e-learning in different aspects. Some believes that e-learning is the magical learning process that can improve the learning process in Saudi Arabia, while others remain hesitant to go ahead with e-learning in the kingdom. Each of these groups has their respective point of view. Therefore, many studies have been conducted in Saudi Arabia to determine the advantages and disadvantages of e-learning to assess its effectiveness in the kingdom (Ola Al Shagran , 2010).

Higher educational establishments world-wide have made a major shift from purely face-to-face lecturing and traditional class attendance towards e-learning. Most universities in the kingdom are expected to significantly increase their focus on e-learning and will replace the entire curricula by e-learning materials or blend significant e-learning resources into existing curricula (Mirza Abdelrahman, 2008) .

To this end, the various Saudi Arabia e-strategies and deployment of ICT infrastructure in government, health, education and e-cities will be a major determinant in the growth of e-learning where the primary stakeholders doesn't have an interest. The following universities are known to have formal agreements with the English Language Center (ELC) to introduce e-learning materials into their curricula: King Saud University, King Abdul AZIZ University, Baha University, Taiba University, Qassim University, and Madina Islamic University (Source :www.e-service-expert.com/e-Learning-Saudi.html).

Although there are many advantages and great benefits associated with E-learning, the Saudi educational institutions still facing many obstacles that impede them to apply E-learning system in different educational fields. The main problem is based on the nature of Saudi Educational society that believes in the traditional systems and refuses anything new which may change and develop their way in teaching and learning. Moreover, Saudi Arabia is considered a new comer to the field of technology revolution and doesn't have a long history in using technology and communications in educational fields (Ola Al Shagran , 2010).

Change management and information systems (IS) projects

For us, the aim of this paper has been to shed some light on issues related to e-learning, education, ICTs and project management that have been apparent in the implementation of the e-learning project at UBT. Such crucial issues still need further research especially in developing countries where valuable resources are being invested in ICT related projects given that education in particular for these countries, as it is in Saudi, is one of the most important areas that provide the country with its major resource – qualified human resources.

The management of change is an important discipline in today's ever changing environment. Change is never easy, and managing it in a large corporate environment is even more challenging. Based on the relevant literature, change can only be effectively implemented through proper planning and communications. Technological change can affect the learning experience in profound ways, but the direction of change depends more on historical events, technological invention, and the diversity of business needs and opportunities.

An information system-technology (IS-IT) project has unique attributes that give such projects a different nature from other projects. IS-IT projects can differ in terms of project size, project complexity, ambiguity in project requirements, products produced, environment, resource requirements, skills of project team, and the cost and benefits of the project, which usually include many intangible and unexpected costs and benefits, in addition to rapid change in the technology used within these projects which brings more ambiguity and uncertainty to project outcomes. Consequently, IS-IT project managers need to consider different factors due to the unique environment of these projects **(Berlin et al, 2009)**.

Due to the above factors, change in IS-IT projects is a normal and complex organizational concept. It is argued that no matter how carefully the project is defined through the initiation phase, the scope of most projects is subject to considerable uncertainty and change (Linderoth, 2005). Furthermore, even if the project is well planned by the project manager and team for implementation; it is almost certain to be changed before its completion. These changes may result in changing business processes and procedures, creating new roles and responsibilities leading to organizational restructuring, and need for new equipment, human resources, or new skills (Garies and Humann , 2008).

There are many basic causes for change in projects such as; project team characteristics (e.g. awareness, qualifications and commitment), rules and regulations, and technological uncertainty. Some changes occur because mistakes were made in initial assessment as how to achieve given goals, or in choosing a clear vision and goals for the project (Steffens et al , 2007) . Technological change is a fundamental factor for uncertainty or project risks. Other changes result because users or project teams lack awareness, qualifications and commitment to the project, in addition to high turnover. Many changes involve people, who are the key to the successful implementation of any IS-IT projects. Therefore, managing change is primarily dealing with people issues and involving them at every stage of the project (Atkinson et al , 2006).

Data collection

Data collection for case studies may come from a number of sources such as documents, archival records, interviews, and participant's observation (Yin, 2003). Data for this paper was collected by conducting semi-structured interviews with people involved in the project, including a member of the Accreditation Committee at the Saudi Ministry of Higher Education (MoHE); the president of the University, the former project coordinator and the current project manager. In addition, co-authors of the paper are involved in the project in different capacities. One, is currently the project coordinator from U.B.T. Halah Naseef, who contributed to the research by providing U.B.T. e-learning project information.

In each interview one or two of the researchers were present and notes were taken, which were immediately discussed and summarized. In addition, the co-authors of the paper were involved in the project in different capacities. One was the project coordinator from U.B.T. The other has been involved in an online course development since the start of the project and two others are members of the E-Learning Higher Committee at U.B.T. Data collection took place between September and October 2014.

Theoretical framework – project management phases

A project is a unique, complex, one time effort, with specific limitations (time, budget, resources, and performance) designed to meet organizational goals or customer needs (Al-Jaghoub et al, 2009). Project management is concerned with providing project managers with new tools that improve their ability to plan, implement and manage activities to accomplish specific organizational objectives (Meredithand Mantel, 2006)**.**

A project is normally divided into a series of phases, called the project life cycle, which could be conducted sequentially or in parallel (Cadle and Yeates, 2008) . The project life cycle can be a useful tool for project managers, especially its guidelines for monitoring and controlling projects. There are a number of different lifecycle models in project management literature, most have four or five phases, but some have nine phases or more (Duncan, 2000) . In our framework we use the four process groups' model which is shown in Figure 1 and discussed briefly below (Gray and Larson, 2008) .

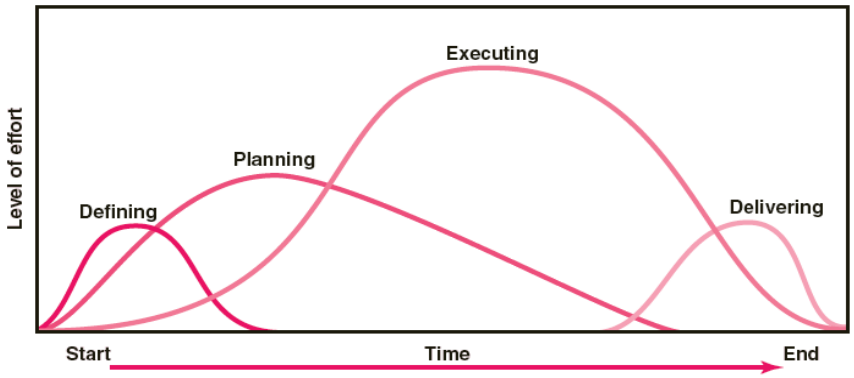


Figure 1: Project Life Cylce framework (Gray and Larson 2008)

Defining phase

This is the first phase of the project Life Cycle where it's evaluated, selected, and clearly defined. This phase is about identifying project vision, mission and goals, specifications, tasks and responsibilities. In addition, it includes establishing the project initiation committee, operating plan, management procedures, project management, environment, and project chart.

Planning phase

In this phase, the project concept is verified and developed in to a workable plan in order to start implementation. This involves schedules, budgets, estimating resources, creating a resource plan, identifying and assessing risks and alternatives, feasibility, estimating staffing and also certain management activates to assure that the project is established with clear reference terms and substantial structure.

Executing phase

Executing consists of the processes used to complete the work defined in the project management plan to accomplish the project's requirements. This is the phase in which the deliverables are physically built and presented to the customer for acceptance. While each deliverables is being constructed, a suite of management processes are undertaken to monitor and control. These processes include many sub-phases \ activities such as management time, cost, changes, forecasts quality, risk issues, suppliers, customers and communication project status.

Delivering phase

The focus of this phase is to bring the project to a successful end and the formal acceptance, where the project process is completed and documented and the responsibility moved from the developers to owners and users. Administrative activities include the archiving of the files and documenting lessons learned for future projects. This phase involves: finalize all activities across all of the processes, terminate suppliers contracts; obtain approval to close the project. In addition to customer training, documents transfer, release resources, release staff, and lessons learned.

U.B.T.: E-learning project

Before presenting the case study of this paper, it is useful to identify the context within which it is placed – the Kingdom of Saudi Arabia, Jeddah City. Many countries realized the importance of ICT in developing life of an individual and society, and its role in boosting the economy and income for the individual and state (Mulla, 2007). The Kingdom of Saudi Arabia is witnessing noticeable growth and development in all aspects of life, which has led to its progress and prosperity. During the past few years, the Kingdom has paid increased attention to rapidly growing and fast evolving sectors; one of which is Information and Communication Technology.

The wise leadership of the Kingdom has realized the vital role of ICT in building an information based society, characterized by the production, penetration, and processing information has led to the start of a number of e-learning initiatives both at school and university level. In view of this, came the kind directive to formulate a National Communications and Information Technology Plan (NCITP) for the Kingdom to implement it.

The e-learning project at U.B.T. is placed within this context in which ICTs are becoming as an important means for change and development to eventually transform the kingdom into knowledge-based economy. UBT was the first private university to be established in 2012, with a pioneering role in providing private higher education in business and technology to students in the kingdom. In 2007, The College of Business Administration (C.B.A.) started implementing its E-learning project, the vision and mission as expressed by the president of the University professor Hussein Al-Alawi was: "*Our vision is to become a leading institution in E-learning for UBT students as well as to those who did not have a chance to continue their college education. And "Our mission is to provide quality E-learning system for interactive teaching process in classes, off classes, and beyond university borders".*

Different forms of e-learning has been implemented at Saudi universities, but at UBT the aim of this program was to develop courses that are "made at U.B.T." from scratch, and offer these courses to students online: *"We have looked at the University of Business and Technology (UBT) to become the premier Leader University of E-learning education in the region as well as develop an E-learning world where learners, teachers, and researchers use technology to enhance the overall educational experience both in campus and off campus" (E-learning project manager – UBT).*

The main objectives U.B.T. E-learning is:(a) to increase the learning and teaching efficiency and increase flexibility to adopt changes in the business environment; (b) improve students' learning process by interactivity and boost their interest in learning where simulations, video projects, mobile learning and such can elicit fruitful engagement; (c) enhance the assessment and evaluation process to evaluate students & faculties effectively in a timely manner; (d) provide lifelong learning resources for U.B.T. graduates and alumni; (f) extend educational opportunities to those masses missing conventional education because of distance, disabilities, or age; (g) balance educational opportunities for higher education by distance mode for a large sector of the population, including those in employment and others who wish to upgrade their educational level; and (h) serve the local community in general .

For U.B.T., the project is still ongoing and the vision is still to establish a 'virtual university' despite the challenges. Currently established and future plans in U.B.T. will help it to adopt complete e-learning tools and services, through a two phase strategy. The E-learning project is responsible, not only for implementing the project, but to offer opportunities for training, consulting, and development of other projects in the future. Table 1 and Table 2 gives the current and future plans.

Table 1
E-learning current services at U.B.T.

LMS-Moodle	Moodle is the known open source web based learning management system that is used in lots of universities and schools all around the world. It is the main communication link between the instructor and the students. Each registered student will have his/her course listed each academic term in Moodle. Instructors are able to use Moodle to post course materials such as presentations, handouts, projects and they are able to communicate with the students using messages, chat and discussion forums. They can also assess the student using quizzes and assignments and other tools.
TurnitIn	TurnitIn is the known leading plagiarism software. It is integrated with Moodle, so both instructors and students use the TurnitIn Tool when they login to Moodle. Instructors can use TurnitIn to detect plagiarized papers and view the similarities percentage to outside content in the web or other published resources. It can help to detect previously submitted work by previous students in the university or in any other universities. Students also can use TurnitIn to submit their assignments and view the similarity report to learn what mistakes they have done.
McGraw-Hill Campus	McGraw-Hill Campus is a Book resources tool provided by McGraw-Hill to our campuses though integration with Moodle. It allows the teacher a free access to McGraw-Hill book resources such as instructor materials: presentations, test banks and solution manuals. It also provide the tools of Connect to customize an e-learning platform based on the resources of the, and also instructors are able to customize an E-book version collected from several McGraw-Hill books. Student can access the customized book and the customized e-learning platform and have access to quizzes and exercises provided by the instructor. McGraw-Hill is always in contact with UBT to provide their continuous support.
Pearson Labs	Pearson Labs are e-learning lab activities, exercises, tutorials and assessments that come with Pearson books. Students get to access the labs per purchasing the book required for the courses. Pearson Team is always in contact with UBT for their continuous support & cooperation. Example of labs: STAT lab, Finance lab, IT lab, and others.
Computer Simulations	Computer Simulations are simulations provided with specific courses such as Marketing, HR, MIS and Finance. They include license student usage for educational simulations used by the instructor of the class and applied by the students.
Smart Classroom software	UBT campuses install smart software in each classroom and in each instructor computer. The smart software includes smart notebook and smart board software and such. It allows the teacher to customize and designs his/her own lectures to be interactive and animated and present it inside the classroom using the smart touch boards. It transforms a rigid text lecture into a creative, innovative interactive experience inside the classroom. The students enjoy smart board lectures and they get to experience the board when presenting their projects themselves or solve exercises on the board.

Source: www.ubt.edu.sa/.../Applications-Development-Division/E-learning

Table 2

E-learning Projects

Phase (1):Interactive learning & communication and ease of online process projects:
Video Conferencing
E-Mail Services: For staff e-mail: Use your UBT e-mail account from any Web browser. Schedule meetings and appointments on your calendar. Save phone and address information for people you communicate with. Student Email services: Shared calendars, file sharing, One Drive cloud storage, online conferencing, screen sharing, public website, Office Online. Create and edit Word, Excel, PowerPoint, and OneNote files via a web browser
LMS: learning management system (Moodle) enhancements; Moodle is a free and open source e-learning software platform, also known as a Course Management System, Learning Management System, or Virtual Learning Environment. E-learning system, course materials , presentations, handouts, projects , quizzes, assignments, messages, chat , discussion forums.
Interactive course contents
E- library (library department)
Online payment /Admission/Registration
Mobile connectivity
Phase (2) :Extended learning resources to distance students and facilitate distance learning projects :
Online admission
Virtual classroom
Website student E-learning
Online and contents
Exam proctoring

Source: www.ubt.edu.sa/.../Applications-Development-Division/E-learning.

Before stating an E-learning program, any institution needs to have a clear vision of what its aims are and the risks and challenges involved. In addition, human resources, their culture and the ability to sustain resources once they acquire the necessary know-how is major issue that needs careful consideration. Moreover, many constraints related to higher education laws and regulations within each country need to be considered carefully because of the special nature of the educational process (Tavangarian et al, 2004).

A very important part of the project for U.B.T. was the establishment of the E-learning Centre of Excellence at the University which hosts the most recent technology. It aims to facilitate offering ICT enabled education, developing online courses, and in general providing the community with services.

Discussion

We examined the nature of change in higher education with respect to the introduction and growth of e-learning. While the ostensible aim is to use e-learning to improve the quality of the learning experience for students, the advisors of change are numerous, and learning quality ranks poorly in relation to most of them. Those of us working to improve student learning, and seeking to exploit e-learning to do so, have to ride each new wave of technological innovations in an attempt to divert it from its more natural course of techno-hype, and drive it towards the quality agenda. We have to build the means of e-learning to evolve and mature as part of the educational change processes, so that it achieves its promise of an improved system of higher education.

The original plan was to offer online courses developed by U.B.T. staff that lead to offering online degrees and ultimately achieve the vision of a 'virtual university'. Among Saudi universities, U.B.T. is arguably the first university to follow such a methodology according to a market research.

This is what made the project more challenging. For a number of reasons, there have been many changes within the project, and such changes had to be managed so that the project could continue to introduction of Moodle and the current e-learning system at U.B.T.

In this section we will discuss a number of these changes that have been faced and consequently discuss these issues with the people related to this system in relation to a theoretical framework.

First, Higher Education in Saudi Arabia is subject to laws and regulations of the Ministry of Higher Education (MoHE.) and according to these laws, offering online degrees are still not allowed. Therefore, the implementation of the original vision of "E-learning University "is still not possible. The non-accredited status of online courses over the internet in the Kingdom is the known major reason for not taking online courses, the other reason is non-interaction with other students and faculty (Sayed et al).

The second issue that proved to be problematic is the development of a fully online course from scratch as this proved to be difficult, time consuming, and lacks some aspects such as the required interactivity between students and instructors (Hussein Al - Yaseen, 2009) .These problems have resulted in making changes to the development methodology for the courses themselves, which has led to UBT to adopt a new methodology for developing its tools and courses using Moodle. The aims of this new methodology are to shorten development time, provide better interactivity, enhance collaborative learning, and meet the requirements of the MoHE in terms of blending online with face-to-face teaching, which is argued to be most successful approach for e-learning (Georgian and Olson., 2008).

Technological uncertainty is the third issue. The technology for the project had to be changed because the original specifications for that IT infrastructure were seen to be insufficient. The new technology infrastructure was with better specifications and the change in technology proved to be positive change in the project. Fourth, the availability and sustainability of human resources involved in the project has been a major challenge and resulted in many changes within the project team, which has also been reflected in the implementation of the project.

The project also faced a number of challenges that have also affected its implementation. One of the major challenges is the culture related to e-learning among faculty members and students. For some faculty members, it was difficult to change the way of teaching for many years, as e-learning is a new trend that requires new teaching cultures (Uhomoibhi, 2006) and for some students changing the way they were taught was also difficult, which has also been the case for students elsewhere (O'Donoghue et al, 2003).

Higher education institutions face persistent challenges in the use of technology, with e-learning management systems being the latest technology challenge. Getting a new idea adopted, even when it has obvious advantages, is difficult. Accordingly, adapting a new technological innovation, such as e-learning systems in higher education, requires faculty to change their ways of teaching; such change does not come easily (Rogers, 2003)**.**

The reviewed literature identified some challenges for implementing- learning systems tools in the institutions of higher education, which are due to a number of different issues, the most common challenge are; faculty members hesitate to change; some faculty members do not have skills to use e-learning systems and are not especially eager to learn; and there is an institution reluctance to provide sufficient personal and financial assistance to facilitate the use of such technology. One of the other challenges for implementing e-learning systems in higher education is that some instructors may have felt threatened by change, so chose to resist e-learning systems (Al-Shboul, 2007).

To overcome these issues, extensive training is needed but the problem is that training is costly, time consuming and of course sustaining the qualified faculty members is another problem issue. Furthermore, appointing a qualified project manager who is able to translate the vision of the e-learning project into a workable plan has proven to be difficult. Changing managers in a short period of time meant that each project manager comes with different vision, plan of action, and management style. This creates confusion and uncertainty (Hussein Al - Yaseen, 2009).

Conclusion, recommendations and future work

Conclusion: E-learning technologies are increasingly utilized in U.B.T.. Issues related to standardizations for reusability and interoperability, assurance of quality, and prevention of adverse effects, become crucial. Therefore, national standards for e-learning should be developed. Moreover, many constraints related to higher education laws and regulations within each country need to be considered carefully because of the special nature of the educational process.

The issue of e-learning itself is still problematic in terms of its definition and consequently the methods of implementation. Before starting an e-learning program, any institution needs to have a clear vision of its aims and the risks and challenges involved. In addition, human resources, their culture and the ability to sustain these resources once they acquire the necessary know-how are major issues that need careful consideration.

Recommendations: with reference to the findings and conclusions of the study, the following recommendations are offered:

1. In order to promote e-learning, the government should come up with regulations and accreditation plans so that companies and universities willing to offer e-learning courseware can start planning for such courses.
2. Increase the educational community awareness of the importance of the e-learning.
3. Encourage private sector to help in this kind of education and provide financial support.
4. Initiate further researches concerning the pedagogical methods that are employed in using e-learning tools.
5. Solve complex e-learning issues with higher education, government and corporate partners.

Future researches: in order to support rapid exchanges in information and build on experiences of different national and global academic institutions, further research is needed to understand what is being developed and implemented in terms of e-learning activities, capacities, and infrastructure**.** Finally, it could be argued that generalization in our case may be in drawing implications and contributions of insights that are useful for the e-learning project at U.B.T..

Acknowledgements

Our acknowledgement and gratitude to the advisors and contributors. First and foremost, we would like to thank the president of U.B.T.: Professor Hussein Al-Alawi, the Dean of CEIT: Professor Mohammad Daous for their support and encouragement. We would like also to thank the e-learning project manager in UBT: Mrs.Hala Naseef and the staff of IT department. The product of this research paper would not have been possible without their help and support.

References

A'eshah Al-Omari. (2007). *E-Learning advantages and disadvantages* . Jeddah : King AbulAziz University.

Akkoyunlu and Yilmaz-Soylu. (2008). Development of a scale of learne's views on blended learning and its implementation process . *Journal of Internet and Highe Education, 11* , 26-32.

Al-Jaghoub et al. (2009). The e-learning project at AAU:Vision,reality and change. *European and Mediterranean Conference on Information Systems (EMCIS,2009)* (p. 3). Izmir-Turkey: EMCIS.

Al-Shboul, M. A. (2007). *Faculty attitudes and perceptions concerning the use of course management systems in higher education.* Unpublished Dissertation ,Northern ILLionis University : Dekalb,IL.

Al-Smadi & Al-Shboul. (2008). Challenges of Implemeting Digital Certificates in Jordan and its impact on e-business. *paper presented at the 2008 International Arab Conference of e-Technology (IACe-T'2008),15-16 ,2008.* Amman,Jordan.

Atkinson et al . (2006). Fundamental uncertainities in projects and the scope of project mangement . *International Journal of project Management, 24 (8)* , 687-698.

Berlin et al. (2009). Comparison of estimation methods of cost and duration in IT projects. *Information and Software Technology,51(4)*, 738-748.

Cadle and Yeates. (2008). *Project Management for Information Systems* . England : Pearson.

Casal, C. (2007). ICT for education and development . *Info,9 (4)*, 3-9 .

Caudron, S. (2001). Evaluating e-degrees. *Workforce,80(2)*, 44.

Codone, S. (2001). *"An E-learning Primer"*. Florida: Pensacola.

Duncan. (2000). "Developing a Project Management Body of Knowlwege Document". *International Journal of project Management,13* , 91.

Garies and Humann . (2008). Change management and projects . *International Journal of project Management,26 (8)* , 771-772 .

Georgian and Olson. (2008). Integration of technology in higher education: A review of faculty self-perceptions. *Journal of Internet and Higher Education,11*, 1-8.

Guide, P. M. (2005, March 3). *Va's Office of Information Technology*. Retrieved from http://www.ppoe.oit.va.gov/docs/VA_IT_PM_Guide.pdf.

Hussein Al-Yaseen. (2009). The e-learning project at AAU:Vision,reality and change. *European and Mediterranean Conference on Information Systems (EMCIS,2009)* (pp. pp. 8-9). Izmir-turkey: EMCIS.

Ipaye, B. (2004). e-learning and e-inclusion. *Presentation at the annual E-Learning Africa Conference* . Nairobi,kenya.

ITC. (1998). *Instructional Technology Council's Definition of Distance Education*.

Jansen, W. H. (2002). In the Proceedings of the 2002 Informing Science & IT Education Conference, pp: 733-746.

Kelly et al . (2007). A comparison of student evaluations of teaching between online and face-to-face courses. *Journal of Internet and Higher Education , 10* , 89-101 .

Koubek and Jandle. (2000). Diversified use of ICT in education. *Campus-Wide Information Systems 17 (5)*, 161-166.

Linderoth, H. P. (2005). Frames and inscriptions : tracing a way to understand IT-dependent change projects. *International journal of Project Management, 23 (5)*, 415-420.

Meredithand Mantel. (2006). *Project Management :A managerial Approach.* Asia: Wiley.

Mirza Abdelrahman. (2008). *Is E-learning Finally Gaining Legitimacy in Saudi Arabia.* http://faculty.ksu.edu.sa/amirza/MyPublications/Is%20elearning%20finally%20gaining%20legitimacy%20in%20Saudi%20Arabia.doc) accessed on 11/7/2009[B12].

Morgan, G. (2003). *Available online: http://www.educause.edu/LibraryDetail Page/666?ID=ERS0302.* Retrieved from faculty use of course management systems (Volume 2) .Boulder , colorado : Educause Center for Applied research.

Mulla, M. (2007). *National Communications and IT plans* . Riyadh: The Ministry of Communications & Information Technology.

Nadhi, H. (2001). Utilizing of distance learning technology among industrial and technical teacher education faculty. *Journal of Industrial Teacher Education, 36 (4)*, 12-24.

Namahn. (2011). *"E-learning: A research Note"*. Retrieved from http://www.namahn.com/resources/documents/note-e-learning.pdf.

O'Donoghue and Singh. (2001). A study of social-learning networks of students studying an on-line programme. *International Conference on Advanced Learning Technologies (ICALT).* Wisconsin USA : Madison .

Ola Al Shagran . (2010). *E-Learning and its effectiveness in Saudi Arabia.* Jeddah: King AbdulAziz university-faculty of computer and information technology.

Redfern and Naughton. (2002). Collaborative virtual environments to support communication and community in Internet-based distance education. *Journal of Information Technology Education,1 (3)* , 201-211.

Roach, R. (1999). The higher education technology revolution . *Black Isues in Higher education, 3* , 8-21.

Rogers, E. M. (2003). *Diffusion of innoviations (5th.ed.).* NewYork: Free Press.

Sayed et. al. (2003). *perceptions about e-Learning in Saudi Arabia.* Al-dammamm : King Fahd University of petrolium & Minerals, Saudi Arabia .Available : www.ccse.kfupm.edu.sa/~sadiq/research/.../Ali_ICASE_Apr2003.pdf.

Sicilia, M. (2007). Competencies in Organizational e- Learning: Concepts and Tools. Information Science Publishing.

Steffens et al . (2007). Changing decisions in product development projects. International Journal of Project management , 25 (7), 702-713.

Tavangarian et al. (2004). is e-learning the solution for Invidual learning ? Journal of e-learning.

Twigg, C. (2001). Innoviations in online learning : Moving beyond no significance. Retrieved October 25, 2005, from http://www.thencat.org/Monographs/Mono4.pdf. .

Uhomoibhi, J. (2006). Implementing e-learning in Nothern Ireland : Prospects and challenges. Campus-wide Information Systems,23(1), 4-14 .

Waits & Lewis . (2003). Distance Education at Degree-Granting Postsecondary Institutions: 2000-2001. Washington, D.C.: U.S: Department of Education, National Center for Education Statistics.(ok)

Walsham. (2001). 'Interpretive case studies in IS research:nature and methods'. European Journal of Information Systems,4, 74-81.

Witmer, D. (1998). Introduction to CMC: A master syllabus for teaching communication technology. Communication technology ,47 , 162-173 .

Yin. (2003). *Case Study research:design and methods,3rd edition.* London :Sage : Thousand Oaks.

About the authors

Abdelrahim .M, Al-Zabadi is from the E-learning program at the University of Business and Technology (U.B.T.) in Saudi Arabia at Jeddah.

eMail: a.zabadi@ubt.edu.sa

Mohammad saleem alshura is from the E-learning program at the University of Business and Technology (U.B.T.) in Saudi Arabia at Jeddah.

eMail: mhmadcshura@yahoo.com

Return to Table of Contents

Return to Table of Contents

Editor's Note: This thoughtful and detailed analysis of transactional distance theory clarifies theoretical and practical aspects of its impact on learning and its role in the design and implementation of distance learning programs.

Using Transactional Distance Theory to Inform Online Instructional Design

Antonia Koslow and Anthony A. Piña
USA

Abstract

Moore's Transactional Distance Theory is one of the most recognized and widely cited theories in distance education. In this paper, we examine the principles and components of Transaction Distance Theory, and provide practical considerations for the design of online courses. We offer several recommendations and strategies for addressing course structure and learner autonomy of online courses in order to increase learner satisfaction.

Keywords: transactional distance, online learner satisfaction, online instructional design, learner autonomy, self-regulated learning

Introduction

Michael Grahame Moore's Transactional Distance Theory (Moore, 1985) is one of the most recognized and widely cited theories in distance education. However the concept of educational transaction did not originate with Moore. In 1949, John Dewey and Arthur Bentley wrote about transaction as a sequence of behaviors that occur in one's environment. They described behaviors such as the hunter and rabbit, and the game of billiard where one has the buyer, player and objects of the game, to explain that the transaction itself is due to each player and object. Any portion of the event can be detached; however, the transaction itself "must be subject to the wider observation of the full process" (p. 134). The behavior then is a result of the activity performed by individuals and events as part of one's environment. They wrote that "behavior that results in knowledge is not a result of activity one performs in and of itself as the behavior is performed in the process of one's environment" (p. 104).

More than two decades prior to the advent of online courses, Moore, then Assistant Professor of Education at the University of Wisconsin, laid the groundwork for transactional distance theory in his theory of independent learning and teaching (Moore, 1972). "We decided that a learner's distance from his teacher is not measured in minutes or miles. It is defined as a function of individualization and dialog" (p. 665). Moore then created a "dimensions of distance" classification, where low dialog (i.e. less interactive) activities, such as reading a textbook, were associated with more distant education, while high dialog activities, such as talking to an instructor on the phone, were associated with less distant education.

Transactional distance

By 1985, Moore--now a professor at Pennsylvania State University--was extending the concept of transaction that began with Dewey and Bentley and developed further by Boyd and Apps (1980). As cited in Moore and Kearsley (2005, p. 200), Boyd and Apps (1980) wrote, that "it [transaction] connotes the interplay among the environment, the individuals, and the patterns of behaviors in a situation, between people" (p. 5).

Moore postulated that, in distance education, there was not only a physical distance between teachers and learners, but also a cognitive or psychological distance. "Distance is not simply a matter of geographical distance, but is a pedagogical phenomenon (in an online learning environment)" (Moore & Kearsley, 2012b, p. 209). Moore and Kearsley (2012a) stated,

"transaction called distance education is the interplay between people who are teachers and learners, in environments that have the special characteristic of being separate from one another, and a consequent set of special teaching and learning behaviors" (p. 200).

Components of transactional distance

Moore and Kearsley (2012a) wrote about the pedagogical needs of learners for structure, dialogue and autonomy in a distance-learning environment. The separation of learners and teachers in an online learning environment requires a course design unlike the traditional format. They suggest that "dialogue and structure may affect student online learning" (p. 209). The third variable that influences dialogue and structure in an online course is learner autonomy (Moore, 1972).

Course structure

Researchers have explored the effect of course design on student learning and satisfaction, finding that course content that is organized and presented in a logical manner has an effect on student satisfaction (Sahin & Shelley, 2008; Sun, Tsai, Finger, Chen & Yeh, 2008; Swan, Schenker, Aviv, Shea, Shea & Lin, 2006; Yuselturk, 2009). Sun et al. (2008) found that course flexibility is a strong suggestion of student satisfaction. They wrote "an unsatisfactory perception will hamper students' motivation to continue their distance education" (p. 1196).

Moore (2013) states that distance learning programs are not distant in the absolute sense, but more or less distant, as evidenced by the amount of structure and dialogue (interaction) in the course (p. 69). He describes a structured course as one in which the learners are closely followed by the instructor, where the instructor monitors the learner's progress, provides feedback and learning activities that serve as remediation. The instructor's goal is to "ensure that every student has accomplished each step of the course in a tightly controlled sequence" (p. 69).

In a less structured course, students may follow different paths to learn concepts (Moore, 2013). For example, students may review different articles posted in the course room, information on websites, or videos on websites that have the same concepts explained in a different format. The assessment may vary in the online course to accommodate the needs and learning styles of each student. Students may write papers, complete projects, or take online tests to demonstrate they have accomplished the learning outcomes of the course. In a less structured format, students have the option to select the resources and contact the instructor only if they need direction. Both approaches provide a different learning experience, where the first approach provides more structure and less learner control, and the second approach accommodates the learner's needs and preferences on learning style and is responsive to each learner on an individual basis (Moore, 2013, p. 70).

Dialogue

The term *dialogue* is used by Moore (2013) to describe learner interactions in online education. He wrote, "Interaction is not always constructive, but dialogue by definition is. Dialogue has a synergistic characteristic, 'as each party in the exchange builds upon comments of the other'" Moore, 2013, p. 70). The role of the learner varies between a structured activity and a more open activity. One example is the use of videoconferencing technology to support a learning activity where learners on the Web interact in real time, listening to a lecture and taking notes. Another example is the use of videoconferencing technology to accomplish a case study exercise. In this example, the learners listen to an exercise, ask and answer questions, individually or in groups, while receiving guidance from faculty. The students learn from each other's experiences. The latter example is a less structured environment where there is dialogue among learners while the first example is a highly structured activity where the learner takes a more passive role in the learning experience (Moore, 2013, p. 70).

The degree of structure and dialogue in a course depends on the students' ability to learn autonomously. Moore (2013) states "highly autonomous learners are able to cope with a lower degree of dialogue but less autonomous need a relatively high degree of dialogue" (p. 71) and that the degree of dialogue and structure varies in online courses and is dependent on the subject matter, the instructor's philosophy of teaching and learning, and the abilities of learners to learn in an autonomous setting. He defines the autonomous learner as "needing instrumental support, i.e., information and advice necessary to get the job done" while the less autonomous learner needs "more emotional support from the teacher" (p. 73).

In an online learning environment, the teacher may incorporate learning activities to promote critical thinking via dialogue (Moore, 1989). Anderson (2003) wrote about the impact of interaction in distance education, reviewing the types of interaction proposed by Moore to include student-teacher, student-content, and student-student interaction:

> The capacity of the Internet to store, catalog, and deliver such content, supplemented by the capacity of computers to support a rich variety of computer-assisted instruction, simulations, and presentation creation tools, is significantly altering the context of student-content interaction (p. 136).

There are a variety of ways that content can be presented using multimedia elements of text, images, video and audio. Anderson (2003) observed that distance educators use media and technology to support interactions. "Daniel and Marquis's (1988) seminal challenge to distance educators in the late 1980s was to 'get the mixture right' between independence (student-content interaction) and interaction (mainly student-teacher interaction)" (Anderson, 2003, p. 141).

Gunawardena and Duphorne (2000) conducted a study to determine the factors that predict learner satisfaction. They found that learner interaction by way of dialogue has an influence on satisfaction. They wrote,

> Computer conferencing (CC) is the vehicle that can facilitate the dialogue and interaction necessary for the teaching and learning process in web-based courses by providing opportunities to negotiate meaning, validate knowledge, and construct knowledge through social negotiation (p. 101).

Researchers have explored the relationship between student satisfaction and interaction (Bollinger & Martindale, 2004; Moore & Kearsley, 2005; Palloff & Pratt, 1999). They wrote that students who interact with one another in classroom discussions feel connected in the course, which affects their continued satisfaction in the course.

Researchers have also examined the effect of social presence – the feelings of connectedness that individuals experience in an online course environment (Bouhnik & Marcus, 2001; Swan, 2001). Because of the nature of online learning where students learn at a distance, the interactions between instructor and student and among students are more challenging and can create a sense of isolation (Kuh & Hu, 2001). Swan and Shih (2005) wrote that "'social presence,' the degree to which participants in computer-mediated communication feel affectively connected one to another, has been shown to be an important factor in student satisfaction and success in online courses" (p. 115). Their study examined the "nature of social presence and how it develops in online course discussions" (p. 115). Swan and Shih (2005) found a correlation between the students' perception of social presence and satisfaction with online discussions (p. 115).

Learner autonomy

Moore (1993) defines transactional distance as the relationship between dialog and structure, taking into consideration the learner's autonomy. He wrote that less course structure and increased dialog support student learning and satisfaction. With regard to learners as independent, he wrote "independent study is a transaction between an individual student and a tutor. The

student reads assigned materials, prepares papers, or engages in a project, and reports frequently to his tutor, who provides guidance and responds to the materials submitted" (p. 18). On distance learning, Moore wrote:

> While the separation of learner and teacher in the scholarly tradition of independent study is deliberately arranged to promote the student's self-direction and independence in working, in the thematic tradition it is invariably a necessity imposed by the learner's social and geographical circumstances. (Moore, 1993, p. 18)

Saba (2003) proposed a new paradigm based on Moore's theory of transactional distance to describe a "causal loop between structure and dialog" (p. 13). He stated that there exists a feedback loop between teacher and student:

> A negative feedback loop provides a mechanism for determining how much transactional distance is desired and required at each point in time. If the learner needs more direct instruction, structure and transactional distance both increase. If the learner requires more autonomy, transactional distance decreases as dialog increase and structure decreases. The inverse relationship between structure and autonomy (dialog) is at the highest hierarchical level in the instructional/learning subsystem depicted in Fig. 1.3. Structure and autonomy can be further represented in relationships that define learner control and instructor control. (p. 13)

Benton et al. (2013) conducted a study of online business students to determine their perception of course structure. On learner autonomy, they wrote "the greater the student effort, the less likely a course was taught online. This was in spite of the fact students in online courses were more likely to say the instructor expected them to take their share of responsibility for learning" (p. 216). Benton et al. (2013) wrote that they felt that transactional distance increased as the instructor attempted to foster learner autonomy. They found that students did not respond to the instructor's attempt at creating an autonomous learning environment.

Learner interface

Hillman, Willis and Gunawardena (1994) wrote about a fourth type of interaction, described as "learner/interface interaction" (p. 33). They describe student interaction as "a process of manipulating tools to accomplish a task" (p. 34). They describe the process of interaction as one where the learner "understands the procedures, or tools, of the interface and the reasons for the use of procedures to accomplish a task" (p. 34). Learners who understand the interface, the purpose and outcome of such an interface, will be more satisfied in the online learning experience. Hillman et al. (1994) wrote,

> If we apply this interpretation to the case of distance learning technology, we can see that the learner in a distance education class studying non-technical subjects such as psychology, art history, or remedial English skills is actually taking two courses: one teaches the content and the other teaches the interface. (p. 35)

Anderson (2003), describing learner interface as focusing "on the access, skills, and attitudes necessary for successful mediated instruction. All forms of interaction in distance education context are, by definition, mediated forms of interaction" (p. 132).

Given the nature of distance education, where learners navigate a course website to find information, how the site is used can be important for learning. Ingram (2002) wrote on the usability of websites, stating that designers consider how to make the navigation easy to use. If the learners cannot find information due to poor interface, they can become frustrated. As reported by Ingram (2002), Jakob Nielsen (1993) defines usability of any technological system as consisting of five major characteristics: "learnability, efficiency, memorability, error rates, and satisfaction" (p. 34). Learnability refers to the ease and speed with which novice users can learn

the system; it applies primarily to early use of the system. Ingram (2002) states that in business, poor web site design can result in loss of sales. For education, he wrote that structure of a website, in terms of design layout, is dependent upon the subject area. He recommends that websites for educational purposes be tested for ease of navigation and wrote that, "student satisfaction with a site is, of course, a subjective phenomenon, but one that is important in keeping students returning to our sites" (Ingram, 2002, p. 38).

Ingram (2002) observed that the structure of an educational site could be linear, where items presented are in order or hierarchy, from simple to basic, or it can be organized as items such as by assignment or course objectives. Students are interested in finding out what they have to do and how to do it. He recommends that course designers survey students to understand their expectations and needs, thereby take a student approach in the design of courses.

Transactional distance and student satisfaction

Koslow (2015) conducted a correlational study to determine whether course structure, dialogue, learner autonomy, and interface dimensions were significant predictors of undergraduate nursing students' perceptions of online course satisfaction. The sample included 42 nurses enrolled in an undergraduate online program at a private university in the Midwest. Multiple linear regression analysis was used to determine if student satisfaction in an online course was affected by course structure, interaction, learner autonomy and interface.

A questionnaire by Huang (2002) was adapted – with the author's permission – to sample the perception of online undergraduate students on factors that are considered in the literature to reduce transactional distance in an online course. The questionnaire included items that examined the four variables of transactional distance theory: interaction, structure, learner autonomy and interface. The instrument included eight subscales of four dimensions in interaction, course structure, learner autonomy and interface and achieved Cronbach's alpha coefficients of .95, .91, .91, and .95 for the interaction, course structure, learner autonomy and interface, respectively.

Results indicated that interaction, structure, learner autonomy and interface, in aggregate, were significant predictors of student satisfaction on online courses. However, the four variables were not found to be equal in influence. When each variable was examined to determine its individual contribution to student satisfaction, it was found that learner autonomy was the highest amount of variance in student satisfaction, followed by course structure as indicated in Table 1 below.

Table 1
Percent variance for learner satisfaction by transactional distance variable

Variable	Variance for Learner Satisfaction
Learner Autonomy	64.0%
Course Structure	59.8%
Dialog/Interaction	57.9%
Interface	47.4%

Practical considerations for instructional designers

The research shows that learner satisfaction is positively related with student retention. Students who are satisfied with their online experience will most likely remain in the course (Kibiloski, 2012). Student retention has economic and other implications for the university. The strategic plans of colleges and universities consider monetary, programmatic and other issues, such as the mission of the institution to serve the community in its course offerings. Koslow (2015) found

that the two variables that most influenced student satisfaction were learner autonomy and course structure. However, these two are generally understood to have an inverse relationship—when one increases, the other decreases (McIsaac & Gunawardena, 1996). The following sections provide considerations for the design and development of online courses and reflect the experiences of the authors.

Course structure

At first, it would appear that online courses, by their very nature, provide less course structure than face-to-face courses. Online courses are often marketed as "anytime, anyplace" education. However, the structure of online courses can be determined through multiple means, including its layout, navigation, instructional activities and assignments.

How the course is laid out for the learner and how the learner navigates the course is an obvious way to increase or decrease course structure. Highly-structured courses tend to feature a layout of sequential folders or a table of contents corresponding to successive weeks (week 1, week 2, etc.). Students are expected to navigate the course sequentially and complete the instructional, assignment and activities of one week before going to the next. Course folders/contents may also be laid out according to major topics covered in the course or by the chapters of a course text. Highly-structured courses include course schedules with fixed due dates to assure that students are working on the same topics, materials and assignments at the same time. This is a very common model for online courses.

Assignments can also promote increased course structure. Assigning a discussion forum whose posts are due at the end of the week often results is an avalanche of posts on the final day. Structure is often imposed by having an initial post due earlier in the week, with initial responses due a few days a later and final responses due by the end of the week. This structure encourages engagement during the week, rather than just on the last day. Another strategy is to have students make an initial post based on personal experience with the week's topic and to have responses identify or apply the principles or concepts from the week's lesson, as opposed to merely telling students to "respond to two of your peers." Group assignments can be also used to increase course structure—particularly if each member of the group is given a unique role or assignment within the group with specific tasks and is assessed based on those tasks, rather than simply assigning the same group grade to all group members.

Highly-structured courses can benefit learners who are inexperienced or are in introductory courses (Freeman, Haak & Wenderoth, 2011). One of the authors has taught courses in law office software (Microsoft Office, CaseMap, Summation, Abacus Law, Timeslips and Westlaw) for several years to prospective paralegal students. Most of these students have no previous experience in law, so their familiarity with the day-to-day activities in a law firm are limited to their course work in the program. Keeping this in mind, the course tends to be highly structured by weeks, with measurable learning outcomes with prior assessment of student knowledge of civil litigation, legal research and writing Microsoft Office skills and continual formative assessment to make sure that they are mastering the course concepts before tackling complex legal database programs.

Many learning management systems contain tools that can allow students to access and view course materials in a linear or non-linear format (Piña, 2013). The course may be set up with a fixed learning path, so that certain content cannot be viewed unless other content is accessed first or until a quiz is completed with a sufficiently high score.

Learner autonomy

Cubucku (2009) stressed the relationship between self-regulated learning and learner autonomy, emphasizing that the use of self-regulated learning strategies is essential for successful

autonomous learning. Online courses can be ideal environments for incorporating self-regulated learning strategies and for fostering the development of self-regulated/autonomous learning skills (Harris Lindner & Piña, 2011).

Harris & Piña (2014) offered several strategies and techniques for incorporating self-regulated learning into online courses. There were grouped into five categories: 1) conditional awareness; 2) self-monitoring; 3) self-evaluation; 4) self-motivation; and 5) self-explanation.

To promote *conditional awareness*, which is "defined as a student's ability to identify and execute appropriate SRL strategies based on contextual clues in a particular learning situation and context" (Harris & Piña, p. 8), courses can be designed to require learners to set specific academic goals for a course and to develop a strategic plan to achieve their goals based on contextual clues in the course. This is best done at the beginning of a course. Learners can be prompted to find contextual clues within the course syllabus and assignment description, to determine whether the course is based on acquiring factual knowledge, applying principles, analyzing cases or other skills and aligning their goals to facilitate the outcomes required in the course (Harris & Piña, 2014).

Self- monitoring prompts can be inserted throughout the course at strategic points, to allow learners to ask themselves questions, such as, "To what degree did I understand this concept?" "Have I identified all of the key points in this article?" "I didn't do as well as I thought I would on the last test--what learning strategies do I need to use to prepare for the next exam so that I will get an A?" or "My attention is beginning to drift—what do I need to do to stay focused for the next 45 minutes?" (Harris & Piña, 2014, p. 11-12).

Instructional designers and course developers can provide opportunities for learners to engage in *self-evaluation*, such as utilizing quizzes for formative "in progress" learning checks, rather than as high-stakes graded summative assessments (Piña & Bohn, 2010). Self-evaluation prompts can include: "If I were to take a test on this information right now, what grade would I most likely receive?" "Now that I know my score on this exam, what would I do differently for the next exam to do better?" "To what degree am I following the plan I made for achieving my goal?" or "Why did I perform this way on the self-test? What misconceptions or misunderstandings do I have?" (Harris & Piña, 2014, p. 12).

Since motivation is a critical factor in both learner autonomy and achievement, periodic prompts, allowing learners to assess their level of *self-motivation*, can be designed into the course. These may include items like, "How is my motivation right now? If it is low, I need to remind myself that I have been a successful student in the past and that I have overcome difficult challenges on other occasions" "As soon as I complete the self-test, I am going to reward myself" or "Even though this article is taking much more time than I anticipated, I am not going to give up until I complete it." (Harris & Piña, 2014, p. 14-15).

Finally, *self-explanation,* prompts can help students to "analyze, clarify, amplify, draw inferences, interpret, and then explicate to themselves the subject matter of the course" (Harris & Piña, 2014, p. 15). Examples of self-explanation prompts include, "How would I describe the situation, problem, concept, activity, etc.?" "What possible implications or predictions can I draw from the information thus far?" "How would I sum up, interpret, or explain the situation, problem, concept, activity, etc. thus far to someone else?" Having learners summarize what they have learned from an individual lesson or write a reflection paper on what they have learned in the course also promotes self-explanation.

As with course structure, the features and capabilities of the LMS can be used by course designer to facilitate learner autonomy. These include wikis, blogs, discussion forums, course announcements and the ability of test/assessments to provide immediate feedback to learners.

Conclusion

Reigeluth (2012) has posited that much instructional theory has been generated to guide the design of instruction. Transactional Distance Theory provides a rich foundation from which instructional designers and course developers can put theory into practice. By incorporating principles of course structure and learner autonomy into the design of online courses, the effects of both the physical and cognitive distance between online learners and their instructors can be addressed and mitigated.

References

Anderson, T. (2003). Modes of interaction in distance education: Recent developments and research questions. In M. G. Moore (Ed.), *Handbook of distance education* (pp. 129-144). Mahwah, NJ: Erlbaum.

Benton, S. L., Li, D., Gross, A., Pallett, W. H. & Webster, R. J. (2013). Transactional distance and student ratings in online college courses. *American Journal of Distance Education, 27*(4), 207-217, doi: 10.1080/08923647.2013.838458

Bollinger, D. U. & Martindale, T. (2004) Key factors for determining student satisfaction in online courses. *International Journal on E-Learning*, *3*(1), 61-67.

Bouhnik, D., & Marcus, T. (2006). Interaction in distance-learning courses. Journal of the *American Society Information Science and Technology, 57*(3), 299–305.

Boyd, R., & Apps, J. (1980). *Redefining the discipline of adult education*, San Francisco, CA: Jossey-Bass.

Cubucku, F. (2009). Learner autonomy, self-regulation and metacognition. *International Electronic Journal of Elementary Education 2*(1), 53-64.

Dewey, J., & Bentley, A. F. (1949/1960). Interaction and transaction. In *Knowing and the known* (pp. 103-143). Boston, MA: Beacon Hill.

Freeman, S., Haak, D., & Wenderoth, M. P. (2011). Increased course structure improves performance in introductory biology. *CBE Life Science Education 10*(2), 175-186.

Gunawardena, C. N. & Duphorne, P. L. (2000). Predictors of learner satisfaction in an academic computer conference. *Distance Education*, 21(1), 101-117.

Harris, B. R., Lindner, R. W. & Piña, A. A. (2011). Strategies to promote self-regulated learning in online environments. In G. Dettori & D. Perisco (Eds.) *Fostering Self-Regulated Learning through ICT* (pp. 122-144). Hershey, PA: IGI Global.

Harris, B. R. & Piña, A. A. (2014). Incorporating self-regulated learning strategies in online courses. In A. A. Piña & A. P. Mizell (Eds.). *Real Life Distance Education: Case Studies in Practice* (pp. 3-20). Charlotte, NC: Information Age Publishing.

Hillman, D., Willis, D. J., & Gunawardena, C. (1994). Learner-interface interaction in distance education: An extension of contemporary models and strategies for practitioners. *American Journal of Distance Education, 8*(2), 30-42.

Huang (2002). Student perceptions in an online mediated environment. *International Journal of Instructional Media, 29*(4), pp. 405-420

Ingram, A. L. (2002). Usability of alternative web course structures. *Computers in the Schools: Interdisciplinary Journal of Practice, Theory, and Applied Research*, *19*(3-4), 33-47, doi: 10.1300/J025v19v03_04

Kibiloski, F. T. (2012). *Marketing through online leadership to retain invisible customers: Perceptions of online students* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses (3494624).

Koslow, A. (2015). *Relationship between students' perception of satisfaction in undergraduate online courses and course structure, interactions, learner autonomy and interface*. (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses (3688874).

Kuh, G. D. & Hu, S. (2001). The effects of student-faculty interaction in the 1990s. *The Review of Higher Education, 24*(3), 309-332.

McIsaac, M., & Gunawardena, C. (1996). Distance Education. In D. H. Jonassen (Ed.), *Handbook of research for educational communications and technology: A project of the Association for Educational Communications and Technology* (pp. 403–437). NY: Simon and Schuster.

Moore, M. G. (1972). Toward a theory of independent learning and teaching. *Journal of Higher Education, 49*(12), 661-679.

Moore, M. G. (1989). The editorial: Three types of interaction. *American Journal of Distance Education, 3*(2). doi: 10.1080/08923648909526659

Moore, M. G. (2013). The theory of transactional distance. In M. G. Moore (Ed.), *Handbook of distance education (3rd ed.)* (pp. 66-85). New York, NY: Routledge.

Moore, M. G., & Kearsley, G. (2005) *Distance education: A systems view (2nd ed.)* Belmont, CA: Thomson Wadsworth.

Moore, M. G., & Kearsley, G. (2012a). Course design and development. In M. Kerr, G. Allen, & G. Lindquist, (Eds.), *Distance education: A systems view of online learning (3rd ed.)* (pp. *97-123);* Belmont, CA: Wadsworth.

Moore, M. G., & Kearsley, G. (2012b). The distance education student. In M. Kerr, G. Allen, & G. Lindquist, (Eds.), *Distance education a systems view of online learning (3rd ed.)* (pp. 150-174). Belmont, CA: Wadsworth.

Palloff, R. M. & Pratt, K. (1999). *Building learning communities in cyberspace: Effective strategies for the classroom*. San Francisco, CA: Jossey-Bass.

Piña, A. A (2013). Learning management systems: A look at the big picture. In Y. Kats (Ed.) *Learning Management Systems and Instructional Design: Metrics, Standards and Applications* (pp. 1-19). Hershey, PA: Information Science Research.

Piña, A. A., & Bohn, L. (2010). Best practices for LMS integration into a professional doctoral program. *Instructional Practice in Higher Education 1*(1), 4-6.

Reigeluth, C. M. (2012). Instructional theory and technology for a postindustrial world. In R. A. Reiser & J.V. Dempsey (Eds.) *Trends and issues in instructional design and technology (3rd Ed.).* (pp. 75-83). Boston, MA: Pearson.

Saba, F. (2003). Distance education theory: Methodology, and epistemology: A pragmatic paradigm. In C. M. Reigeluth (Ed.), *Handbook of distance education* (pp. 3-31). Mahwah, NJ: Erlbaum.

Sahin, I. & Shelley, M. (2008). Considering students' perceptions: The distance education student satisfaction model. *Educational Technology & Society*, *11*(3), 216-223.

Sun, P., Tsai, R. J., Finger, G., Chen, Y., & Yeh, D. (2008). What drives a successful e-Learning? An empirical investigation of critical factors influencing learner satisfaction. *Computers & Education*, *50*, 1183-1202. doi: 10.1016/j.compedu.2006. 11.007

Swan, K. (2001). Virtual interaction: Design factors affecting student satisfaction and perceived learning in asynchronous online courses. *Distance Education*, *22*(2), 306-331.

Swan, K., Schenker, J., Aviv, R., Shea, R., Shea, P., & Lin, Y. (2006). *Student satisfaction with online learning: A concept network analysis.* Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

Swan, K. & Shih, L. F. (2005). On the nature and development of social presence in online course discussions. *Journal of Asynchronous Learning Networks*, *9*(3), 115-136.

Yukselturk, E. (2009). Do entry characteristics of online learners affect their satisfaction? *International Journal on E-Learning, 8*(2), 263-281.

About the authors

Dr. Antonia Koslow is instructional designer at Loyola University Chicago, Health Sciences division. She has been involved in teaching, faculty development and course design and development since 2003. Her research interests involve the use of course design elements to minimize the psychological distance between student understanding and instructor. Additional research interests involve the use of prompts in online learning environments to help student learning and metacognition.

Email: akoslow@luc.edu

Dr. Anthony A. Piña is Dean of the Online Division of the Sullivan University System. He has been involved in the teaching, development and administration of distance education since 1994. Tony is President-Elect of the Division of Distance Learning of the Association for Educational Communications & Technology (AECT) and has published three books and over 45 articles on instructional technology and distance learning. His research focuses upon management and institutional aspects of online/distance education.

Email: apina@sullivan.edu

Return to Table of Contents

Editor's Note: Mobile learning requires technical and pedagogical decisions to optimize this resource for a variety of users and mobile devices. Before developing mobile applications, educators must determine criteria to assure the most effective use of this dynamically changing resource.

Criteria for selecting the appropriate mobile application development platform for higher education

Joongkak Kook
Republic of Korea

Abstract

Methods and styles of learning in higher education have evolved to become the epistemological ecosystem of the 21st century. We live in an age where mobile devices have become ubiquitous. Educators (or developers) are becoming increasingly interested in mobile application development (MAD). Three main approaches to MAD exist: native application development (NAD), Web application development (WAD), and hybrid application development (HAD). There is considerable uncertainty among educators and formulators of education policy regarding which of these approaches is appropriate for the development of a platform for higher education. Consequently, in this study, we address two issues: the comparison of the available platforms and the delineation of a few criteria for an appropriate platform to be applied when developing mobile applications for higher education. Our intended audience is educators and developers interested MAD in higher education.

Keywords: mobile technology, mobile application development, native applications, web applications, hybrid applications, criteria, learning, higher education

Introduction

We live in the mobile age, where the use of mobile devices is widespread in our daily lives. In the academic setting, students use mobile devices not only for communication, but also for learning.

The remarkable and rapid development of mobile technology in the last few decades has led to considerable educational innovation, and mobile applications are a novel approach to the world of learning. Mobile applications provide a means to take advantage of a new wave of electronic and learning devices that offer portability and ease of use.

In recent years, many educational institutions have responded to this innovation by hastening in the direction of mobile application development (MAD). Mobile applications are no longer only an option: they are a necessity (Edgard, 2013). There are three main approaches to MAD: native application development (NAD), Web application development (WAD), and hybrid application development (HAD) (Huynh & Ghimire, 2015; Serena, 2014; Agrawal & Gill, 2013). In the context of higher education, there is considerable uncertainty among educators and education policy makers as to which of these three approaches is appropriate for higher education.

This study addresses two issues: the comparison of the available platforms and the delineation of a few criteria for an appropriate platform when developing mobile applications. Furthermore, the focus is on the criteria that should be considered when developing mobile applications for higher education. The author hopes that educators (or developers) can use these considerations to select the most suitable platform option for MAD in higher education.

Research questions

The following are the key research questions explored in this study:

- What are the differences between the three approaches to MAD?
- What are the characteristics/advantages of each of the three approaches to MAD mentioned above?
- What are the criteria for a viable and useful strategy for MAD?

Research objectives

The following are the specific objectives of this research:

- To clarify the concept of each approach for mobile development
- To determine the differences/characteristics of each application development approach
- To compare the advantages/disadvantages of each application development approach
- To seek criteria that should be considered when developing mobile applications for use in higher education.

Organization of this paper

The next section provides background to aid the reader's understanding of the various approaches to MAD, the current status of the mobile operating system (OS) market share, the current trends, the theoretical background, a literature review, and the research methodologies implemented in the area. The subsequent section provides a comparison and analysis of these approaches in terms of their characteristics and merits. Then, a few criteria that should be considered for a MAD platform suited to higher education are determined. The final section contains the conclusions of this study and directions for future research.

Related work on selective approaches to mobile application development

Mobile application development approaches

The three major approaches to MAD - NAD, WAD, and HAD - are shown in Figure 1 (Salesforce, 2015; Charland & Leroux, 2011; IBM 2012; Appcelerator, 2012). Developers and educators first need to choose the platform to use. Native-centered NAD is written in the programming language specific to the device platform in question. Web-centered WAD involves the use of standard Web-based technologies, and can be interpreted through any Web browser. Hybrid-centered HAD uses both native components and Web technologies, and a significant portion of the application is written using cross-platform Web technologies. However, there is more to choosing an approach than simply considering its technological advantages and disadvantages (Microsoft, 2012; Holzer and Ondrus, 2012).

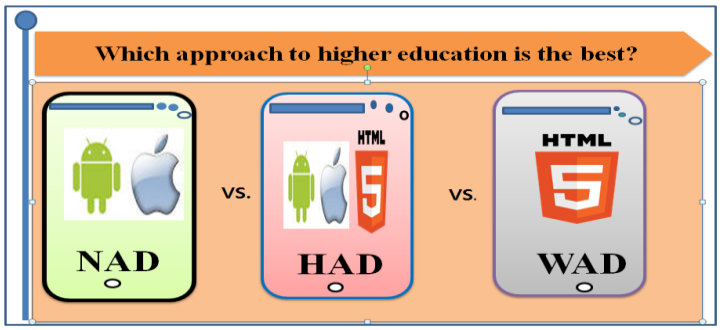


Figure 1. Which approach to higher education is the best?

Status of mobile OS market share: Q1 2015

The worldwide mobile market shares of smartphone OSs are listed in Table 1, according to data reported by the International Data Corporation. The table shows that from 2012 to 2015, Android, iOS, and Windows were the most widely used and rapidly evolving OSs installed in smartphone devices. It can be seen that the Android platform is the clear leader in the worldwide mobile platform market, because of its adoption by manufacturers such as Samsung and HTC, while Apple's iOS emerges as the second most popular.

Table 1

Worldwide smartphone OS market share (share in unit shipments)

Period	Android	iOS	Window phone	BlackBerry OS	Others
Q1 2015	78.0%	18.3%	2.7%	0.3%	0.7%
Q1 2014	81.2%	15.2%	2.5%	0.5%	0.7%
Q1 2013	75.5%	16.9%	3.2%	2.9%	1.5%
Q1 2012	59.2%	22.9%	2.0%	6.3%	9.5%
Source: IDC, May 2015					

Current trend

In the past, HTML5 and native applications were in competition for adoption by developers. Currently, native applications occupy the market, while HTML5 has continued to evolve and improve and has secured a growing market share. The gap between HTML5 and native applications will thus probably be closed, and the former will attract more developers and consumers. A new competitor, hybrid applications, has recently emerged (Mulligan, 2013).

Theoretical background for mobile application development selection

According to March and Smith (1995), research in Information Technology (IT) addresses the design tasks faced by practitioners. They proposed a two-dimensional framework for research in IT. One dimension is based on broad types of design in relation to natural science research activities and the second is based on general types of outputs produced by design research. They stated that a design for natural science activities is required, and for this purpose IT research is both relevant and effective. In simple language, the former dimension means that IT research must address the design tasks faced by developers and practitioners, and attempt to reach an understanding of and explain reality, while the latter aims to create artifacts that serve human goals. Real life problems must be suitably conceptualized and represented, and the appropriate skills and techniques to find their solutions must be developed. In addition, the solutions need to be implemented and evaluated using the appropriate criteria (Holzer and Ondrus, 2011). In summary, the former dimension is related to the design science approach, and the latter to the social science approach in IT research. From past research studies, we know that research in the field of information systems often integrates both dimensions (Holzer and Ondrus, 2011).

In this study, we focus only on the components of the design science approach. That is, this research study targets the creation of a decision-making process that involves a set of relevant criteria for evaluating the three main development platforms for MAD (i.e., NAD, WAD, and HAD) in terms of supporting higher education. Thus, our study attempts to determine the appropriate criteria that will allow better decision making in the mobile application development process.

Review of research on mobile application development

In this section, we review past research in the area. The goal of the review is to gather fundamental data in order to compare previously proposed solutions to that proposed in this paper.

Fluttert's (2013) study was concerned with a multi-criteria decision system for deciding between NAD, HAD, and WAD. Criteria were collected and tested using semi-structured interviews with mobile application experts. Six of these criteria (c1-c6) were grouped together as the major criteria having the highest relevance scores, as shown in Table 2. Ten (c7-c16) were designated as normal criteria strongly related to the choice of implementation platform and were used to further fine-tune the choice between the three platforms.

Table 2
Overview of hierarchically ordered criteria

Group	C#	Criteria	Description
	c1	Connectivity	The app operates without internet connectivity
	c2	Device sensors	The app uses 1 or more device sensors
Major	c3	Market	The app requires distribution through an application store
criteria	c4	Platform amount	The app is deployed to multiple mobile operating systems
	c5	Mechanisms	The app requires native functionality to function correctly
	c6	Content	The app shows simple content like text and images, which cannot the replaced by Web techniques
	c7	Updatability	There are multiple versions planned on the roadmap of the app
	c8	Personalization	App show personalized content for used (based on user and/or location)
Normal	c9	Responsiveness	App has to respond immediately on input
criteria	c10	Native UI	App requires native elements
	c11	Screensize	App has to support many screensizes (phone + tablet + desktop)
	c12	Heterogenerity devices	App supports many devices
	c13	User expectation	User has high expectations, both visually and performance wise
	c14	Encrypted data	Storing encrypted data on device
	c15	Market fee	App uses in-app transactions
	c16	Regulation	Impact of restrictions (Terms of Service) from OS vendors

Another study on this topic was conducted by Edgard (2013). In this study, the criteria were divided into four categories, as shown in Table 3. The first category comprised the dominant criteria (performance, user interface, and quality). These criteria were considered dominant because of their fundamental characteristics. The second category consisted of time, portability, and code update, which are considered important for choosing a MAD strategy. The third category consisted of cost and development resources. Developers appear less concerned about criteria in this category, yet they represent non-negligible factors. The fourth category consisted of least-used criteria among mobile professionals (development skills and core device API form).

Table 3
Categories of criteria

Category group	Criteria	Description
1st category	Performance	Dominant criteria
	User Interface	
	Quality	
2nd category	Time	Considered to be important in the processs of choosing a mobile development strategy
	Portability and code update	
	Code update	
3rd category	Cost	Criteria of least concern, although non-negligible factors
	Development resources	
4th category	Development skills	The least used criteria
	Core device API form	

Another study mapped criteria specifically to the mobile application life cycle of three criteria categories: development (e.g., technical specifications, development support, portability, maintenance), distribution (e.g., access to consumers, ease of distribution, monetization), and usage (e.g., performance, and look and feel) (Holzer & Ondrus, 2012).

In summary, we found a few criteria common to these studies: performance, maintenance, development cost and time, etc.

Research methodology

Our interest in MAD in this study is related to higher education. However, the literature on MAD for specific organizations of this type is still scarce. This study provides a basic step toward building a decision strategy to assist multiple-criteria decision making. We aim to create a MAD strategy by using a design science approach (Hevner et al., 2004).

Our research framework can be stated in two points. First, a few of the common criteria found in the literature review in the previous section (performance, maintenance, development cost, time, etc.) were adopted in this study. Second, some criteria that facilitate the extraction of the main criteria are added following a concrete and extended analysis of the literature, in conjunction with archival data on the Internet (specialized websites, blogs, and development forums).

Comparison and analysis of mobile application development approaches

To best implement MAD, it is important to know the fundamental differences between and the characteristics of the available platforms. We compare and analyze them in this section. Each of the three platforms mentioned in the previous sections has its advantages and drawbacks. It is noteworthy that since no platform dominates in all aspects of MAD, the choice of platform depends mainly on the use of the application by the target audience. At this stage, our analysis simply provides an overview of MAD strategies in the light of the criteria. We do not consider the nature of specific applications that require particular attention in terms of certain criteria.

Comparison of mobile application development platforms

Table 4 compares several mobile platforms. Of about 10 versions of mobile OSs available, only a few representative mobile platforms are shown (Chun, 2014;Tun, 2014;MRC, 2012).

Table 4

Comparisons of applications development platforms

Features	Android	iOS	Windows
Manufacturer	Google Inc.	Apple Inc.	Microsoft Corporation
Recent version of Mobile OS	4.4.2 Kit Kat	iOS 7.0.4	Window Phone 8.0 (Apollo)
Newly distributed date, recent version of mobile O.S.	Dec. 2013	Nov. 2013	Oct. 2013
License	Apache 2.0	Proprietary	Proprietary
Website	android.com	apple.com/ios	windowsphone.com
User Interface	Graphics user's interface	Cocoa Toutch (Multi-touch, GUI)	Live style user's interface
Programming language	Java	Objective-C	C#, VBnet
Development tools	Android SDK	Xcode	Visual Studio
Packaging format	.apk	.app	.xap
Platform	ARM, MIPSx86	ARM	ARM v7, Snapdragon QSD8X5D
Kernel	Linux	Hybrid (Darwin)	Hybrid (NT Kernel)

Advantages and disadvantages of each option

Table 5 provides a comparative analysis of the MAD platforms, consisting of the advantages, disadvantages, and limitations of each (Lambard, 2013; Gondhali, 2014; Mudge, 2012; Salesforce, 2015; Clarice Technologies, 2012).

Table 5

Advantages and disadvantages of mobile application development

	NAD	WAD	HAD
Some Advantages	-convenient store distribution -advanced graphics -fast performance	-cross platform -standard Web language -flexible freedom -fast updates -reasonable development cost -simple maintenance	-distributed in every app store -full device integration -reasonable development cost
Some Disadvantages	-specific programming language (Java or Objective-C) -expensive -long development time -high maintenance	-moderate graphics -moderate device integration -low performance	-requires familiarity with a framework -moderate graphics -slow performance

Comparison of attributes of mobile application platforms

This subsection deals with tsoftware quality indicated in ISO 9126, an international standard for the evaluation of software quality produced by the International Standard Organization. In ISO 9126, software quality is classified into a structured set of characteristics and sub-characteristics. It is aimed to develop a common understanding among developers about objectives and goals of projects that affect delivery and perception of software. These are functionality, reliability, flexibility, accessibility, portability, efficiency, maintainability, usability, responsiveness, and so on. We refer to some of these attributes in line with the developer's requirements and quality characteristics specified in ISO 9126. Table 6 shows a comparison of attributes of various types by analyzing the features of the three mobile application platforms (Pastore, 2014; Lim et al., 2015; Marius, 2010; Pocatilu & Boja, 2009; Garofalakis et al., 2007; McHugh, 2013).

Table 6

Comparison of attributes of various types of mobile application platforms

Features	NAD	WAD	HAD
Development	Customized for each target	Write once, to able to run any mobile phone regardless of manufacturer or network	Combination
Performance	High	Low	Average
Cross platform (interoperation)	No	Yes	Yes
Internet access	Limited need	Continuous need	Efficient use of limited access to the Internet
Development cost/effort	Relatively high	Relatively low	Relatively low
Speed	Very fast	Fast	Speed as necessary
IDE	Xcode (iOS), eClipse (Android)		
Specific app development	Yes	No	Yes
Internet connection	Limited	Required	Required
Market place	App Store (iOS),	Not available	Partially update
	Google Play (Android)		Download
Local storage	Yes	HTML5 supported	Yes
GPS	Yes	Yes	Yes
Installation/update	Deployed/download	Through a URL	Installed through a line or URL
Search	Object-C (iOS). Java (Adroid)	On the Web only	On the handset/web
Collaboration	Yes	Yes	Discussion is easy
Distribution	Most app stroes required:	Necessary with link	Distributed through app stores or via link
	i.e. App store (iOS) required; Google Play (Android)		
Device access	Full	Partial	Full
App Store	Available	Not available	Available
Stand-alone or browser-based?	Stand-alone	Both	Stand-alone
Approval Process	Mandatory	None	Low overhead

Criteria for mobile application development in higher education

As indicated in the introductory section, more factors than only the technical advantages and disadvantages, differences, and characteristics considered above need to be taken into account when choosing a suitable approach to MAD (Microsoft, 2012).

Even if the choice of a mobile development strategy may, to a large extent, be based on the expertise of the developer and the needs of the relevant organization, criteria can be provided from a subjective point of view such that organizations and developers can make an informed MAD selection. However, such challenges are worth identifying for future research of MAD in the field of higher education, in particular, since this study effort is an initial step toward the development of a MAD strategy using a multi-criteria approach.

Figure 2 shows that there are three layers that need to be considered for MAD in higher education. The bottom layer consists of NAD, WAD, and HAD, the intermediate layer of certain criteria, and the top layer of the end users. A contender for adoption as a MAD platform for higher education should weigh the importance of the learners who appear in the upper layer.

The following sections focus on certain criteria that are useful in selecting a MAD approach based on parameters obtained from previous studies in the literature. Each criterion is described.

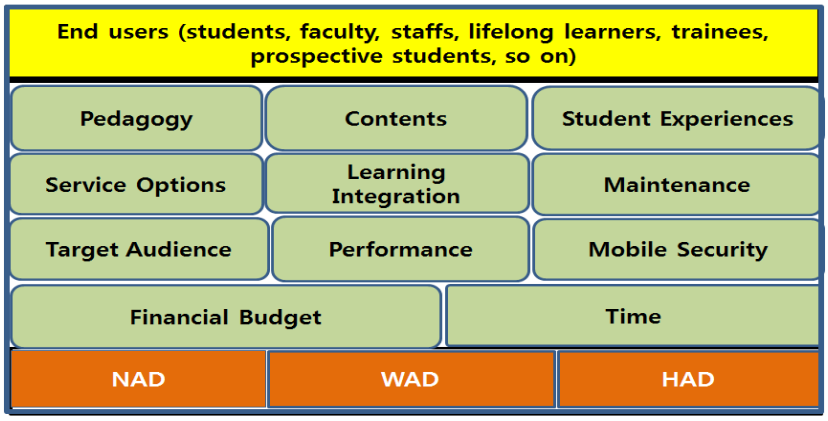


Figure 2. Criteria for MAD in higher education

Pedagogy first

As one of the major criteria for determining the choice of MAD in higher education, pedagogy should be considered first when assessing any educational strategy with technology as a supporting factor (Schofield, 2011). Regardless of the choice that they make, developers and educators should bear in mind that the goal of enhancing learning is at the core of choosing an approach. For instance, this goal should be referred to when evaluating and selecting an application for a study unit. The starting point in such an inquiry should always involve a reflection on the learning objectives and the most effective means of fulfilling them. If a known application is an option, these considerations should be referred to when considering how to incorporate it successfully into the study unit (Schofield, 2011).

Another consideration is pedagogical access rather than the mobile technology itself. The pace of the change in technology is currently very fast, and this makes the continued implementation of one technology for a long time difficult. Further, it takes a while to follow standards as a template. Pedagogy can better deal with the rapid changes in mobile technology (Schofield, 2011).

Consideration of content

Content is vital to learning and is at the hub of a mobile service intended for this purpose. Content is available to the learner in many formats, for example, text, images, video, voice, or data. Users interact with the content of an application, and the content design should hence be carefully considered in order to improve the students' experience. In addition, the planned service should be delivered through a continuous and suitable interface. Another relevant aspect is the format and distribution of content, as well as its accessibility for mobile device users. Content may be generated as well as consumed by learners. Therefore, developers can assist mobile learners by developing content better or making it more freely available in formats that are easily accessible on mobile devices. Developers must focus on better application development and use of content, and they should consider the options that can cross most seamlessly among learners beyond dialogue (Mobile Government, 2013; Schofield, 2011).

Student experience

The student (or user) experience refers to how he or she feels when interacting with an application in a specific context. It relates to utility, ease of use, and efficiency. Another factor that should be considered concerns the manner in which students will interact with the software. This may be a major aspect that determines whether a mobile application is appropriate. It is necessary to determine whether educators want the application in question to deliver a highly graphical, robust user experience, or whether it is primarily intended to deliver server-based information (Appcelerator, 2012). A more appropriate name for this approach may be "learner first," where the application is designed to enhance the user's experience, based on his or her environment, preferred type of application, work, lifestyle, and other factors (Appcelerator, 2012; Klein, 2012).

Service options

The learners' input is required in order to determine the service options, for example, the content level, theme, or depth, that they consider most suitable for them, so that their learning or performance is improved. It is also important to consider content and what material is available for transition to mobile devices. Educators and developers can assist students by making content more readily available in formats that are easily accessible from mobile devices. How can the quality of the instructional content be improved, enhanced, or degraded by its transference to a mobile-compatible format (Schofield, 2011)?

Further, given the variety of services, it can be difficult to determine those that are useful for learners and to understand the context in which they prove useful. Hence, if an educational institution plans to deliver a service, the choice of service must be carefully considered from the viewpoint of the students. For example, common service requirements of learners are well structured guides and plans provided through the assistance of educators or developers and secure data exchange with servers, over the Internet, and to and from devices (Upside Learning, 2011).

Learning integration

Through the use of mobile devices and applications, crucial learning activities and communication within a unit are conducted within a supported learning management system (LMS). In other words, learning requires smooth communication between two systems, mobile devices and LMS systems. Students' learning activities may be conducted in an integrated learning framework, that is, by using not a single system, but dual or complex systems. Mobile devices may allow greater engagement, enhance communication, and add significant value, but they should not replace necessary components of a unit at a site. If mobile applications are used in a unit, their purpose should be clearly noted in advance. Educators should also indicate, for instance, whether the application is cross-platform, i.e., available for use on both Android devices

and iPhones, the generation of mobile device on which the application can be downloaded, and whether students are required to pay for it (QUT, 2014).

Maintenance

Maintenance support for mobile devices and their usage is necessary for learning activities almost every day or at least very frequently. Learners need seamless connectivity and continuous support, providing ease and convenience of use. WAD or HAD applications are much simpler to manage than NAD applications, which are difficult to manage not only for learners, but also for developers, in particular when new versions are issued or bugs need to be fixed. WAD applications, such as Web pages, can be updated and edited to reflect changes in learning content as frequently as needed.

Considering the target audience

Educators (or developers) should know the unique requirements of the target audience. They should know what applications the students are more likely to use, their preferences, the latest trends among them, etc. Further information is helpful, for example, the time at which the students use the applications or access the Internet. Thus, it becomes possible to identify how, when, and where the learning experience can be enhanced by mobility. In-depth knowledge of these preferences can be used to promote student learning. A measurement that can reliably differentiate learners according to their preferences is thus needed (Mobile Government, 2013).

Performance considerations

Mobile performance is also a key criterion for rating mobile applications. In general, performance is evaluated according to two functions, rendering and loading, which determine the failure or success of the application. In spite of the considerable computational power of current smartphones, optimal performance is not guaranteed in terms of rendering and loading. Mobile devices can perform a number of functions, but they may not be appropriate for all learning needs or performance support (Appcelerator, 2012; Klein, 2012).

Mobile security

When providing mobile services to students, security should not be neglected. The privacy and security of important information shared and communicated during the use of the service should be considered when developing mobile services. Institutions should ensure the safe use of services and that the privacy of data (e.g., learning materials and analyzed data) is preserved by the students. They should subject the mobile services to various tests to ensure secure usage. They should also be aware of potential risks management and check the weak points of the mobile services to mitigate threats (Mobile Government, 2013)

Financial resources and time

In higher education, financial resources and time are important considerations. The challenge is to select a platform that can balance the requirements of the educational institution in terms of resources and time and those related to the organization's constraints. The most commonly considered factors in educational application development are related mainly to scheduling and development costs (IBM, 2012). Development costs, that is, initial capital expenditure, on-going cost of infrastructure and technical support, and cost of designing and implementing new concepts, can vary greatly depending on the chosen approach (Edgard, 2013). Usually, hybrid or Web is preferred for developing applications if the institution has limited resources for MAD (Edgard, 2013).

In summary, some criteria that are commonly used in business and enterprises are performance, maintenance, target audience, security, and development resources and time. However, certain criteria are unique to the higher education sector, such as pedagogy, content, student experience, service options, and learning integration.

Conclusions and further research

When developing mobile applications for higher education, educators are often uncertain regarding the platform to use. This paper helped clarify the considerations involved in determining the best MAD platform for higher education. We also proposed criteria for selecting such a platform.

The study in this short paper is the first step toward a larger research effort to better determine the development of mobile applications. When deciding how to approach optimization in higher education, educators (or developers) are faced with three options: NAD, WAD, and HAD. There is no "one-size-fits-all" mobile application approach. That is, while each approach has its own advantages, there is no approach that best suits all circumstances.

There is more to choosing an approach than simply considering its technical advantages and disadvantages. The choice of the appropriate approach depends not only on the needs and purposes of higher education, but also on a number of criteria, such as pedagogy, content, service options, learning integration, maintenance, target audience, performances, mobile security, resources and time. Thus, the results of this study provide insights into the design criteria for developing mobile applications for higher education.

Consequently, higher educational institutions should choose a flexible solution that can support all approaches to application developments, but that should support also secure and scalable integration of applications into the IT infrastructure of entire educational systems, and enable them to monitor and control their entire group of applications. Ideally, even if higher education has the resources to develop all types of applications, many colleges cannot always afford such a comprehensive option. The approach that educators (or developers) should adopt ultimately depends on the nature of the higher education for which they are intended and the purpose of the application.

In future research, we intend to include the aforementioned criteria in a survey for educators and developers in order to identify those that are important in the educational setting, so that they can be applied in the development of a suitable MAD strategy.

References

Agrawal, M., and Gill, G. (2013). "Mobile application development strategy at Vology1," *Journal of Information Technology Education: Discussion Cases, 2, Case Number 13*. Retrieved from http://www.jite.org/documents/DCVol02/DCv02TOC.pdf.

Appcelerator (2012). "Native vs. HTML5 — Mobile App Development – Which option is best?" Appcelerator white paper. Retrieved from http://appcelerator.com.

Andreou, A.S., Panayidou, D., Andreou, P., and Pitsillides, A. (2005). "Preserving quality in the development of mobile commerce services and applications," *ACIT Software Engineering*, Novosibirsk, Russia, pp. 11-16, June 2005.

Chun, I.K. (2014). *Android programming, easily explained as picture*. Revised edition, Sangreung Publisher, September 18, 2014.

Clarice Technologies (2012). "Native, Web, hybrid: Which is a better mobile app strategy?" Retrieved from http://issuu.com/claricetechnologies/docs/mobile_app_strategy.

Charland, A., and Leroux, B. (2011). "Mobile application development: Web vs. native," *Communications of the CACM*, vol. 54, 5.

Edgard, G. (2013). "A mobile application development strategy-finding model." Master's thesis, 2013. Retrieved from http://sixrevisions.com/mobile/native-app-vs-mobile-web-app-comparison/

Executive Education (2011). "Going mobile in executive education." Retrieved from http//uniconexed.org / 2011/research/ UNICON-Going_Mobile_In_Executive_Education-Schofield-Taylor-West-Nov-2011.pdf.

Fluttert, E. (2013). "Deciding between mobile implementation platforms – A multi-criteria decision system for implementation platforms for mobile applications." Deloitte, University of Twente. Master's thesis, June 2013.

Jang, Y.S, and Seong, N. H. (2014). *Step by Step Android Programming: Easy to Start Android ver.4.4 App Development* (written in Korean), Infinity Books Publishing Company, August 2014.

Klein, D. (2012). "How to decide: Mobile websites vs. mobile applications." Retrieved from http://www.adobe.com/inspire/2012/02/mobile-websites-vs-mobile-applications.html.

Garofalakis, J., Stefani, A., Stefanis, V., and Xenos, M. (2007). "Quality attributes of consumer-based commerce systems," *IEEE International Conference on E-Business and Telecommunication Networks,* pp. 130-136.

Gondhali, U.N. (2014). "An analysis of mobile application development approaches." April 2014, Happiest Mind Technologies. Retrieved from http://www.happiestminds.com/whitepapers/an-analysis-of-mobile-application-development-approaches.pdf

Hevner, A. R., March, S.T., Park, J., and Ram, S. (2004). "Design science in information systems research," *MIS Quarterly*, vol. 28, 1.

Holzer, A., and Ondrus, J. (2012). "Mobile app development: Native or Wed?" Retrieved from http://www. janondrus. com/wp-content/uploads/2008/05/WEB2012.pdf.

Huynh, M., and Ghimire, P. (2015). "Learning by doing: How to develop a cross-platform web app," *Journal of Information Technology Education: Innovations in Practice,* 14, pp. 145-169. Retrieved from http://www.jite.org/documents/Vol14/JITEv14IIPp145-169Huynh1842.pdf.

IBM (2012). Native, Web, or Hybrid – Mobile-app development. IBM Software Thought Leadership White Paper. Retrieved from ftp://public.dhe.ibm.com/software/pdf/mobile-enterprise/WSW14182USEN.pdf.

Katz, M., and Tiggzi (2012). "Native apps vs. mobile Web: Breaking down the mobile ecosystem." Retrieved from http://www. wired.com/insights/2012/11/native-applications-vs-mobile-web/.

Lim, S.L. Bentley, P.J. Bentley, Kanakam, N, Ishikawa, F., and Honiden, S. (2015). "Investigating country differences in mobile app user behavior and challenges for software engineering," *IEEE Transactions on Software Engineering*. vol. 41, no. 1, Jan 2015.

March, S.T., and Smith, G.F. (1995). "Design and natural science research on information technology," *Decision Support Systems*, vol. 15, pp. 251-266.

McHugh, A. (2013). "Fight for the future: HTML5 vs. native applications." July 3, 2013. Retrieved from http://blog.smartbear.com/mobile/fight-for-the-future-html5-vs-native-applications/.

Michelle K. (2012). "Developing mobile applications: Web, native, or hybrid?" Retrieved from https://blogs.oracle.com/fusionmiddleware/entry/developer_s_corner_developing_mobileWikipedia.Mobileoperatingsystems. http://en.wikipedia.org/wiki/Comparison_of_mobile_operating_systems#.

Microsoft (2012). "Choosing between a web and native experience." *Microsoft Patterns and Practices.* Retrieved from https://msdn.microsoft.com/en-us/library/jj149679(d=printer).aspx.

Marius, P. (2010). "Audit process during projects for development of New Mobile IT Application," *Informatica Economica*, 2010, vol. 14, issue 3, pp. 34-46.

Mobile Government (2013): Guidelines. Telecommunications Regulatory Authority (TRA), Abu Dhabi, United Arab Emirates (UAE). Retrieved from http://www.tra.gov.ae.

Mobility Practice Happiest Minds (2012). "Dealing with the dilemma: Mobile app development approach and decisions," March 2012.

Lambard, I.L. (2013). "Native mobile applications: The wrong choice for business? – Why businesses should think twice before building native mobile applications." A white paper from Michaels, Ross, & Cole, Ltd. (MRC). Retrieved from http://www.mrc-productivity.com/research/whitepapers/ NativeApplicationsWrongChoice.pdf.

Mudge, J.T. (2012). "Native app vs. mobile Web app: A quick comparison." Mulligan, C. Retrieved from http://sixrevisions.com/mobile/native-app-vs-mobile-web-app-comparison/.

Mulligan, C. (2013). "HTML5 as good as native applications when it comes to mobile development, survey says." SD Times, published November 20th, 2013. Retrieved from http://sdtimes.com/html5-as-good-as-native-applications-when-it-comes-to-mobile-development-survey-says/2/.

Pastore, S. (2014). "Developing mobile educational applications: development strategies, tools and business models," *Advances in Computer Science: an International Journal*. vol. 3, no.7, January.

Pocatilu, P., and Boja, C. (2009), "Quality Characteristics and Metrics Related to M-learning Process," *Amfiteatru Economic,* vol. 11, pp. 346-354.

QUT (2014). "Mobile applications in learning and teaching: Guidelines for use at QUT," Division of Technology, Information and Learning Support, September 2014.

Salesforce (2015). "Native, HTML5, or hybrid: Understanding your mobile application development options." Updated April 2015. Retrieved from https://developer.salesforce.com/page/Native,_HTML5,_or_Hybrid:_Understanding_Your_Mobile_Application_Development_Options.

Schofield, C. P., West, T., and Taylor, E. (2011). *Going mobile in executive education: How mobile technologies are changing the executive learning landscape*, ASHRIDGE & UNICON.

Sharples, M. (2014). "Big issues in mobile learning. Report of a workshop by the Kaleidoscope Network of excellence mobile learning initiative." Retrieved from https://en.wikipedia.org/wiki/Mike_Sharples.

Tun, P. M. (2014). "Choosing a mobile application development approach," *ASEAN Journal of Management and Innovation*. January –May, vol. 1, no. 1, pp. 69-74.

Upside Learning (2011). "Mobile Learning – A quick start guide. An upside learning eBook." Retrieved from http://www.upsidelearning.com.

Wikipedia. ISO 9126. Retrieved from https://en.wikipedia.org/wiki/ISO_9126.

Woodill, G. (2011). "Re: Mobile learning in Canada" [Web log post]. Retrieved from http://www.mobilelearningedge.com/2011/02/mobile-learning-in Canada.

About the author

Joongkak Kook, Ph.D is full professor in the Department of Computer Science and Engineering, College of Science and Technology, Sahmyook University, Seoul, Republic of Korea. Research interests: Mobile learning, Mobile application development, Object-oriented programming, Software Engineering. He earned his bachelor's degree from Kookmin Univeristy in Seoul, Korea, and received a master degree in Computer Information from McGill University, Montreal, Canada, and a Ph.D. in Computer Information from University of Oregon, Eugene, OR, U.S.A.

Email: jkkook@syu.ac.kr or cookyok@gmail.com

Return to Table of Contents