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Editorial

RTP – Retention, Tenure and Promotion

Donald G. Perrin

“Publish or Perish” is a big issue in academia depending on the university or institution of higher education to which you belong. When a position becomes available for which you are qualified, that is your first hurdle – you complete with a large number of qualified applicants. If you win the position, you must qualify for retention by distinguishing yourself for research (meaning publication), teaching, and public service. Some professors may not be retained even with exceptional performance in two of these areas. And if they are retained, there is no guarantee that they will achieve tenure or promotion in their lifetime.

The Community Colleges offer a different proposition. They teach college prep courses for students who want to go universities for upper division work, and they teach trade and professional courses for specific jobs. Tenure track positions are about 20% of the total which include administrative positions, so that even the best instructors are hired on a course by course basis. The lack of tenured positions is because the college cannot make a lifetime commitment because the college budget varies with the economy and its ability to provide relevant job training. It gives the college flexibility to change courses (and instructors) to fit the job market, and to hire teachers and trainers who perform these jobs on a day-to-day basis. On the flip side, there are great teachers who love to teach, but require concurrent jobs in several institutions to make a living.

The editors and reviewers for this Journal are aware how important publication in refereed journals is to success in retention, tenure, and promotion. Getting you published is our first priority. As an all-volunteer organization, we often fail to let you know your article is accepted, that you are published, or that publication is delayed. We are looking for a sponsor but do not want advertising in the Journal. This month we are under unusual pressure to publish ten articles of very high quality. This is why I am ending this editorial so for 17 authors and 50,000 readers so we can have this issue on the web within 24 hours.

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Editor's Note: This is a significant writing because it explores the impact of technology from a cultural point of view. By determining the role of western civilization and its technologies with tribal cultures and developing countries, it gives fresh insights to the role of technology in education across all cultures.

Neoliberalism, discourse, and educational technology in Oman

Michael K. Thomas and Salma Al-Humaidi
USA and Oman

Abstract

This paper reports on a study of the discourses surrounding educational technology implementation in the Sultanate of Oman. Using a modified critical grounded theory methodological approach and discourse analysis two researchers explored questions related to how educators and a government think, talk about, and implement policy related to the use of eLearning in this developing country. Findings indicate that because of how technology is viewed it is likely to have implementation problems as the rhetoric rubs against cultural proclivities and religious sensibilities of the people. Additionally, we posit that there is an alliance between neoliberalism and neofundamentalism in Oman and elsewhere and this is viewable in educational technology discourses.

Keywords: discourse, discourse analysis, educational technology, Oman, Neoliberalism

Introduction

The use of computers in education is almost universally called for. Throughout the world the use of technology in schools is lauded and trotted out as a trend that is not only desirable but essential. The enthusiasm for educational technologies is so strong that is it an almost irresistible discourse. To oppose educational technology is to oppose progress, modernity, and to invite a lack of preparedness for an imagined technology-rich future. Despite this rhetorical enthusiasm, there have been serious problems with the implementation of educational technologies in schools. Top-down approaches to their implementation have been problematic. Buckingham (2007) states,

> *"Technology is presented here as a source of innovation, of empowerment and liberation, and of authentic educational practice. Yet, in much less celebratory terms, it is also part of a broader move towards bureaucratization, regulation, and surveillance"* (p. 13).

Educational technologies are commonly oversold but underused (Cuban, 2001). McFrail (2007) comments that if teachers' pedagogical beliefs support a teacher-centered approach to pedagogy, they tend not to see technology as useful for communication or interaction. Further, Becker (2001) asserts that teachers' use of technology reflect their beliefs about teaching and learning. It is important, therefore that we explore the beliefs and attitudes that educators have about technology in schools.

Many researchers have attempted to find reasons for the slow uptake of technology for instruction in schools. Some have found that computers in schools continue to be used infrequently despite the encouragement from technology advocates and their uses have inclined more towards use for management than for instruction. In most places they still have failed to produce the reforms anticipated by educators and policy makers (Becker & Ravitz, 2001; Cuban, 1986; Saettler, 2004). Technology promoters and reorganizers have attributed this to the stalwart backwardness of teachers and the obstinacy and insularity of school culture for this ongoing resistance to educational computers in schools (Hodas, 1993). There has been an emphasis placed on the presence of computers or internet connectivity in schools rather than on how they are used and what they are used for and instructional purposes have taken a secondary role in schools. Many have found that what takes place is that technologies are brought in for the management of schools or for managing routines such as attendance, grading and other non-instructive purposes. Cuban (2001), for example, noted, “In classrooms of serious and occasional users, most students’ use of computers was peripheral to their primary instructional tasks” (p. 133). Even more disappointing he states, “In the schools we studied, we found no clear and substantial evidence of students increasing their academic achievement as a result of using information technologies” (p. 133). Too often, teachers and students are not consulted in the design of educational computing programs or systems. This is a serious problem in accptance of appropriate uses of technology in schools. Teachers must be collaborators in the design and implementation process rather than being seen as obstacles who need to be fixed, or overcome (Thomas, Barab, & Tuzun, 2009). The technologies must be thoroughly considered, discussed, and solidly grounded in the actual practice of schools, teacher training and the practice teaching. In other words, implementation must be grounded in the cultures in which they are implemented.

Currently there is a mismatch between the needs of the classroom, the needs of real teachers and the needs of administrators, policy makers, those involved in the *business* of education and the educators themselves. This mismatch may be even more glaring outside of western society. This is because there are questions related to the appropriateness of systems created in the so called “west” for “non-western” consumers. Technology is a phenomenon that is certainly not particularly western. However, many thinkers have wondered aloud as to whether globalization and the withering of the relevance of the nation state is a trend that inevitably comes with cultural homogenization and whether the technology we know is essentially a western phenomenon. Is there an alternative to the western model of modernity and technology implementation? Is technology essentially western (Dusek, 1998; Feenberg, 1995)? Dusek (1998) troubles the appropriateness of Western technology for developing nations. He states,

> *“In the nineteenth century and through most of the twentieth, the prevailing view was (and still is for many) that developing nations should imitate the technology and organization of developed nations and import Western technology to replace their own. More recently, examples of failures of implementing advanced Western technology in the environments of developing nations have suggested that less complex and difficult to service technology is needed. This technology is called “appropriate technology” or “intermediate technology”* (p. 157).

Others have criticized the implementation of technology as coming with a particular set of values that emphasize the modernistic notions of efficiency, predictability, the preference for the quantitative over the qualitative, and surrender to non-human agents (Ritzer, 1999). Adorno and Horkheimer (1993) believed that rationalization in Western thought has totally outstripped reason in the modern world and the resulting emphasis on these modernistic notions have left us with a functionalist view of the world that traps us in an amplifying loop of rationalization and dehumanization (Finlayson, 2005). Martin Heidegger (2013) notes that technology comes with a trend toward making the world a commodity. He states, “Things have been demeaned into objects or store matter for wealth making or what he (humanity) calls the ‘standing reserve’” (Heidegger, 1977, p. 33).

There is a particular need for this to be explored in the Muslim World where there is currently a great deal of discussion and consternation taking place regarding westernization and resistance to it. This accords with the problem of the extent to which technology implementation or adoption comes with globalization or westernization. To what extent do Muslim educators view educational technology implementation as eroding existing cultural values, proclivities, or norms? Sugimoto (2004) offered four Muslim reactions to Western modernity; traditionalist, modernist, reformist, and revivalist. However, the lack of any central authority in modern Islam allow

Muslims the flexibility of personalizing their attitudes and actions. It is therefore not possible to fully articulate a “Muslim” response to technology, westernization, globalization, or anything else. Muslim scholars have also presented various definitions of technology and its use (Daud & Zain, 1999; Ghamari-Tabrizi, 2000). Still, the adoption of technology in the Muslim world in the contemporary period has proceeded wholesale and, with the technology of schooling, has also become a discourse for the implementation of educational technologies in schools. In some cases, technology has been adapted to fit the needs of particular cultures in the Muslim world. In other situations, the technology has brought about unintended consequences (Ghamari-Tabrizi, 2000; Lee, 1999; Robinson, 1993; Yousif, 2001).

The problem

The central problem here is the question of technological determinism and the question as to whether technology is essentially western and if so, might it be adapted for appropriate local use. Educational technology is always complicated in implementation. As we have already noted, we have seen poor implementation of educational technology and we have also seen that the implementation of educational technology is chiefly an affair that is essentially cultural reflecting the beliefs, attitudes and common proclivities of those in the implementation context. However, it is not only cultural. It is political, economic and if we agree that it is cultural than we must consider that religion and religious attitudes play a central role as well. Educational technology is cultural and political and therefore is acted upon by the religious notions of those who design, develop and implement it. Its implementation we might even expect to be couched in religious terms. We might also find curious omissions from discourses about technology. Are there Muslim discourses regarding educational technology? How have Muslims looked at technology in general and technology in education in particular? Some scholars have asked if there is something essentially wrong with Muslims? Lewis (2002) claims that Islam held back Muslims in the period of rapid western development. In making this argument Feenberg (1999) points out, “After all, neither Russian nor Chinese communism, neither Islamic fundamentalism nor so-called “Asian values” have inspired a fundamentally distinctive stock of devices” (p. 189). Is technology inherently opposed to Islamic values? In exploring this we have to be clear as to what we mean by technology and what we mean by Islam. We must consider that these are not static entities and they continually develop and they do not develop in isolation of the other. Our purpose then must be to see how these changes are occurring by looking at how people think about them. A longer view would be to see how this changes over time.

This paper explores educational technology in the Sultanate of Oman, a nation currently engaged in a number of broad scale educational technology implementation projects. We looked at this through the prism of government discourse on educational technology and tried to see how these ideas are spoken to by the government as it seeks to advance the agenda of imbuing education with a 21st century feel. We wanted to see what this means for broad based efforts on the implementation of educational technology in the context of developing Muslim nations.

Oman

Oman is an Arabian peninsular nation located in the south eastern corner of that arid region. It is a Sultanate established in 1951. Since that time it has been ruled by the Qaboos family. Its location jutting out into the Arabian Sea places it just outside the strategically important Strait of Hormuz and into the Indian Ocean. For centuries, it has been an important port of call for seafaring traders who trade between Persia, India, and East Africa. It was at one time, ruled from Zanzibar in Tanzania. It retains a slightly more African character than its Arab neighbors. Today, the Sultanate of Oman is an important member of the GCC6 along with Saudi Arabia, UAE, Kuwait, Qatar, and Bahrain who form a conglomerate of Arab Gulf States with common interests and concerns and cultural proclivities. Of particular importance is the role that petroleum plays in these countries. Oman became a GCC 6 member in 1981. Sometimes called one crop economies, such countries are heavily dependent on the oil trade to maintain development. Oman is an absolute monarchy. Sultan Qaboos deposed his father in a bloodless coup in 1970. Culturally, Oman is somewhat different from its neighbors. While it is an Arabic speaking nation, it is predominantly neither sunni nor shia. More than half of Omanis are follow the Ibadi school of Islamic thought that has roots in the movement of the Khuwarij, a rebellious and puritanical form of early Islam.

In terms of size, Oman is slightly larger than Italy in area. The population is approximately 3.1 million. This includes more than half a million expatriates. It has a 2.06% growth rate. Oman is a nation long supported by trade in the Indian Ocean. In the latter part of the 1700s, the Sultan then reigning from Muscat signed a treaty with the British. Although Oman became increasingly friendly with Great Britain and greatly benefitted from this friendship in a number of ways, Oman never became a colony. This history of independence is unique in the region and colors the character of the country. Omanis have a sense of self-confidence that works with their independence. At the same time, the geographic location has made it a relatively tolerant and cosmopolitan society. In 2011, Sultan Qaboos promised greater political freedoms after Arab Spring demonstrations chiefly by students in the capital. In 2012, he introduced a job creation plan to stem the increasing problem of unemployment among youth. The nation held its first municipal council elections in late 2012. There is a mix of Anglo-Saxon law and Islamic law in the country. Oman has the highest rate of military expenditure to GDP. There was a period of rebellion and continual struggle in the 20th century until 1970 when Sultan Qaboos successfully deposed his father and ushered in an ambitious and largely successful modernization campaign.

Equity and access was cited as a major concern with respect to higher education in a study published in 2002. This study also listed eight recommendations that were “market oriented” reflecting a turn to neoliberal “entrepreneurial” activities to support higher education (Al-Lamki, 2002).

Why Oman?

Why is it that the discourse that appears in documents related to educational technologies in Oman particularly warrant exploration? We believe that certain aspects the country and the efforts of the small Gulf nation make it a compelling case study. There are many ways that make Oman similar to other Arab nations in the region. However, there are many important differences that make it an important and unique case. Firstly, Oman has been far ahead of others in promoting the education of girls and women. Secondly, Oman is an excellent example for smaller countries in Africa. The economy is more modest in terms of petroleum wealth and the society is more open to accommodation of difference. Oman has had dramatic increases in educational access. In 2002, 65% of Sultan Qaboos University students were women. Literacy rates have skyrocketed in the past generation. In 1980, the literacy rate in Oman was 52% for men and 16% for women. By 1995, this had climbed to 75% and 51% respectively (Rugh, 2002). By 2003, this has climbed again to 86.8% and 73.5%. Educational expenditure is 3.9% of GDP as of 2006 (CIA World Fact Book).

We should be wary of ahistorical “presentisms” that are tempting when looking at developing nations such as Oman. We do not mean to exoticize Oman, the Muslim world, or the nonwestern. We are aware of Edward Said’s Orientalism (Said, 1978), however we cannot shrink from making critical observations and we do not wish to set up an argument between the rational west and the irrational (or at least non-rational) east (Dusek, 2006, p. 156). In Oman we see certain trends that make it a better test case than other nations in the Muslim World. It is Arabic speaking but it is not plagued by issues of overpopulation like Egypt. It has political movements but they are not as sharp as those in Iran. It is an oil rich nation but it is not the economic powerhouse that Saudi Arabia or Kuwait are. It is economically vibrant but not as much so as UAE. The role of women is more pronounced than the strictly segregated large neighbor, Saudi Arabia where women are still, at the time of this writing, forbidden to drive cars. Additionally, we see some important commitments to education in Oman that are worth of attention and some particular programs that are surprisingly absent in the neighbors. In Oman we are not burdened by many of the trends that make the study of education technology so difficult. There is relative openness in Oman but it is still the complex intersection of issues that we see throughout the Muslim world where a remaking of identity of Muslims has been a serious concern.

> *Post-Basic Education strives to prepare students who value the Islamic culture and are firmly grounded in the Omani identity. In addition it aims to equip them with positive work attitudes, analytical and critical thinking skills, and positive attitudes toward the environment, awareness of global trends, bilingualism, and pride in the Arabic language* (Sultanate of Oman and Malaysia, 2008, p. 21).

There was some unrest in the nation during the so called Arab spring with limited student protests. There is a very strong affinity for globalization in Oman. There is none of the xenophobia that is so active in Saudi Arabia especially in its interior and instead there is a well-developed Indian Ocean cosmopolitanism (Jones & Ridout, 2013). Oman is a nation that has an interesting dichotomy woven into the fabric of its very being. On the one hand it is cosmopolitan, an Indian Ocean nation with branches in east Africa and the Makran coast of Pakistan only recently sold to the British in the 1950's. At the same time it is an insular and isolationist society. It is tribal in the interior. A system of Imamate or (Imam leadership) has existed since the 8th century and is firmly ensconced in Ibadi Islam. Like other Muslim nations, with the cold war ending in 1989, Oman had to change strategies It enjoys warm relations with Iran and other neighbors as well as the United States, Britain, and other western nations.

In 2005 Sultan Qaboos Bin Said is reported to have stated,

> *"Technological progress…is the future and without it there is nothing. Some of us may become the illiterates of the near future because we do not know the language of the computer… we shall do everything we can to ensure that these programs expand and take their rightful place, because one wants technology. One wants modernization…"* (Sultanate of Oman Ministry of Education, 2005. p. 3).

What we see here are important processes taking place. There is a full commitment to technology and modernization and to globalization.

Research questions

We set out to explore discourses of educational technology in Oman. In demonstrating how discourse analysis may be used, Gee (2011) offers guiding questions for looking at discourses as pieces of language. How is this piece of language being used to make certain things significant or not and in what ways? What activity or activities is this piece of language used to enact? What identity or identities is this piece of language being used to enact? What sort of relationship or relationships is this piece of language seeking to enact with others? What perspective on social goods is this piece of language communicating? (normal, good, correct, etc.) How does this piece of language privilege or dis-privilege specific sign systems? Using these questions and the constructs of neofundamentalism and neoliberalism, we used the Sultanate of Oman as a bounded case (Stake, 1995) asking the following question:

1. In what ways is the government of Oman doing identity work or citizenship building on Omanis in the future by way of Omani schools in the present?

2. What transnational trends are evidenced in this work?
3. In what ways do we find covariance or resonance between trends in Muslim Omani identity work in the context of globalization?

Data and data analysis

To explore these questions we set out to conduct a discourse analysis of a series of publications created by the Omani government. These included (1) Education for All in the Sultanate of Oman: A Report on Oman's Commitment and Achievements Toward the EFA Goals; (2) ICT and Education in the Sultanate of Oman; (3) Post-Basic Education Programme Grades 11 and 12; and (4) Educational Development in Malaysia and Oman: Two Success Stories.

Discourse analysis

We used the discourse questions of Gee (2005). These are the questions:

1. How is this piece of language being used to make certain things significant or not and in what ways?
2. What activity or activities is this piece of language being used to enact (i.e., get others to recognize as going on)?
3. What identity or identities is this piece of language being used to enact (i.e., get others to recognize as operative?
4. What sort of relationship or relationships is this piece of language seeking to enact with others (present or not)?
5. What perspective on social goods is this piece of language communicating (i.e., what is being communicated as to what is taken to be "normal," "right<" "good," "correct," "proper," "appropriate," "valuable," "the way things are," "the way things ought to be," "high status or low status," "like me or not like me," and so forth)?
6. How does this piece of language connect or disconnect things; how does it make one thing relevant or irrelevant to another?
7. How does this piece of langue privilege or disprivilege specific sign systems (e.g., Spanish vs. English, technical language vs. everyday language, words vs. images, words vs. equations) or different ways of knowing and believing or claims to knowledge and belief? (Gee, 2005, pp. 11-13).

We coded the material using both preexisting and emergent codes. Emergent codes or open codes are those that occur to the analyst *in situ* at the moment of analysis. Open coding "is coding the data in every way possible" (Glaser, 1978, p. 56). We also used memoing and theoretical coding to further interrogate the discourses at work in these documents (Glaser & Strauss, 1967; Glaser, 1978; Miles, Huberman, & Saldaña, 2014; Maxwell, 2013; Charmaz, 2000; Charmaz, 2006). The methodological effort involved answering the Gee questions whenever possible while simultaneously attending to the research questions. Coding is part of this effort as coding serves as a way to interrogate the narrative while providing a tangible vehicle for abstraction. Saldaña offers a schema for first, second and third cycle coding methods. These are complemented by his expressions in the third edition of *Qualitative Data Analysis: A Methods Sourcebook,* (Miles, Huberman, & Saldaña, 2014) that points us toward other methods of qualitative data analysis.

Findings – answers to the research questions

In short, our analysis suggests that neoliberalism and neofundamentalism are co-occurring and are acting upon the ways the Omani government is doing identity work through educational technologies in schools.

Neoliberalism

Neoliberalism is a process whereby governments move away from managing market forces and instead work to make conditions favorable to international trade and business. Torres (2009) states that, "Neoliberal governments promote notions of open markets, free trade, the reduction of the public sector, the decrease of state intervention in the economy, and the deregulation of markets" (Torres, 2009, p. 1). Harvey (2005) provides the following definition of the term:

> *Neoliberalism is in the first instance a theory of political economic practices that proposes that human well-being can best be advanced by liberating entrepreneurial freedoms and skills within an institutional framework characterized by strong private property rights, free markets, and free trade. The role of the state is to create and preserve an institutional framework appropriate to such practices* (p. 2).

Globalization may be seen as being strongly supported by neoliberal trends. The current vision of neoliberalism that dominates is not a laissez-faire approach to governing on the part of nation states but rather is one that seeks to maintain a global super structure that is friendly to the notion of stability for the purpose of protecting the free flow of wealth (Carroll & Carson, 2006, P. 54).

McLaren (2007) writes,

> *Neoliberal globalization is unifying the world into a single mode of production and bringing about the organic integration of different countries and regions into a single global economy through the logic of capital accumulation on a world scale* (p. 263).

Apple (2004) writes,

> *Neoliberals are critical of existing definitions of important knowledge, especially that knowledge that has no connection to what are seen as economic goals and needs. They want creative and enterprising (but still obedient) workers* (p. 190).

When applied to education, neoliberalism may be observed as a trend toward the privatization of education, and a strong emphasis on notions of efficiency, cost-effectiveness and assessment. The neoliberal goal is to make schools a potential source of corporate profits. There is also a utilitarian view of education from the neoliberal perspective. This means that education should prepare students for a place in the existing economic structures of the world. Technology implementation in schools and elsewhere is inherently connected to culture, social structures, and economic infrastructures. It is not neutral and has embedded in it values and agendas that are themselves not neutral and may be, in fact, hostile to many existing cultures and cultural elements and people. We must ask, "Are computers in schools good for all students or just a few and who are the winners and losers in this process and why is this the case? In non-Western contexts we might also ask if educational technology is an instrument of empire.

Neofundamentalism

Another important global trend that is particularly relevant for the Muslim world is neofundamentalism. This term, coined by Oliver Roy (2004) in his discussion of globalized Islam refers to a form of contemporary Islam in which there is an emphasis on text rather than tradition, a contempt for culture in its role on jurisprudence, a global focus, an aversion to interpretation in favor of the literal and an affinity for individual accountability in religion rather than on community. The global Islamic movement today is more neofundamentalist than it is traditional. Bin Laden himself states, "This battle is not between al-Qaeda and the U.S. This is a battle of Muslims against the global crusaders (Ibrahim, 2007, p. 262). Neofundamentalism is contemptuous of the nation state except as seen as a vehicle for the establishment of the Islamic state which is a stated goal of many neofundmentalist movements including the Ikhwan in Egypt, the National Islamic Front in Sudan, Jamaat Islami in Pakistan, PAS in Malaysia. There are *sufi* and *shia* global neofundamentalist movements but generally speaking we are talking about a movement in *sunni* Islam. In Iran, the revolution was forwarded by the clerical hierarchy that is notably absent in sunni Islam. While there are such movement in the Arabian Peninsula, these are generally excluded from any role in government as all of the GCC6 nations are autocratic nations ruled dynastically. Neofundamentalism is postcolonial and rides on the anger of the disaffected. However, it is a mistake to think that this is class struggle. The religious nature of neofundamentalists means that we would expect to see strong neofundamentalist manifestations among the wealthy as well as the disaffected and the middle class. This is indeed what we have seen in Saudi Arabia and with Al-Qaeda.

The relationship between Neoliberalism and Neofundamentalism

There are several ways in which neofundamentalism and noliberalism are related and this collusion appeared in relation to research question 3:

1. Both neofundamentalism and neoliberalism are transnational movements that seek the withering of nation state control.
2. Both neofundamentalism and neoliberalism emphasize the role of the individual over the role of community or *ummah*.
3. Both share a contempt for the left and anything that smacks of collective ownership, communism, or even socialism and emphasize property rights.
4. Both are highly suspicious of collective labor movements.
5. Both accept the presence of elite concentrations of wealth.
6. Both are contemptuous of taxation (and therefore one the central functions of a *legitimate* state).
7. Both accept an instrumentalist view of technology and embrace technology as a means to spread itself.
8. Both oppose popular or populist movements.
9. Both embrace legitimate violence to achieve their objectives.
10. Both consider culture and tradition as unimportant and replaceable.
11. Both are anti-intellectual movements.
12. Both are directly supported by an alliance between the United States and the Gulf States.

It is clear that these twin trends of neoliberalism and neofundamentalism should be used in the analysis of education in the Muslim world. By using these notions as a theoretical framework, we may foreground these notions in an analysis of educational technology in nations in the Muslim world. Technology, or more specifically the use of computers in schools, is not a neutral prospect. It comes to life animated by a particular set of values and propositions and “common sense” notions that themselves must be subject to question and critique.

Discussion

We propose the following: (1) Technology must be viewed not as neutral but as coming with agendas, goals, that themselves have winners and losers. (2) Technology in a modern era is modernistic meaning that it is ensconced in an emphasis on predictability, efficiency, an emphasis on the quantitative above the qualitative, and a surrender to non-human control in this pursuit. (3) Modernism has given rise to a particular form of globalization that in which neoliberalism is ascendant. (4) Neofundamentalism in the Muslim world is part of modernization and globalization and, in turn, neoliberalism. (5) The technology of education is modern, and neoliberal (6) educational technology is a prime example of an area that is particularly besmirched by neoliberalism, neofundamentalism, and modernism, and is therefore incompatible with Omani civilization. However, (7) this is amenable by taking on Indian cosmopolitanism as opposed to modern globalization and taking on Omani diplomacy that balances isolationism and modernistic globalization. Bauman (1998) writes,

> *Neo-tribal and fundamentalist tendencies, which reflect and articulate the experience of people on the receiving end of globalization, are as much legitimate offspring of globalization as the widely acclaimed 'hybridization' of top culture – the culture at the globalized top* (p. 3).

We see the following trends in writings by the Omani government with respect to educational technology:

- Education is tied to technology
- Technology is tied to globalization
- Globalization is tied to progress
- Progress is tied to "keeping up" or "not being left behind"
- Competition is tied to all of the above

Fear of leftbehindedness is one of the primary drivers of educational technology. ICT in education is always driven by fear of being left behind or being left out. It is almost impossible to argue *against* the use of technology in education or in any other sector if it is framed as preventing leftbehinedness. This is particularly strong in education where children are the main focus. Education is always a forward looking enterprise. Children are the vehicle for perpetuating the species.

Discussion

What do these processes mean for how we think about and what we should do to support the use of ICT in Education in the Oman and in the Muslim world more generally? Clearly there needs to be better aligned processes for dealing with this. Writings about education tend to take a finger wagging tone. They are directed at an audience of fearful adults.

Educational Technologies focus on (a) learning and then (b) the management of education. What we have seen in many countries is that there is a great emphasis on management and technology serves the purpose of governing and policing policies. However, with respect to actual instruction, there is very little. Oman is a young state with a young population and with a very young educational infrastructure.

> "…technology is not neutral but like any artifact embodies the cultural values of the society in which it was first created. Technology transfer is therefore more than an economic exchange; it is also a process of cultural diffusion in which machines serve as vectors for the spread of values of the more advanced societies to the less advanced" (Feenberg, 1991, p. 131).

An authoritarian culture of work comes with western technology. We have found the same with the case of Oman.

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About the authors

Michael K. Thomas, Ph.D. is an assistant professor in the Department of Educational Psychology, College of Education, The University of Illinois at Chicago, Chicago, IL
email: micthom@uic.edu

Salma Al-Humaidi is from the Sultan Qaboos University, Oman.

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Editor's Note: When we first experimented with computer programming, we hard-coded instructions so they would only work in the manner we originally intended. This was very limiting because the program would have to be rewritten if we changed the parameters or the data. Then we adopted variables so that we could process any data set provided by the user, leading to powerful and flexible systems like Google and Amazon. Just as educators become comfortable with the internet and learning management systems, a new technology called cloud computing promises to raise our options for teaching and learning to a higher level. It provides an opportunity for digital natives to go where no teacher has gone before…

The article that follows provides a bridge for educators to learn of future opportunities now available to them.

Review of agent based e-learning management system

Avinash Appasha Chormale and Sunanda Arun More

India

Abstract

Internet technology has changed the way in which applications are developed and accessed. They are aimed at running applications as services over the Internet on a scalable infrastructure. Many applications such as word processing, spreadsheets, presentations, databases and more can all be accessed from a web browser, while the software and files are housed in the cloud. Educational institutions can take advantage of cloud applications to provide students and teachers with free or low-cost alternatives to expensive, proprietary productivity tools. Browser-based applications are also accessible with a variety of computer and even mobile platforms, making these tools available anywhere the Internet can be accessed. This paper presents a cloud computing based solution for building a virtual and personal learning environment which combines a wide range of technology, and tools to create an interactive tool for science education. The proposed environment is intended for designing and monitoring of educational content as well as creating a platform for exploring ideas. The system allows exchange of educational content and integrates different pedagogical approaches to learning and teaching in the same environment.

Keywords: personal learning atmosphere, virtual learning atmosphere, cloud computing e learning, gadgets.

Introduction

Recent advances in computing, multimedia, and communication technology provide an opportunity to build a self-growing, unit sharing virtual environment for teaching and learning. At present, it is common to access content across the Internet independently without reference to the underlying hosting infrastructure. This infrastructure consists of data centers that are monitored and maintained around the clock by content providers. Cloud computing is an extension of this paradigm where the capabilities of applications are exposed as services. These services enable the development of scalable web application in which dynamically scalable and often virtualized resources are provided as a service over the Internet [7,24]. Providers such as Amazon, Google, IBM, Microsoft, and Sun Microsystems have begun to establish new data centers for hosting Cloud computing applications in various locations around the world to provide redundancy and ensure reliability in case of site failures. Since user requirements for cloud services are varied, service providers have to ensure that they can be flexible in their service delivery while keeping the users isolated from the underlying infrastructure.

Cloud computing technologies enable institutions that do not have the technical expertise to support their own infrastructure to get access to computing on demand. Cloud computing makes it possible for almost anyone to deploy tools that can scale on demand to serve as many users as desired. Service providers enjoy greatly simplified software installation and maintenance and centralized control over versioning; consumers can access the service anytime, anywhere, share data and collaborate more easily, and keep their data stored safely in the infrastructure. To the end user, the cloud is invisible; the technology that supports the applications doesn't matter. For many institutions, cloud computing offers a cost-effective solution to the problem of how to provide services, data storage, and computing power to a growing number of Internet users without investing capital in physical machines that need to be maintained and upgraded on-site.

Educational institutions are beginning to take advantage of existing applications hosted on a cloud that enable end users to perform tasks that have usually required site licensing, installation, and maintenance of individual software packages [20, 21]. Many applications such as word processing, spreadsheets, presentations, databases and more can all be done inside a web browser, while the software and files are housed in the cloud. In addition to productivity applications, services like YouTube, Google Docs and Spreadsheets, as well as a host of other browser-based applications, comprise a set of increasingly powerful cloud-based tools for almost any task a user might need to do especially in E-learning applications. Furthermore, it is very easy to share content created with these tools, both in terms of collaborating on its creation and distributing the completed work. Applications like virtual office, spreadsheets, databases, and social software can provide students and teachers with free or low-cost alternatives to expensive, proprietary productivity tools. Browser-based applications are accessible with a variety of computer and even mobile platforms, making these tools available anywhere the Internet can be accessed.

Virtual and personal learning atmosphere

Now scientist and educationist accepted that, 'Learning is a Multi-dimensional Activity.' Therefore Multimedia and network technologies are introduced and changed teaching and learning aspects in Education System. E-Learning provides better platform for individual and group learning across the space, time and place [1]. Virtual Learning Environments (VLEs) are electronic platforms that can be used to provide and track E-learning courses and enhance face-to-face instruction with online components. Primarily they automate the administration of learning by facilitating and then recording learner activity. VLEs have evolved quite differently for formal education and corporate training to meet different needs. The most common systems used in education are Blackboard [8] and Moodle [10]. VLEs are the dominant learning environments in higher education institutions. Known also as learning management systems (LMS) and course management systems (CMS), their main function is to simplify course management aimed for numerous learners. The content within VLE is developed by teachers, which are mainly experts of a special domain. VLEs provide an easy to use system for flexibly delivering learning materials, activities, and support to students across an institution. For the administrator, a VLE provides a set of tools which allows course content and students to be managed efficiently and provide a single point of integration with student record systems. For the tutor, a simple set of integrated tools allows the creation of learning content without specialist computer skills, at the same time as class administration tools facilitate communication between tutor and individual learners.

One major drawback of existing VLEs is that it is content-centric. Many instructors simply move all their teaching materials to the system. The materials are presented uniformly to all learners regardless of their background, learning styles and preferences [18]. Nowadays, we are seeing the trend in education that emphasis on learner-centric learning. A learner-centric learning places learner at its heart. Learners are expected to actively engage in the learning process to construct their own learning. Thus they have more responsibility for their learning. Instructors are still responsible for learners' learning, but they play the role of "facilitator" who guides the learning process instead of being the sole information provider. A learner-centric learning will give learners a deeper and richer learning experience, as there is greater participation and involvement in the learning [3].

In the last few years a new wave of web technologies such as blogs, wikis, and social software, known as Web 2.0, has become a major technology that supports content publishing over the Internet [1,26]. Web 2.0 allows people to create, publish, exchange, share, and cooperate on information in a new way of communication and collaboration. Applying Web 2.0 technologies to E-learning can enhance interactive communication and collaboration among participants and learners who either possess related learning resources, or can help to discover and obtain the resources, or are willing to exchange and share the resources with others in the Web- based learning. In Web 2.0, learners can read and write to the Web, in which learners become the consumers and producers of learning resources. Thus, Web 2.0 provides a learning environment have the potential to fundamentally change the nature of learning and teaching, through the creation of learner controlled learning web. This kind of environment is named Personal Learning Environment (PLE) [19].

Adoption of PLEs as the platform for E-learning is motivated by several reasons. The most important is that PLEs help learners control and manage their own learning. This includes providing support for learners to set their own learning goals, manage their content and communicate with others in the process of learning, and thereby achieve their learning. A PLE also permits learners to join into groups and provides a suitable environment to practice social skills. Furthermore, PLEs can provide support for lifelong learning that is mainly informal and occurs over the life of the learner. Nevertheless, it has not been proven yet if PLEs can enable the growth of reflective skills, and thus enable the growth of self-directed learner [18].

PLEs can be classified based on their architecture, client/server e.g. PLEX [5], or web-based with loosely joined or tightly joined web services, e.g. ELGG [9]. A second approach is based on their platform. For example, VLEs systems like Moodle and Blackboard have an architecture that supports a rich facility for extension points for PLEs' components [17,2]. Social software like Facebook includes a number of APIs that enable developer to produce a learning context as simple as building a Facebook entry for a class and then associating a number of Facebook applications with the context [6]. A more discerning classification approach of PLE's is based on their pedagogical approach. In the following, we will present three pedagogical approaches of PLEs.

Self-regulated pedagogical approach

This kind of PLEs represents a set of loosely joined services that are utilized by a learner, usually a skillful user of the Internet, to set and achieve his learning goals. Loosely joined services will ensure modular development of the system and make it so easy to build a PLE that is continuously evolvable to meet user needs. The PLE is very much learner controlled and suited to self-directed learning. For example, user can use Google Docs as web-based office where he can share documents with peer learners and for collaborative report writing. Also, learner can use YouTube to share educational videos, Google Calendar to set goals and timetable, etc. In fact, Google Apps for education resemble this kind of PLEs. Social software based PLEs, such as ELGG which is social software especially built for E-learning, provide self-directed pedagogy where user can be a member of a social network of common learning goals, get peer assistance and exchange information with other peers. Personalized home pages, like iGoogle or myYahoo, offers an environment where the user can glue up all components of his PLE in canvas view.

Self-regulated and teacher-led pedagogical approach

This pedagogical approach supports both formal and informal lifelong learning and strives to facilitate empowerment of both learners and teachers, while producing personalized learning experiences. The already in use VLEs that covers the social aspects of online learning is the most suitable platform for this PLE. Current VLE systems have architecture to flexibly expand these systems in order to add features where this social collaboration can take place within a learning context. The Moodle VLE is one example that is developing rapidly and contains the affordances necessary for this model of eLearning. However, a major shortcoming is these mechanisms for extension are proprietary and users cannot themselves extend these VLE systems.

Self-regulated, teacher-led, and personalized pedagogical approach

Besides the formal and informal learning support, this PLE provides personalized pedagogical assistant to the learner such as recommendation of material, common interest learners, and adaptive path personal learning. Systems that provide personalized pedagogical aids could improve the quality of instruction while reducing the demands of an instructional designer. This smart PLE able to learn the habits of an individual user, remember those habits, and make the user's experience less repetitive and fixed. The iClass project is an open learning system which aims to establish a framework that delivers a personalized, adaptable and adaptive learning experience in a collaborative environment for learners [12]. iClass includes a number of services and an adaptive intelligent system exploiting the potential of ICT to support a personalized, flexible, learner-centered approach, for facilitating personalized eLearning experiences.

Cloud-based personalized e-learning system

This section presents a web-based E-learning system that utilizes various social tools, smart agents, and interactive environments of Web 2.0 and available in cloud. The main components of the system are shown in Figure 1. The system has three major functionalities that are designed to support lifelong formal and informal learning. The first one is a web-based course management system (CMS), which is managed by the web server. The second is a PLE where various web-based services and applications are utilized with iGoogle as a portal to these applications. The third is the smart agents which consist of a personalized learning path generation system and test generation engine.

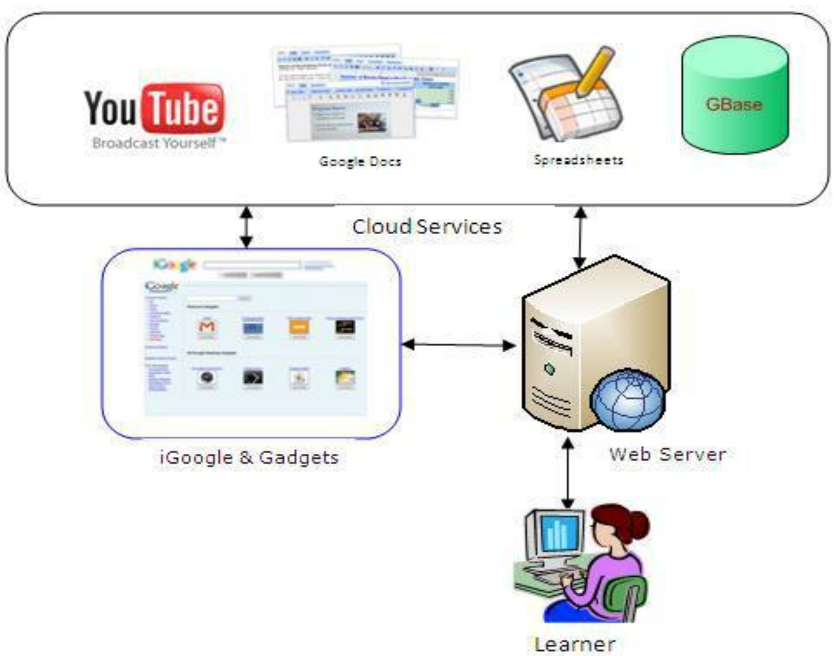

Figure 1. The main components of the system

The system has two models for personalization, assessment-based personalized learning and personalized space. Collaboration is achieved via Learning Service, which provide specific collaboration services for learners. Although the proposed system integrates personalization and collaboration in the learning environment, users have the option of switching off the personalization so the learning space can act as a collaborative environment. One major issue is the extra overhead required by instructors to set up the relationships between learning content upon addition of learning content into knowledge base. The underlying architecture of attaching assessment questions to each learning topic together with the relationships among learning content make it possible to easily and automatically generate quiz to assess learners' understanding of a particular learning topic.

The system functionality is implemented using C# and ASP.NET. Microsoft Language Integrated Query (LINQ) and the .NET client libraries, provided by Google, are used to interact and manipulate the data retrieved from the cloud services. In the following subsection, more details will be given for each component in the system.

The Web-Based CMS

The main objective of the CMS is to provide the formal learning for registered learners where they can access course materials provided and maintained by teachers. The course contents, which could be documents, presentations, or videos, are hosted in Google Docs and YouTube. Google Docs is a web-based word processing application that allows users to create, view and share documents, presentations, and spreadsheets over the Internet. Each document has a creator, who determines who is allowed to access the file, either as a viewer (with read-only rights) or a collaborator (who can change the file). Because Google stores all of the files and content centrally, collaboration and document management become far simpler than when distributing files to multiple people and keeping track of different versions.

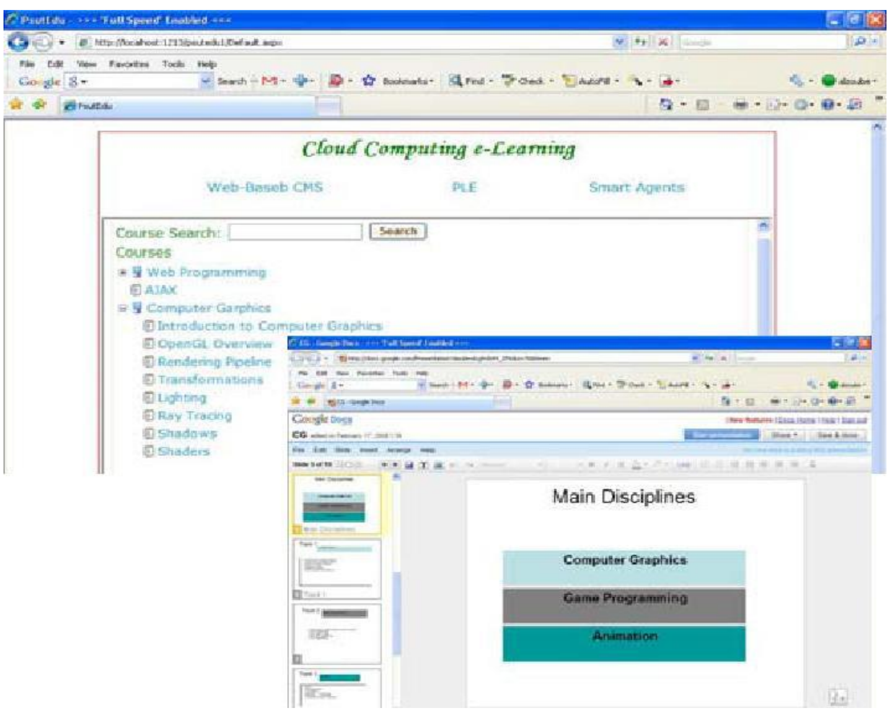

Figure 2. Web-based CMS UI and a sample presentation hosted in Google Docs.

On the other hand, if the lesson is a video then it can be hosted in YouTube web site. YouTube allows users to post videos, watch those posted by others, post comments in a threaded-discussion format, search for content by keyword or category, and create and participate in topical groups. It also offers an open access to key parts of the YouTube video repository and user community, via an open API interface and RSS feeds. YouTube is increasingly being used by educators as a pedagogic resource. Many educators believe that the act of creating content is a valuable learning exercise, helping develop a deeper understanding of the subject matter and the tools used to create that content.

The CMS maintains an XML file of the lessons URLs which are arranged according to each subject graph. A teacher can add a subject to the by adding an entry to the XML file with the corresponding lesson titles and URLs. The Docs API also enables full-text search over the documents, and hence, it is more convenient for students to search for specific information in the lessons. Figure 2 shows the CMS page with the available courses and lesson from Google presentation.

The PLE

The PLE can be implemented in different ways as described in section 2. In our system iGoogle and gadgets are exploited as platform for learner to use whatever available gadgets he likes or build his own to set and achieve his learning goals. For example, a learner can choose Google Docs gadgets to access his own documents, Instant Messenger to send and receive messages, To Do gadget to set learning goals, etc. Figure 3 shows an example after the learner has logged to his iGoogle page.

Figure 3. The PLE implemented with iGoogle and Gadgets

One of the interesting gadgets in the PLE is the Personal Learning Network (PLN). PLN is a collection of resources that can help learning. This includes family and friends, teachers, and people in the local community. It can also include non -human resources, such as books, journals and other forms of media. PLNs provide individuals with learning and access to leaders and experts around the world bringing together communities, resources and information impossible to access solely from within school walls. One way to build that collection of experts is via RSS Feeds, which allows you to subscribe to their content and have it delivered to you in your RSS Aggregator (e.g., Google Reader). Every time they produce new content, it automatically gets delivered to you, allowing learner to tap their knowledge. The reader gadget in Figure 4 shows an example of PLN.

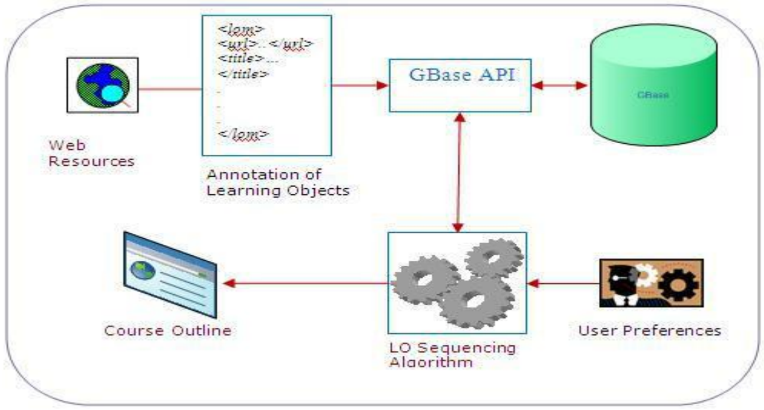

Figure 4. The personalized learning path generation process.

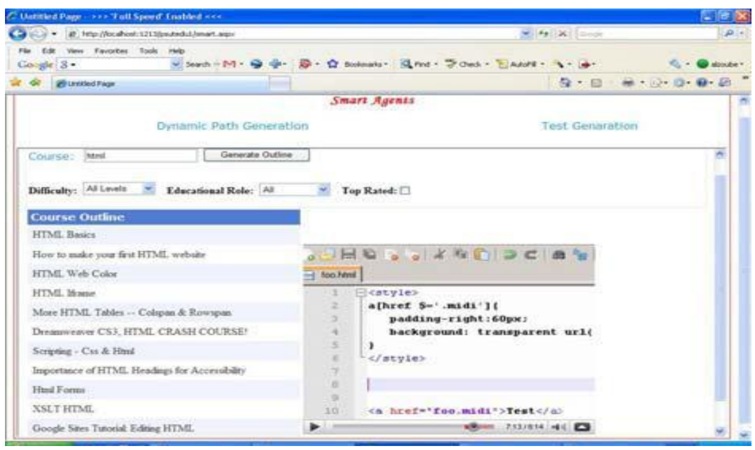

Figure 5. A sample of generated course.

The Smart Agents

The purpose of the smart agents is to uniquely address the specific learning needs of a learner based on his prior knowledge and context. The system includes two agents; the first one is the personalized learning path generation. This agent provides an interactive mechanism for building adaptive courses dynamically. Instead of artificial intelligence-based algorithm, learners were placed at the centre of the system and asked to define their own learning style, paths and profile. The courses materials are web resources found to be suitable as learning objects, and described with suitable metadata elements. The following metadata are adopted from the IEEE LOM [15]: URI, title, topic, difficulty, educational role, concept, and prerequisite concept. The metadata are stored in GBase which is a service where users can upload their structured data and use the GBase API to query those data. The algorithm allows the learner to choose the difficulty, type, or rate of the learning objects, and then query the GBase for learning objects of the specified topic. The retrieved list of learning objects are sorted according to their educational role while maintaining the concept and prerequisite concept relation them. Fig 4 depicts the process of generating personalized learning path, and Figure 5 shows an example of generated outline for HTML with YouTube lesson is presented.

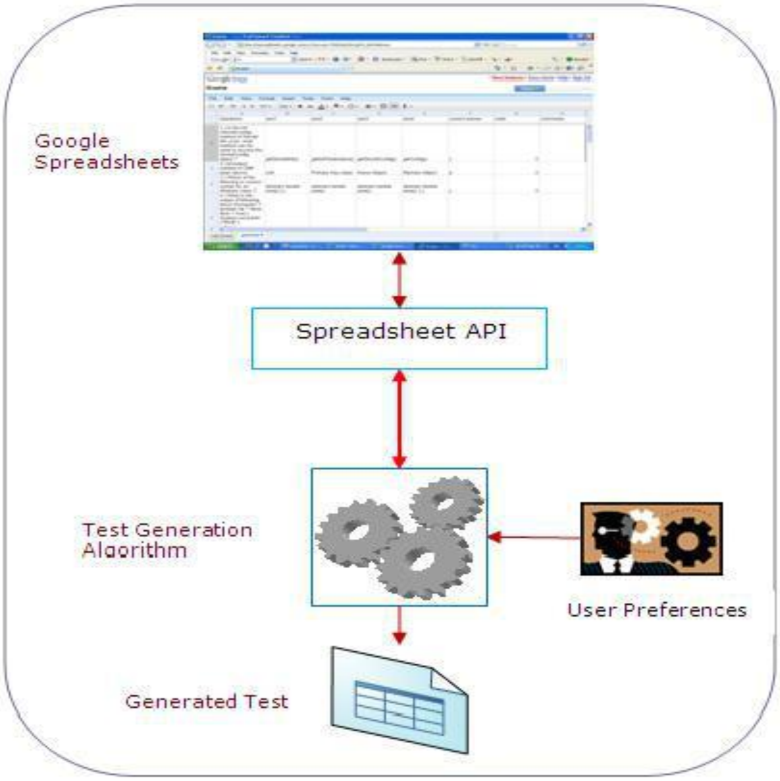

Figure 6. The test generation system

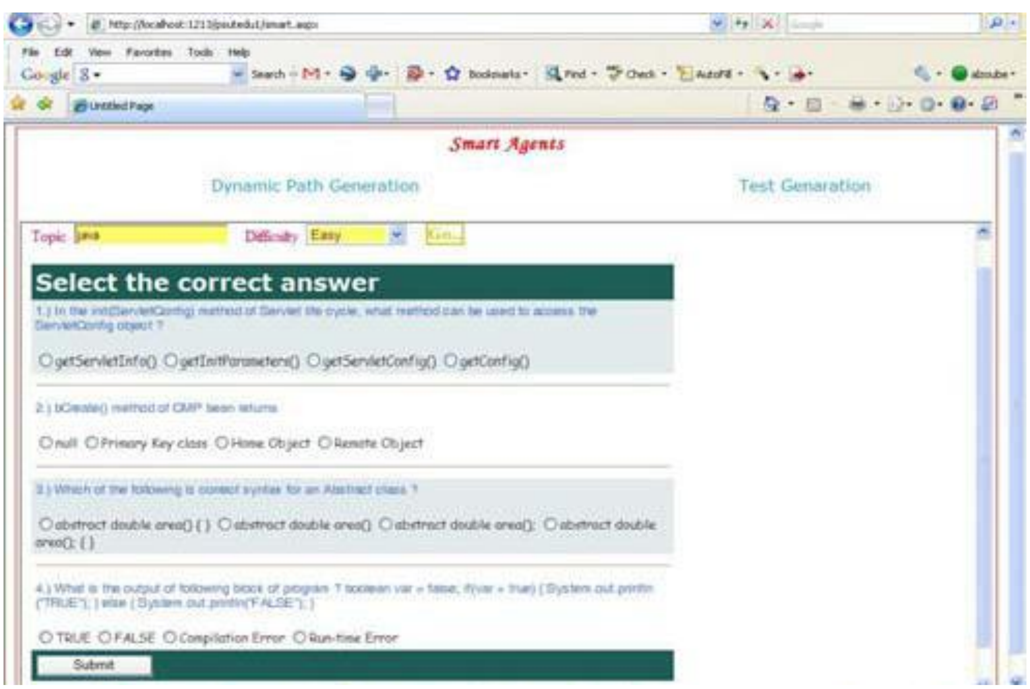

Figure 7. A sample of generated test.

The second software agent generates multiple choice tests. Google spreadsheets are used as a database for multiple choice questions, where each question record includes the following information about the question: a unique question identifier, the question text, the topic of the question, i.e. Ajax, HTML, the concept this question treats within the topic, and the difficulty level of the question. A test can be generated automatically by the application using the spreadsheet API. The learner selects the set of concepts to be covered by the test as well as the difficulty level. Figure 6 illustrates the test generation process, and Figure 7 shows an example of a generated test.

Related Work

There are a number of similar or related projects that use cloud-based applications in elearning. Casquero, *et al.* [4] presented a framework based on iGoogle and gadgets over Google Apps infrastructure for the development of a network of corporative PLE. They discussed the integration of institutional and external services in order to give support, in a personal way, to the daily activity of each faculty member, and to take advantage of the framework as a test-bed for the research, implementation and testing of social services for educational purposes.

Marenzi, *et al.* [16] investigated how social software can be used in formal learning or work environments, and how to develop and integrate models and tools into an open source infrastructure for the creation, storage and exchange of learning objects, suitable knowledge resources as well as learning experiences. They presented the "*LearnWeb 2.0*" infrastructure to support lifelong learning and enhance learning experience. This infrastructure brings together information stored on institutional servers, centralized repositories, locally on learner desktops and online community-sharing systems like Flickr and YouTube.

North Carolina State University offers an online virtual computing lab [14], for requesting and reserving a virtual computer, complete with any of a number of applications such as Matlab, Maple, SAS, and many others that can be remotely accessed from over the Internet.

Conclusion

In this paper we verified that cloud computing technologies can be exploited to build the next generation of platform-independent tools and scalable data storage E-learning systems to provide smart formal and informal learning. This set of technologies has clear potential to distribute applications across a wider set of devices and greatly reduce the overall cost of computing.

We built a virtual and personal learning environment which combines a wide range of services to create an interactive tool for education based on services available in the cloud. The proposed environment enables designing and monitoring of educational content as well as creating a platform for exploring ideas, and has a service oriented architecture that simplifies the management and increases the effective utilization of the underlying web resources. The system integrates different pedagogical approaches to learning and teaching under the same environment. Initial feedback from users who tested the system shows this approach provides a much better user experience than the traditional learning management systems as it provides the learners a well-known environment where they can easily achieve their learning goals, and flexible architecture enabling learners to mash up heterogeneous set of services that support different learning activities such as production, distribution, reflection, and discussion. In a future work, we plan to implement more services that are semantically aware of learners' context.

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About the authors

Avinash Appasha Chormale is a Research Fellow, School of Architecture Science and Technology, Yashwantrao Chavan Maharashtra Open University, Nashik, Maharashtra, India.

mr.avinash.ycmou@gmail.com

Sunanda Arun More is Associate Professor, School of Architecture Science and Technology, Yashwantrao Chavan Maharashtra Open University, Nashik, Maharashtra, India.

sunandarun@yahoo.com

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Editor's Note: This is a comprehensive, clearly written, and up to date analysis of the instructional design process. It integrates the contributions from many disciplines to show the importance of instructional design in twenty first century learning pedagogy.

The essentials of instructional design process in a digital age

A.O. Egbedokun, T.A. Oteyola, Akinlabi, P. Ayodele & M. Adeyemo
Nigeria

Abstract

The thrust of this paper is to examine some important issues relating to instructional design in the digital age. The paper does not intend to discuss the details of model of instructional but key issues such as instructional objectives specification, needs assessment, instructional strategies and media and also how learning takes place.

Keywords: Instructional design, strategies, media, delivery, prescription

Introduction

At the beginning of every school year, session and semester, teachers are mainly concerned about how to make sure every student in their class performs significantly better than what obtained in the previous session or semester. Teachers/lecturers strive to make sure that notes and media of instructional delivery are reviewed, especially with special focus on the recent trends. There are however fundamental issues that teachers do not pay keen attention to in the preparation of their instruction. Instructional preparation goes beyond note preparation. It is both a process and science. Brown and Green (2016) defined instructional design as a systematic development of instructional specifications using learning and instructional theory to ensure the quality of instruction. The authors further believe that instructional design is the science of creating detailed specifications for the development, implementation, evaluation, and maintenance of situations that facilitate the learning of both large and small units of subject matter at all levels of complexity. Brown and Green's description of instructional design is an attempt to point out to teachers that instructional delivery is like a surgical procedure that requires precision and accuracy in order to give room for improved performance.

Instructional design is a continuous process, undertaken not once but repeatedly. Thiagi (2008) describes instructional design as a process that never comes to an end, and that it is always a process of continuous improvement. Smith and Ragan (2005) defined the term instructional design as the systematic and reflective process of translating principles of learning and instruction into plans for instructional materials, activities, information resources, and evaluation. Reigeluth (1983) mentioned that the purpose of any design activity (activities as mentioned by Smith and Ragan) is to devise optimal means to achieve desired ends. The major job of the instructional designer is to create an event-instructional event- that will enable specific individuals to learn a skill in order to bring about change in behavior (Brown and Green, 2016). Event creation is a task that involves a lot of activities, some of which are summarized by Smith and Ragan (2005) as follows:

a. We must have a clear idea of what the learner should learn;
b. The best instruction is effective (learning takes place), efficient (least use of learners time) and appealing (motivating);
c. Students learn from many different modes;
d. Some principles of learning apply across age and content;

e. Evaluation should be done of instruction, as well as learner performance;

f. Evaluation of learners should be measured against objectives, not other people;

g. There should be congruence among objectives, activities, and assessment.

Designers' job is basically bringing these activities together using a particular instructional design model. There are a number of models (but this paper is not interested in highlighting these models) that a designer could use in guiding his job. Brown and Green (2016) opined that no matter which established model one refers to, there are generally three phases to the instructional design (ID) process:

1. examination of the situation (needs, task, and learner analysis);
2. creating instruction (planning, creating, and implementing the intervention); and
3. evaluating the effect of the instruction.

The submission of Smith and Ragan (2005); Brown and Green (2016) is that there are definitive prescribed procedures/processes that instructional designer must adhere to in order to achieve his aim.

The processes/procedures prescribed by any instructional design model identifies the essential roles that certain stages of the process plays. The roles of goals and objectives, needs assessment/analysis, instructional strategies and media and then evaluation are keys to successful delivery. This article is intended to examine the important roles these components of instructional design play in the instructional design process and the eventual implementation of instruction in the digital age.

Instructional goals and objectives specification

It is a well-known fact that if an individual is clear about what he wants to achieve, it would be easy to navigate through any challenging times and situations to achieve. This is to underscore the fact that learning outcome or performance could only be measured using the instructional goal or instructional objective meter. Goals in the parlance of instruction/training could be referred to as the milestones that an individual can achieve. It is a way of explaining the reasoning behind what you will teach in a session, a declaration about what the teacher will do. Goals are usually statements of educational intention. On the other hand, objectives are potential goals. Instructional objectives are statements that express the expected learning outcomes of the learners at the end of instruction. Morrison (2004) described an instructional objective as a statement that specifies, in behavioural (measurable) terms what a learner will be able to do as a result of instruction. It describes the intended outcome of an instruction rather than a description or summary of the content. It is but one of several steps that should be followed when developing instruction. Instructional objectives provide both you and your students with 'section direction'. Morrison further asserted that instructional objective must be learner-centred, not teacher-centred, outcomes-driven, not process-driven, objective measures, not subjective measures, specific behaviours, not vague behaviours. A well-written instructional objective should therefore meet the following criteria: (1) describe a learning outcome, (2) be student oriented, (3) be observable (or describe an observable product). Let it be mentioned clearly here that a successful instructional design process must identify the specific instructional goals and objectives to be achieved at the end of the instructional event.

In the specification of instructional objectives, the 'ultimate' goal must be thoroughly interrogated and broken down into learnable chunks. Instructional objectives are specified in such manners that will identify specifically what learners would be able to do at the end of the instruction. These specifications must also identify the sequence learners would follow in order to be able to succeed. Instructional designers must be apt to further break a particular instructional objective in smaller units of enabling objectives and essential prerequisites. While enabling objectives are the essential actions that learners must perform, essential prerequisites form the bases for supportive actions and experiences.

Needs assessment/analysis

The starting point in any teaching program is to determine whether teaching is needed and, if needed, to specify what that teaching should accomplish. So making analysis of the learners' needs is of vital importance to the success of teaching (Zheng, 2010). Instructional designers have the responsibility of determining this fact before prescriptions are made. Needs assessment is carried out to determine the gap between what is known and what should be known. This is why the goals of an instruction must have been stated and clearly considered. The term 'Needs Assessment' is often used interchangeably with 'Needs Analysis'. Needs assessment comprise of two important words: needs and assessment. 'Need' is an essential starting place for needs assessments. Though the word need is used casually in many contexts without a definition. A need has been described as:

- "A gap between real and ideal that is both acknowledged by community values and potentially amenable to change." (Reviere, Berkowitz, Carter and Gergusan, 1996).
- Different from such related concepts as wants ("something people are willing to pay for") or demands ("something people are willing to march for"). (McKillip, 1987)
- A gap between "what is" and "what should be." (Witkin and Altschuld, 1995)

Approaches to the definition of needs

The first approach identified by Stufflebeam is the *discrepancy view,* which is best characterized by the work of Kaufman (1972). It is probably the most popular approach to needs assessment. In this view, a need is a discrepancy or gap between measures or perceptions of desired performance and observed or actual performance, and herein lies a major potential problem. It is often applied in situations where norms and standards are readily available and where measurable criteria are emphasized. A second approach identified by Stufflebeam is the *democratic view,* which is derived from the practice rather than from the theory of needs to involve many people in the needs assessment process and, therefore, has high public relations value. It can be applied quite easily and can be used to sample opinion regarding a wide range of variables and potential needs. The third approach identified by Stufflebeam is the *analytic view,* in which a need is described as the direction in which improvement can be predicted to occur, given information about current status. It is future-oriented and involves critical thinking about trends and problems that may arise. The fourth approach, the *diagnostic view,* need is defined as something whose absence or deficiency proves harm or whose presence is beneficial. This approach uses logic and available research to identify and describe deficiencies that may be harmful, and requires that a relationship between two variables be documented to be able to substantiate that harm or benefit results on one variable from the withholding or provision of the other variable.

The needs assessment process

The needs assessment process consists of five interrelated sets of activities:

1. Preparing to do a 'needs assessment'
2. Gathering desired needs assessment information
3. Analyzing the needs assessment information
4. Reporting needs assessment information

5. Using and applying needs assessment information

These steps do not necessarily occur in a strict sequence since steps can be pursued simultaneously and because recycling will inevitably (and should) occur.

The objectives of the instruction will dictate how needs assessment is to be designed and conducted. Needs assessment can either document the current situation for a group or for a target population. A needs assessment is often conducted for a specific group, organization, or business in order to improve effectiveness or productivity of the group related to its mission. Assessment objectives relates to the objectives of the organization. For a company, organization assessments learn how to close a training or performance gap (Gupta et al., 2007).

Importance of needs assessment

Educators must deal with students, communities, and social institutions that are dynamic, resulting in changing needs. It is in the context of attempting to be responsive to these changes, and to the many wishes and needs that schools are asked to address, that needs assessment can be useful. Needs assessment is a process that helps one to identify and examine both values and information. It provides direction for making decisions about programs and resources. It can include such relatively objective procedures as the statistical description and analysis of standardized test data and such subjective procedures as public testimony and values clarification activities. Needs assessments are used to address most areas of educational programming and student growth (such as academic, emotional, social, vocational aesthetic, physical, and moral) (Stufflebeam, 1977) at local, state, regional, and national levels. Needs assessments are implemented for several reasons; two primary reasons are to assist in planning and to promote effective public relations. Other purposes include identifying and diagnosing problems and assisting in the evaluation of the merit and worth of a program or other endeavor. Thus, it is a process that can be used for many different purposes.

Identifying instructional strategy

Once the goals of the instruction have been established and the needs assessed, a plan must be enacted to transmit the knowledge, skills and attitudes to the learners. The plan may include several layers to ensure that learning takes place. This plan for management and facilitation of learning is summarily accomplished by prescribing one or a combination of instructional strategies. Instructional strategy, otherwise known as “teaching strategies” refers to the structure, system, methods, techniques, procedures and processes that a teacher uses during instruction. Instructional strategies are means through which instruction is implemented. It is therefore a must that the prescribed instructional strategy must be consistent with the content of the instruction, and must be handled/implemented appropriately.

Instructional strategies refer to methods used to help students learn the desired course contents and be able to develop achievable goals. Reigeluth (1983) identified three aspects of instructional strategies: (i) organizational strategy, (ii) delivery strategy, and (iii) management strategy. These three strategies are prescribed to identify and solve different instructional problems.

Organizational strategies according to Smith and Ragan (2005) refer to how instruction will be sequenced, what particular content will be presented, and how this content will be presented, delivery strategies deal with what instructional medium will be used and how learners will be grouped, while management strategies include the scheduling and allocation of resources to implement the instruction that is organized and delivered as planned within the previous two strategy aspects. The three strategies could be referred to as the characteristics of instructional strategy, which is embedded during every instructional delivery process.

Effective instruction/lessons are usually hinged on prescription and use of an array of teaching strategies, this is because there is no single, universal approach that suits all situations and students. Since instructional strategies are the activities of a learning process, Chellman (2011) advocates that such activities "must match learning objectives, and that to the extent possible, and appropriate, activities can and should mirror the actual expected behaviour". Some strategies however, are better suited to teaching certain skills and fields of knowledge than are others. Some strategies are better suited to certain learner backgrounds, learning styles and abilities. For instance, a lecture, is the oral presentation of information by the instructor, often used in the university, as the main method of teaching. McKeachie and Svinicki (2006) believe that lecturing is best used for (i) providing up-to-date material that can't be found in one source; (ii) summarizing material found in a variety of sources; (iii) adapting material to the interests of a particular group; (iv) initially helping students discover key concepts, principles or ideas; and (v) modelling expert thinking. So, instructional designers consider the factors of age, class and content to prescribe the strategy. Despite the popularity of lectures, the lack of active involvement of trainees or learners limits its usefulness as a method of instruction. The lecture method of instruction is usually prescribed for trainees with very little knowledge or limited background knowledge on the topic.

Furthermore, discussion strategy is a more active learning experience for the trainees and learners than the lecture. A discussion is needed for learners to share experiences, ideas and attitudes. As it helps to foster trainees' involvement in what they are learning, it may contribute to desired attitudinal changes. Discussion may be used in the classroom for the purpose of lesson development, helping trainees apply what they have learnt or to monitor progress by way of feedback. Discussion is usually prescribed for classes such as History, Government, Literature amongst others. Demonstration method is any planned performance of an occupation skill, scientific principle or experiment. "The most effective way to teach an occupational skill is to demonstrate it... one of the two most essential teaching skills is the ability to demonstrate; the other is the ability to explain. Both are vital to the success of either an operation lesson or an information lesson". Brainstorming method encourages ideas to flow freely, building on and improving from previous ideas. No idea, however crazy, should be rejected. These ideas are listed exactly as they are expressed on a board or flipchart, or written on bits of paper. The combination of swiftly generated ideas usually leads to a very animated and energising session. Even the more reserved participants should feel bold enough to contribute. The purpose of listing responses is to collect existing experiences and thoughts. It is usually aimed at discovering new ideas and responses very quickly. It is particularly a good way of getting bright ideas. It differs from the buzz groups' discussion in that the focus is on generating as many ideas as possible without judging them. In this technique, all ideas are given equal credence. Role play method is an instructional strategy that allows participants to use their own experiences to enact a real life situation. When done well, role plays increase the participant's self-confidence, give them the opportunity to understand or even feel empathy for other people's viewpoints or roles, and usually end with practical answers, solutions or guidelines. Role plays are useful for exploring and improving interviewing techniques and examining the complexities and potential conflicts of group meetings. They help participants to consolidate different lessons in one setting and are good energizers.

Instructional media:

An instructional medium is defined as the physical means by which the instructional message is communicated, such as television, print materials, teacher, or computer (Smith and Ragan 1999). It is the channel through which information to be processed as knowledge is presented to learners. Briggs et al (1967) and Molwantwa (1997) submitted that instructional media refers to any and all physical means representing the entire set of stimulus conditions required in the instruction of a learner. Instructional media can be divided into two broad groups: electronic and print media.

Electronic media as the name implies are gadgets that make use of electricity. They are electronic devices. They are categorized into software and hardware while the print media are basically those medium of instruction that are on paper. Instructional media determined to a greater extent the success of any classroom event. Instructional media when not adequately managed can constitute distractions and noise and therefore hamper the whole process of learning. It has been argued that tools do not really affects learning outcomes but the strategies employed in the design and utilization of the tools. Integrating media in classroom instruction therefore is something to be done after necessary and acceptable precautions had been taken.

Introducing media to classroom instructions should not be the goal and objectives of its application. The need to identify the appropriate channels of communication that will provide optimum learning gain and improve upon performances should motivate the selection and the use of the media. It is important that the need assessment be carried out on the type and the form of media to be employed in a specific classroom instruction. No instructional media is universal. Expected learning outcomes should fundamentally determine the instructional media to be employed. It is obvious that learners learn at different rates and have different learning needs. Therefore selecting appropriate instructional media for optimum learning gain is highly important. Selecting appropriate instructional media that will meet individual students learning needs may be tasking. A hearing impaired students probably will not gain in an instructional medium that is basically audio while a student with visual challenges may not benefit from text. Selecting media for individualized instruction thus needs a meticulous appraisal of some important factors. These factors include among others; subject matter and required students' performance, types of learning task (objectives), target population (location and size), learners' characteristics which include students' learning style, cognitive strategies, skills etc., teacher's attitude and skills, availability and accessibility, teaching space (facilities and lightning) (Romiszowski 1988 model) in Molwantwa (1997).

The model thus emphasized that the goal and objectives of the instruction must be identified and clearly stated. The objectives should also constitute steps to be taken to achieve the stated goals. A well stated objectives and clearly presented steps to achieve the goals will facilitate selection of the appropriate media. The target population should also be considered. The size, the location as well as the characteristics will also enhance the selection of appropriate media. The possible challenges that may be encountered accessing the selected media is also a factor to be considered. The quality of the media as well as its appropriateness should also be taken consideration of. The reliability and the readability cannot also be ignored. The attitude of the teacher also play a significant role in media selection. A good media can be rendered ineffective just because of the attitude of the teacher. The environment, available facilities, space, illumination, electrification are cogent factors in media selection. Molwanta (1997) submitted that media selection must be the last step to be taken after all the other factors have been considered.

How people learn and instructional theory

How people learn

Psychologists in their quest to explain human behaviour extend investigation to how humans learn. This enables them to develop theories, strategies and models on how humans process information that leads to learning.

What is Learning?

Having correct and appropriate understanding of the word learning is very important and germane. For both teacher and the student to be able to achieve the goals of learning, right understanding of the concept is invaluable. A teacher with wrong interpretation and wrong definition of the word learning oftentimes will prevent the students from learning. Such a student may be able to recite or even describe a process yet may not have a clear understanding of such process. This can be brought to bear when such a student is required to apply what is described in solving real life problems. There may be an argument that the student had learned but in the true sense of it such a student had not. Braxter, Elder and Glaser (1996) argued that for a student to claim competency then such a student should be able to (i) provide coherent explanations (ii) generate plan for problem solution (iii) implement solution strategies and (iv) monitor and adjust their activities. It can thus be affirmed that learning involves the ability of the learner to clearly exhibit improved performance and changed behavior and attitude. Oftentimes teachers engage in teaching without planning to make their students competent. They are satisfied with the ability of the students to recite given facts without understanding how applicable the recited fact is to identifying and solving human problem which is the whole essence of learning. Teachers may be observed to be busy doing nothing beneficial and enables total learning by the students. It is therefore pertinent that learning is carefully define so as to guide instructional designers as well as teachers on how people learn.

Defining learning has been beclouded with ambiguity (Barron, Hebets, Cleland, Fitzpatrick, Hauber and Stevens, 2015). Houwer and Moor (2013) also opined that the definition of learning cannot be restricted to observable change in behaviour that is brought about as a result of experience. It was posited that the observable change in behaviour was as a result of some intrinsic factors and effects. These factors that determined the observable change in behaviour was opined is learning. It was thus posited that learning is the determinant of the observable and measurable relative permanent change in behaviour. Lachman (1997) in Houwer and Moor (2013) typified learning as a process that underlies behaviour and that learning should not be confused with the product of the process which is the change in behaviour. Therefore learning can be said to transcend the observable change in behaviour. It is the entire processes that brought about the change in the observed behaviour.

To study how people learn thus involve a systematic analysis of the entire processes i.e. both intrinsic and extrinsic that culminated together to ensure a relatively permanent change in behaviour of an individual or students as a result of experience(s) which may be personal or from environment.

The three basic theories of learning

Theories of learning promulgated for the new age sprouted from the three fundamental theories that address the basics of learning among learners. These basic theories are Behaviourism, Cognitivism and Constructivism.

Behaviourism:

Behaviourism basically emanated from defining learning as a change in observable behaviour. Pavlov, Thorndike and Skinner are the pioneers of behaviourism. Pavlov classical conditioning sees learning as a natural response to stimulus. It was argued that human learn as a result of response to stimulus. Skinner's operant conditioning believes that human beings do have a mind, but that it is simply more productive to study observable behavior rather than internal mental events. Skinner's view was rooted in a view that classical conditioning was far too simplistic to be a complete explanation of complex human behavior. He believed that the best way to understand behavior is to look at the causes of an action and its consequences. Skinners' argument was predicated on Thorndike (1905) Law of Effect. Reinforcement was introduced. It was argued that an event that is positively reinforced is likely to be repeated while the one that is negatively reinforced might not be repeated. Operant Conditioning deals with operants (intentional actions) that have an effect on the surrounding environment. Skinner set out to identify the processes which made certain operant behaviours more or less likely to occur.

Behaviourism had been argued is limited in explaining how human learn because learning is much more than an observable change in behaviour.

Cognitivism:

Learning according to cognitive theory is a change in learner's schemata. Cognitive Learning Theory implies that the different processes concerning learning can be explained by analyzing the mental processes first. It posited that with effective cognitive processes, learning is easier and new information can be stored in the memory for a long time. On the other hand, ineffective cognitive processes result to learning difficulties that can be seen anytime during the lifetime of an individual. The cognitive theorist argued that learning is an internal process and not a change in observable behaviour. The theory posited that human processes the information received rather than mere responding to stimuli. Therefore, learning is internal. They are of the opinion that learning occurs in the mind. Also that learning involves memory, thinking, reflection, abstraction, motivation and metacognition (Ally, 2008). Information processing is an integral part of learning in cognitivism. Cognitive theorist introduced the concept of schema. It postulated that sensations are received through the sense into the sensory store, stored in the short term memory for less than one second before processing and if it is not transfer to working memory will be loss. The information can be stored in the long term memory. Information at the long term memory can be recalled at any point in time when needed.

Constructivism:

Constructivism as promulgated by Piaget is an advancement of cognitivist. Constructivism argued that learning takes place when learners construct meaning from past experiences. Three stages of learning were identified in constructivism: they are assimilation, accommodation and equilibration. Constructivism sees learning as an active process in which learners construct meaning from their experiences and environment. Learners are actively engaged in learning processes in constructivism. Piaget identified four basic developmental stages. Thus at each of this stages human learn differently because they have different experiences and also because they construct meaning differently.

Learning in the Digital Age.

It could be observed that all these theories of learning are hinged on the perception and the definition of learning by the theorists. Learning can be summarized as the process through which the learner is being made competent in the skill and knowledge required for problem identification and problem solving in a particular environment. Students are believed to have learnt when they transcend from been a novice to an amateur and from been an amateur to a professional (Jonassen, McAleese, & Duffy, 1993). The ultimate goal of learning is to produce professionals in problem identifications and problem solving. Access to information had increased considerably in the digital age. Processing the available information so as to proffer solutions to identified problem is the major challenge of students. Recalling and reciting statements of facts is a fragmentation process in learning in the digital age. Therefore the theory of learning in the digital age will involve the use of the three basic theories of learning. Thus, Resnik (2002) asserts that:

> "This focus on information, however, is limiting and distorting, both for the field of education and for computers. If we want to take full advantage of new computational technologies, and if we want to help people become better thinkers and learners, we need to move beyond these information-centric views of computing and learning".

In the digital age, access to information is not a challenge but how to organize the information to meaningful pact that will favour problem identification and problem solving. Connectivism as proposed by Siemens (2004) will be a very appropriate theory for the digital age learning. Suffice to say that none of the theories i.e. behaviourism, cognivitism or constructivism can stand alone as the theory of learning in the digital age. Community of inquiry framework which is the process of creating a deep and meaningful (collaborative-constructivist) learning experience through the development of three interdependent elements – social, cognitive and teaching presence is very relevant in designing instruction for the digital age. Learners are able to interact with themselves, with the teachers and with their environment. Through sharing of experiences, discussions, problem-solving amongst others, learners are able to analyze information and synthesis it to draw a plausible inference. They are able to process the information by breaking the statements down and building them up to make a whole meaningful conclusion, thus constructing meaning from past experiences. Learning is about transforming information to knowledge. Creativity, problem-solving, self-regulated and self-directed learning environment should be provided for in the digital age. This is when the focus of the instructional designer is paramount. His prescription in terms of the instructional strategies and media must conform with the realities of the instructional problem to be solved during the lesson.

Conclusion

Instructional design is an evolving enterprise. It is being influenced by the newer technologies and consequently the needs of learners who are digital natives. Instructional designers cannot therefore afford to hold tenaciously to the rigid or conventional model of instructional design without consideration for the needs of the target of the instruction vis-à-vis the available information technologies. This paper has thus highlighted the necessity of instructional strategies and media in the process of instruction design in the digital age. This does not underplay other essential parts of the instructional design process, but underscored their key role in the design of instruction. On one hand, strategies are mainly used to take care of the objectives and needs, while media are deployed/prescribed to convey the objectives and appeal to learners.

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About the authors

Egbedokun, A.O., Oteyola, T.A., Akinlabi, Ayodele, P. & Adeyemo, M.

Department of Educational Technology and Library Studies, Faculty of Education, Obafemi Awolowo University, Ile-Ife, Nigeria

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Editor' Note: In the 1980's and 90's, American schools and colleges built computer labs so students could benefit from the new technologies. By the year 2000, use of computer labs began to diminish because an increasing number of students owned or had access to computers and laptops. Advances in mobile technology now provide a large base of students with smart phones, even in non-industrialized countries. As a result, there is increasing interest in using these mobile devices for educational purposes.

Mobile learning for Higher Education: a South Pacific perspective

Jashwini Narayan and Shavneet Sharma
Fiji

Abstract

This study recognizes and addresses a deficit in research on mobile learning. The purpose of this paper is to examine and better understand mobile learning in higher education in the South Pacific region. Based on secondary reviews and a South Pacific university context, a conceptual model is drawn and a research methodology is proposed. This paper argues that a number of factors affect mobile learning in higher education institutes. This study is useful in setting the premise for future large scale empirical research. Tertiary institutions, scholars and educators will benefit from the suggested model.

Keywords: university, Fiji, higher-education, mobile learning, Pacific, developing.

Introduction

Since teaching and learning differs in the 21st century technology driven society from what it was in the past, learners need the relevant skills and knowledge to operate in such a society (Galatis & White, 2013, pp. 3-4). This explains the growing use of mobile technology in teaching and learning in Higher Education Institutions (HEIs) (Kaliisa & Picard, 2017) as the most current trend resulting in "educators to evaluate the merits and limitations of a new technology" (Rossing, Miller, Cecil, & Stamper, 2012, p. 1). It "challenge[s] teachers to think creatively about mobile learning and develop the confidence to try new ideas" (Mehdipour & Zerehkafi, 2013, p. 98). Notably, today's mobile age requires education to change if learning is to meet such challenges and tap into opportunities (Galatis & White, 2013, p. 2). Undoubtedly, education needs to "accommodate and support an increasingly mobile population" (Mehdipour & Zerehkafi, 2013, p. 93).

Precisely in the past two decades, given the availability and accessibility of wireless connectivity, HEIs have made increasing use of mobile phones and wireless communication technologies to deliver different materials and "to support real-time communication" (Luiz, Ali, & Ouda, 2012, p. 31). As advancements have been made in mobile technology (Hsu & Ching, 2015), geographical desperation between educators and students is no longer a barrier. The issues of just 'part-time' use of computer technology has also been resolved (Schieber, 1999). Mobile learning facilitated through the mobile technology devices, thus offers geographically remote learners the options to fit study around their work or career commitments (Chun & Tsui, 2010).

Mobile technology devices are defined as an electronic palmtop or handheld device that "provides continuous accessibility to users anytime, anywhere without using a wire or cable to connect to networks (like the Internet), transmit data or communicate with others" (Kim, Holmes, & Mims, 2005, p. 55). The integration of mobile technology in the teaching and learning environment has greatly affected the experience and performance of students (Mac Callum & Jeffrey, 2013). Though the use of this technology, students are no longer tied to their desks because learning has become more dynamic. The integration of mobile technology in learning is referred to as Mobile Learning (M-learning).

Traxler (2005, p.325) defines mobile learning as “any educational provision where the sole or dominant technology is a handheld or palmtop device”. The phrase describes the convergence between e-learning and mobile technology which allows for “ubiquitous learning” (Kee & Samsudin, 2014). That is, students can gain access to learning materials from anywhere at any time with the use of a mobile device (Lan & Sie, 2010). This is as a result of the pressure from students to extend teaching and learning outside the classroom by making use of new forms of mobile technology and wireless devices (Prensky, 2004).

Literature confirms that technology based learning has undergone unprecedented changes in the last decade (Galatis & White, 2013). Developments in this field are expected to continue to increase in coming years which will lead to the emergence of more learning and teaching opportunities. The potential of this integration of mobile technology in the teaching and learning environment is only limited by the imagination of the educators and students. However, while the growth in ownership of mobile technology, especially among the young people,created opportunities for educators, it has also its share of challenges (Botha, Cronje, & Ford, 2007). Since the young are fascinated and intrigued with new technologies, such technologies have become a worthy investment in teaching and learning (Galatis & White, 2013).

Mobile learning

An approach to electronic learning (E-learning) (Parsons, Ryu, & Cranshaw, 2007) that utilises mobile devices is Mobile learning (M-learning), the context of which differs from that of the traditional E-learning (Parsons & Ryu, 2006).

"Literature [even] reveals a range of definitions about mobile learning" (Galatis & White, 2013, p. 3). Apparently, the M-learning community is fragmented (Singh, 2010). Literature shows that M-learning scholars define it in terms of their research perspective (Botha, Cronje, & Ford, 2007). For instance, research that is technology-driven describe M-learning as learning through mobile devices whereas pedagogical research define it as the extent to which a particular learning environment is enhanced (Botha, Cronje, & Ford, 2007). According to Botha, Cronje & Ford (2007), such dual nature of M-learning with different definitions imply that there is some disagreement about what m-learning constitutes (Botha, Cronje, & Ford, 2007). With respect to higher education, the definition of M-learning is even more unclear and uncertain (Rossing, Miller, Cecil, & Stamper, 2012) but what is equally true is that a fixed definition for M-learning is untenable because this type of learning involves many evolving concepts (El-Hussein & Cronje, 2010). All in all, we agree with Botha et.al (2007) in that the pedagogy and related technology are not separate issues but interdependent.

M-learning complements classroom experience (Parsons, Ryu, & Cranshaw, 2007, p. 2) offering benefits like ubiquity, convenience, localization and personalization due to mobile devices' mobility and supporting platform (Clarke, Flaherty, & Madison, 2003) where ubiquity refers to accessibility anywhere irrespective of student location (Parsons & Ryu, 2006). The feature that holds much relevance to education is that mobile technology does away with limitations of time, space and connectivity that often characterise a classroom setting and other types of teaching and learning (Botha, Cronje, & Ford, 2007). The key feature is mobility itself (Parsons, Ryu, & Cranshaw, 2007, p. 1) that allows “students to access education in a flexible and seamless manner, at any time and any place, which substantially increases their access to learning” (Wilkinson & Barter, 2016).

Overall, this technology helps “to engage and support student in communicative, collaborative, supportive and constructive activities” (Luiz, Ali, & Ouda, 2012, p. 31). In turn, students are expected to "work, learn, and study whenever and wherever they want" (Johnson, Smith, Willis, Levine, & Haywood, 2011, p. 3). Educators should thus provide formal content that fits well with learning in informal surroundings (Nordin, Embi, & Yunus, 2010). In this respect globally, educators and HEIs are under much pressure to personalize student learning and tailor learning environments to meet individual student needs. To suit individual learning needs, "just in time, just for me model of flexible learning" is one option that can be adapted (Galatis & White, 2013). Personalization enhances student ownership of learning (Clarke & Svanaes, 2014). "This is particularly true in developing countries where millions of people have been excluded from formal education" (Murphy, Jones, & Farley, 2016, p. 461).

While of late there has been an increase in M-learning research and practice, many of these attempts have been conducted with school-age students (Wilkinson & Barter, 2016); relatively less work has been done at university settings and even more so in a small developing island contexts. This may be explained by the comparatively lower potential for M-learning in developing countries (Sharma B. J., Kumar, Finiasi, Chand, & Rao, 2015, p. 2).

Ongoing research on M-learning is of interest to decision makers in HEIs particularly since there is little research on frameworks/models for evaluating M-learning (Hsu & Ching, 2015, p. 13), particularly in the developing country context.

> This gap in research is understandable because research of mobile learning has started in developed countries (the mainstream) that have more resources in capital and infrastructure. Compared to the developing countries, the developed countries are also more advanced in investing in research and development in mobile technologies. This is unfortunate because developing countries, despite the lack of resources, can still benefit from mobile learning (Hsu & Ching, 2015, p. 14).

Our research is an attempt in this direction with a focus on developing island context in the Pacific. Moreover, the quick changes in mobile technologies and learning calls for ongoing updated reviews on M-learning system architecture for the betterment of learners, educators, designers as well as researchers (Hsu & Ching, 2015, p. 15). Also, previously constructed definitions and conceptual frameworks can become outdated as technology advances (Rossing, Miller, Cecil, & Stamper, 2012) rendering the previous studies "only meaningful for a short time" (Beutner & Pechuel, 2012, p. 6). We concur with Maugis et al. (2005) who claim that with respect to e-readiness, there are uncertainties and ambiguities in both theory and practice. They argue that the assumption of a fixed, one-size-fits-all set of requirements fail to consider the unique characteristics of specific countries, creating a larger gap between theoretical frameworks and practical implications. The need is increased for refined frameworks and models as research in this field advances.

Perusal of the literature reveals that no research thus far has created conceptual framework for using mobile technology in HEIs in developing countries like Fiji. This research addresses this gap by studying the impact of mobile technology on HEI students in a small island developing nation. Such exploration may reveal "critical factors constraining the application of mobile technologies in developing country contexts" (Kaliisa & Picard, 2017, p. 2). Previous research has investigated the critical success factors from a student perspective (Alrasheedi, Fernando, & Raza, 2015). The present study not only recognizes instructor and student perspectives but also the perspectives of those who help facilitate M-learning like staff of the Centre of Flexible Learning.

Mobile devices in the Pacific

In an attempt to improve educational delivery and minimise access inequality in formal education, HEIs and governments in the Asia-Pacific region have invested in technological innovation (Murphy, Jones, & Farley, 2016, p. 461). The fast growth in ownership and increasing sophisticated mobile technologies in the region make this possible (Murphy, Jones, & Farley, 2016).

In the Pacific, the number of people who own mobile devices in the form of mobile phones and tablets is increasing. This is due to affordability of such devices and mobile data plans, increase in mobile network coverage, introduction of innovative features, the changing lifestyle of individuals and the increase in need for people to be informed and connected (Ulfa, 2013). Another reason f is the increase in popularity of social media sites such as FaceBook, Twitter and YouTube.

Table 1
Increase in number of mobile devices: Mobile subscriptions in the Pacific region

	2010	**2011**	**2012**	**2013**	**2014**	**2015**
Fiji	697'920	727'000	858'809	930'406	876'176	965'950
Kiribati	10'595	13'788	18'000	20'000	30'000	41'000
Solomon Islands	115'500	274'872	302'147	323'105	376'696	424'712
Tonga	54'300	55'000	56'000	57'500	68'000	73'493
Tuvalu	1'600	2'130	2'800	3'400	3'800	4'000
Vanuatu	169'935	136'956	146'084	127'244	156'051	174'818

(Source: International Telecommunication Union, 2016)

Mobile learning at the University of the South Pacific

At the University of the South Pacific (USP), factors such as: serving geographically dispersed students of various socioeconomic backgrounds, increase in the popularity of ICT, large number of students owning mobile phones and an established learning management system (MOODLE), led to the implementation of M-learning. The goal was to deliver learning material and support via mobile devices free of charge.

SMS notification was the first M-learning service initiated in the second semester of 2011 at the university. Initially, the service was made available to two first-year courses under the Faculty of Science and Technology. With the introduction of this service during the pilot phase, the submission rate for assignments increased from 68 percent to 83 percent while the pass rate improved from 54 percent to 74 percent.

"All students enrolled in higher and further education institutions today have frequent needs for information from their institutions about timetable changes, assessment deadlines, feedback from tutors and other urgent administrative details" (Mehdipour & Zerehkafi, 2013, p. 99). At USP, students stated that the timely reminders and notifications were helpful in keeping them on track (Sharma B. J., Kumar, Finiasi, Chand, & Rao, 2015). To this end, the learning services provided through M-learning include:

- Short messaging service (SMS) notification: students receive SMS from academic staff regarding information on assignment due dates, examination coverage and reminders, important university events/dates and other information such as cancellation of class. Students need to register their mobile number on MOODLE for this service.

- Mark sheet application: Using this service, student can use their mobile phones to send a SMS to receive their examination or assignment marks.
- Examination timetable application: Students can send a SMS and receive details about their examination timetable and seat number.
- Quiz Application: Students who are unable to come to the classroom during an assessment, can use their mobile phone to participate in quiz from wherever they are.
- Library application: This service sends students timely reminders about library books that are due or if a book they have reserved is available.
- Course finder application: Using a web based application, students can access information about courses that are offered by the university.
- Entertainment Module: The University has developed three educational games so that students can learn and enjoy themselves at the same time.

However, because of difficult navigation and the small size of the screen of mobile devices, it is important to target learning material to a large extent (Parsons & Ryu, 2006). In enrolment based university settings, such as that of USP, such targeting can be easier since a lot of information can be gathered about learners to profile learner activities and requirements (Parsons & Ryu, 2006).

"As an emerging mobile terminal, the tablet computer has begun to enter into the educational system" (Long, Liang, & Yu, 2013, p. 61). Just like various "universities are conducting iPad pilots" (Galatis & White, 2013, p. 4), from semester one 2017, all first year undergraduate students who paid fees in full, were given a tablet as part of the USP's effort to enhance M-learning. Two years ago, a similar experiment was conducted on a smaller scale where 200 students were given tablet computers which yielded encouraging results (The University of the South Pacific, 2017).

Implementation challenges of Mobile Learning

To successfully implement any new system, one has to overcome various challenges and pitfalls. Developing countries are faced with the problem of poor technological infrastructure, lack of skills to utilize the full potential, problems with access to the internet, lack of access to modern mobile devices (smart phones) and the poor attitude of educators and staff to take this technology on board. In a study conducted in the Tasmanian University of Sokoine, educators reported that they had to purchase applications for the learning process online. This required the use of Visa cards and was considered expensive. Students who were part of this survey stated that the cost of purchasing smart phones was expensive and so was the cost of purchasing mobile data needed to download large amounts of learning material (Mtega, et al.,2012). According to Mayisela (2013), the South African who participated in a pilot study also reported similar challenges. They highlighted the high cost of using the internet on mobile devices and complained that some mobile devices had compatibility issues when attempting to access the university's learning management system. The study also reported web pages taking too long to load onto mobile devices due to the lack of memory in mobile devices. When compared with desktop, mobile devices differ in performance and capability (Parsons & Ryu, 2006). Another study that was conducted in Uganda's Makerere University reported that 53 percent of the students found it frustrating to use the university's mobile learning system as it was difficult to master the use (Asiimwe & Grönlund, 2015). Overall, students are affected by factors such as the ease of use, screen size and high processing power when choosing to adopt M-learning (Mtebe & Raisamo, 2014; Macharia & Pelser, 2014; Wang, 2016).

According to Maniar et al., (2008), other challenges faced by students include small screen and keyboard size of mobile devices, battery life and connectivity, slow bandwidth for fast streaming, download, copyright issues and content security. Limitations relate to storage, screen size and resolution, (Luiz, Ali, & Ouda, 2012) reliability and speed of wireless connections. Some devices are not able to download mobile Java; this also poses challenges (Parsons & Ryu, 2006).

As per Mehdipour and Zerehkafi (2013), other barriers include high equipment cost, connectivity, regular maintenance, lack of adequate technical support and teacher training; health-related issues from frequent use of technological devices; lack of policy and governmental investment support; lack of interest and awareness on the part of policymakers and the public; and negative social attitudes that see mobile phones as disruptive devices.

The above issues prove that in order to enhance learner-centred high-quality learning components, the content to be learned from M-learning should be rigorously analysed (Parsons & Ryu, 2006). This is where a conceptual frameworks can assist.

Proposed research methodology

While the number of models and frameworks in M-learning are increasing, still more research is required since ‘conceptual and theoretical guidance can help support design and research in mobile learning’ (Hsu & Ching, 2015, p. 2) and provide a basis upon which M-learning can be implemented while noting possible factors that could affect its progress (Kaliisa & Picard, 2017, p. 9). According to researchers like Alrasheedi, et al., (2015, p.38), future work should focus on building “a maturity model for M-learning based on factors that have been found to be significant”.

To assist with conceptualization, look at the M-learning programme run by the USP. It is argued that a conceptual model based on the context of a South Pacific University such as USP, “the premier regional university in the South Pacific region” (Naz, et al., 2015, p. 86), and factors drawn from existing literature, may shed light on issues and challenges facing m-learning (Narayan & Sharma, 2016). Published literature has clearly established the relevance as well as challenges of M-learning and its effects on quality and accessible education.

USP was established in 1968 and “… is one of the [only] two regional universities in the world…” (Naz, et al., 2015, p. 87). It is owned by 12 countries in the South Pacific with students from diverse learning and cultural backgrounds. By applying the framework to actual M-learning implementation, we will better understand the key factors (Parsons, Ryu, & Cranshaw, 2007, p. 1). Additionally, we draw upon our personal experience as students, and now as educators who are involved in M-learning at this university. No doubt, certain factors can be unique to M-learning so a case study (Parsons & Ryu, 2006) of USP with M-learning literature and our academic experience at the same university can help identify factors that can enhance quality. Research indicates that both the quality of software as well as the conceptual basis are important in enhancing the quality of M-learning since quality factors go beyond the technical issues to meet learner requirements (Parsons & Ryu, 2006). In so doing, we propose additional factors that acknowledge the complexity in quality aspects of learning experience (Parsons & Ryu, 2006) in the much under-researched context of developing South Pacific nations, this being this paper's key contribution. In their latest paper, Hsu & Ching (2015, p.14) confirm “the lack of mobile learning models or frameworks that factor in the needs of developing countries in mobile learning”.

As per this paper’s research question and, in keeping consistency with the literature reviewed and the USP’s context, this paper suggests a model, illustrating the relationship between M-learning and high quality education. It is not that models are not available, but there is none that specifically addresses the higher education quality in a regional university in developing smaller islands, this being one of the major contributions of this paper. Given the multi-campus nature of USP and it being spread out in many islands implies that its needs and challenges will differ due to unique cultures, different levels of infrastructure and differing views of what constitutes learning (Traxler, 2005). "Mobile technologies facilitate distance learning in situations where access to education is difficult or interrupted because of geographical location or due to post-conflict or post-disaster situations" (Mehdipour & Zerehkafi, 2013, p. 98). Such differing characteristics of 'developing countries should be valued and researched so learners can benefit from what mobile learning can offer" (Hsu & Ching, 2015, p. 14). In this regard, we agree with Hsu & Ching (2015, p.4) who argue that mobile technologies do broaden the learning experiences, but it's the models and frameworks that are important "in guiding the design, development, implementation, and evaluation of these mobile learning experiences".

The factors that appeared similar in literature, some of which were empirical in nature, were thus noted. From the perusal of literature, it is clear that many factors affect M-learning. Factors such as user [type] and role, interactivity allowing for collaboration, content support learning (from Parsons and Ryu's (2006) study, add type to users also) and pedagogies (Hsu & Ching, 2015).

First, user types and roles are important since, as learning activities becomes ubiquitous, "the focus of design and evaluation has turned towards the user's learning experience" (Parsons, Ryu, & Cranshaw, 2007, p. 2). User type is also important because each user has a different psychological make up that affects their learning experiences (Parsons, Ryu, & Cranshaw, 2007). This factor is akin to the "learning styles and preferences" factor in the Rossing, et.al (2012) study. As at 2014, the student population at USP was approximately 30,000 (The University of the South Pacific, 2014). It operates fourteen campuses and nine centers in twelve member countries of Cook Islands, Fiji Islands, Kiribati, Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, and Vanuatu (Jokhan & Sharma, 2010). The smaller centers are either part of the larger campuses spread out in remote areas or located on the smaller islands in some regional countries (Sharma, et al., 2015, p. 3). Also, at USP, "multifarious issues characterise the teaching of English in a region of over 300 active, indigenous, language communities where English is the sole language of instruction" (Koroivulaono, 2014, p. 94). This means that USP has many different users: learners and staff (both academics and staff at the flexible and distance learning centers like instructional designers) from the 13 member countries and local as well as regional students. Because teaching and learning involve teachers and learners both, it is logical to seek views of both groups (Beutner & Pechuel, 2012, p. 6). Koroivulaono (2014, p.98) informs that both academics and instructional designers at USP develop and design learning resources, which makes sense to include instructional designers as users also. While user perceptions will differ, some emerging patterns and requirements may be generic. In addition what should be understood is that each user will use their mobile device differently (Parsons, Ryu, & Cranshaw, 2007, p. 1). "Different user profiles and their roles" (Parsons, Ryu, & Cranshaw, 2007, pp. 1-2) in use of mobile technologies – becomes even more important in an M-learning environment, which is why educators must make continuous efforts to understand students' level of knowledge and comfort with new technological tools, not just assume that all students are prepared for such technologies (Rossing, Miller, Cecil, & Stamper, 2012). Hsu & Ching (2015, p.8) also suggest the consideration of levels of social/individual activities when designing M-learning. At the same time, because USP is spread out in the region, regional factors such as economic, political and cultural context should be taken into account because these may impact students learning behaviour (Tsai & Hwang, 2013). Murphy, et. al. (2016, p.467) also emphasize culture: "Instead of just using mobile devices for generic learning activities, as far as possible cultural learning and recognition must be incorporated into activities". Since the current assessment tools lack scope or detailed description on how tools should be used, end-user analysis is needed (Vaezi & Bimar, 2009).

Second, collaboration (a factor common in Rossing, et.al (2012) study) is worth noting since it promotes social interaction amongst students as well as academics. Such group experiences bring about relevant collective learning since the users are challenged to explain their experiences when they receive immediate feedback from other participants (Parsons, Ryu, & Cranshaw, 2007, pp. 3, 6-7). Chang, Mwanika, Kaye, Muhwezi, Nabirye, Mbalinda, Burnham (2012b) also identified social influence as a key factor.

Third, while the technical aspects of quality are no doubt important, equally important are content related aspects (Parsons & Ryu, 2006). The challenge is changing technology requires changes in pedagogy (Rossing, Miller, Cecil, & Stamper, 2012). Just “as a pedagogically sound mobile intervention cannot take place without acknowledging the technology to support it,... In the same way a brilliant technological tool unsupported by sound pedagogic is educationally useless” (Botha, Cronje, & Ford, 2007). For a successful initiative, supportive technology and the pedagogic considerations should come together (Botha, Cronje, & Ford, 2007). ‘While both reflect a perspective, neither reveals it in isolation’ (Botha, Cronje, & Ford, 2007, p. 1). What may also be true is that, in every course, a high degree of technological sophistication may not even be necessary. Simple technologies and basic systems such as classroom response systems can be as effective allowing for rich social practice (Roschelle, 2003). Literature has made it clear “that discipline-specific mobile apps will become more popular” (Murphy, Jones, & Farley, 2016, p. 466). Thus, with respect to content, the authors agree with Parsons and Ryu (2006) and Parsons, et.al (2007) on, delivering content in short ‘nuggets’ rather than in large units of information. Kurbel and Hilker (2002) also caution that content format be selected with care especially in universities where there are cultural differences between the designers, learners (Teal, et al., 2014) and academics. In some detail, pedagogical design principles should be clear, up to date and appropriate to all learners, their needs and context, be highly interactive, allow mutual feedback between education providers and learners as well as help identify knowledge gaps (Lehner & Nösekabel, 2002; Massy, 2002). Designers should then identify the important and necessary learning materials, displaying it in a 'bigger, bolder, brighter, and more detailed, or called out with circles, arrows, or labels' (Luiz, Ali, & Ouda, 2012, p. 32). As it is, “... material development (especially compatible with mobile technologies) is one of the extremely sensitive steps which is needed to focus on and to be planned at the first place for effectiveness of the learning environments” (Hocanın & Iscioglu, 2014, p. 16), more so at USP where regional students rely largely on print and online materials and multimedia components for flexible and distance learning mode (Koroivulaono, 2014, p. 95).

In addition, we identified factors such as technology simplicity, trialability, observability, relative advantage, compatibility, support (Wilkinson & Barter, 2016) who referred to the earlier work of Rogers), technology acceptance (Hsu & Ching, 2015), support staff, training, funding, management support (Latham, 1988), e-learning being free of technical problems for all users (Massy, 2002), protocols, rules and norms, subject and community (Botha, Cronje, & Ford, 2007) or context (Parsons, Ryu, & Cranshaw, 2007) or learning environment (Hsu & Ching, 2015) and mobile device ownership (Rossing, et al., 2012) as other very important considerations. To these, we add ‘sufficient time’ allowed and reduced workload for academics for course conversion. Additional support for HEIs leaders should also be available to further develop M-learning initiatives to meet user needs and for integration into current strategies, policies and procedures (Murphy, Jones, & Farley, 2016). Further, we suggest specific time allocation during class for M-learning activities.

Some of the above factors are common across different studies as follows. It is the authors’ opinion that community, context and learning environment (Hsu & Ching, 2015) can be used interchangeably and are similar to Chang, et al. (2012b) factors of environmental factors and facilitating conditions. Chang, et al. (2012b) and Rossing, et al. (2012) factor of access can be similar to Massy's (2002) factor of e-learning being free of technical problems for all users. Their factor of nature of the institution's leadership is similar to management support of Latham (1988). Protocols, rules and norms are similar to the policy and guidelines of Owaza & Ualesi (in press) and Starasts, et al. (in press).

In developing countries, many learners face problems of internet access and costly technology (Mehdipour & Zerehkafi, 2013, p. 99). Thus, in terms of factors such as technology simplicity, trialability, observability, relative advantage, compatibility, what needs more attention are the "comprehensive design of the whole educational system, including the design of the learning support system and instructional strategies, as well as the design and development of educational software and resources" (Long, Liang, & Yu, 2013, p. 61). The findings of research by Jabbour (2014, p.65) prove that when technology is utilized correctly and class time is not wasted in resolving technical issues, students learning experience is positive. A classroom should also be conducive for technology or group activities (Jabbour, 2014). Thus, technology simplicity, trialability, observability, relative advantage, compatibility are the fourth set of important factors in M-learning.

Fifth, ownership of mobile device is an important factor given that "benefits of collaboration and information access are diminished when students do not have access to individual devices or when they do not own the devices" (Rossing, et al., 2012, p. 15). Wilkinson & Barter's (2016, p.20) study revealed that the mobile device of tablets brought about positive experience to student group work, however, students mentioned that there should be "more of them or given out individually by the university". At USP, 2017 year-one students who paid fees in full were given a tablet. While for universities this may be constrained by budgets, Wilkinson & Barter (2016, p.20) caution that individual tablets may detract from group work, affecting peer feedback and sharing of ideas. Whether tablets can be hired by universities to groups of students or handed out to individual students, can be a critical area for future research.

Sixth, support and training are also common factors across M-learning literature be it technological support or management support. Ng and Nicholas (2013) highlight the importance of sufficient technologies and technical support in real time to instill positive attitudes amongst both students and teachers. What is important is effective and easy to use user interfaces (already a hot topic) so that users can "focus on the learning goals, learning content and activities..."; making usability issue a key component of successful and acceptable educational application (Luiz, Ali, & Ouda, 2012, p. 31 & 33). Difficult to use and learn applications fail to attract or keep users (Luiz, Ali, & Ouda, 2012, p. 31). In addition, intensive and ongoing institutional support is a must for unprepared users - both the students and the faculty (Corbell & Valdes-Corbell, 2007). Literature proves that many educators prefer didactic, instructor-led approaches (Johnson, et al., 2012; Murphy, et al., 2016 p.466) that does little to enhance M-learning which is often student-centred and self-directed (Murphy, Jones, & Farley, 2016, p. 467). Teachers' hesitate facilitation of instruction with tablet computers given their own poor knowledge about tablets and their instructional functions (Long, Liang, & Yu, 2013). Support and training (Padmo et al., in press; Sharma, et al., in press) are thus very important factors to motivate and enlist the cooperation of academics.

Given our experience as academics, we also suggest sufficient time as the seventh factor for academics to convert the learning materials to relevant content suitable to M-learning. Academics, alongside their normal teaching and research duties are expected to make course conversions. Training and support thus should be discussed thoroughly with the academics with an agreed timeframe and reduced normal workload. Preparation of adequate materials take time and will take longer with poor technical support and poor training. This is where top management support also comes in since a lot depends on the instructor on successfully using new technology - literature confirms that "support for instructors is vital" (Rossing, Miller, Cecil, & Stamper, 2012, p. 4). In this technological age, “teachers are more important than ever, as is the professional development that ensures they are qualified to fulfil new and more dynamic roles” (Vosloo, 2012, p. 34). Despite this, not much attention has been paid to professional development on mobile learning – “mobile devices have rarely been used to deliver professional development and teacher support”' (Galatis & White, 2013, p. 8). Long, Liang & Yu (2013) accordingly suggest new instructional strategies to assist teachers improve their instructional effect with new forms of mobile tools such as the tablets. The opinion of teachers is very important since they are the ones expected to make effective use of technology (Hocanın & Iscioglu, 2014). Alrasheedi, et al. (2015, p.27) highlights instructors’ autonomy and blended learning as the most important elements enhancing M-learning adoption. They elaborate on mobile vision and competency based teacher training for transformation of the pedagogy (Alrasheedi, Fernando, & Raza, 2015, p. 28).

Students should also be provided with such training (Murphy, et al., 2016; Ozawa, et al., in press; Sharma, et al., in press; Starasts, et al., in press) since different students at different centres/campuses will have different skills levels. In the absence of training, some may feel left behind. More than learning how to use a device, learners need to be taught digital literacy skills to adopt and adapt to the online world (Galatis & White, 2013) because not only the teachers and educational administrators, but the students are also pressured into adapting to such changes with the introduction of a new technology (Long, Liang, & Yu, 2013).

How the users interact with technology is subject to or even regulated by protocols, rules and norms (Botha, Cronje, & Ford, 2007) which is why this is also added as the eighth important factor. Protocols, rules and norms are considered important because the Asia-Pacific region is so diverse culturally, therefore, ‘rules and roles of the social relationships in the mobile learning space must be made explicit’ (Murphy, Jones, & Farley, 2016, p. 467). At USP, students and staff are not able to connect to social media while at USP until 4pm on week days.

The ninth set of factors is the context, community, learning environment, environment or the facilitating conditions as the surroundings that can affect user experiences indirectly and in complex ways (Parsons, Ryu, & Cranshaw, 2007) and this can be either negative or positive. "The emphasis here is on the nature of the physical environment in which the learner is placed, … that is now possible with mobile technologies that were not possible with a desktop" (Luiz, Ali, & Ouda, 2012, p. 33).

The tenth factor of ‘e-learning being free of technical problems for all users’ is even more important in the Pacific due to poor internet access or in some cases, even lack of electricity, seriously affecting the success of e-learning in many parts of the Asia Pacific (Murphy, Jones, & Farley, 2016). Because network coverage is a major issue in developing countries, it is important to sort out technical infrastructure problems (Nordin, Embi, & Yunus, 2010). Rossing, et al. (2012) also highlighted connectivity as a major inconvenience than any other feature.

Eleventh, support for leaders of HEIs is considered essential since in developing countries, M-learning can be costly. The other extreme of ‘Bring Your Own Device’ (BYOD) also raises the ethical issue of inclusion' (Wilkinson & Barter, 2016, p. 16) since not all learners “have access comparable quality devices or sufficient data plans to connect online” (Galatis & White, 2013). Algonquin College in Canada has a Mobile Learning Centre that allows learners to borrow high-quality devices (Galatis & White, 2013). In addition, there is a need for partnerships between HEIs, government, donors and even the private sector who sell mobile devices to contribute or HEIs and students to share costs. Effective M-learning “... require[s] a good cooperation between companies and the providers of M-learning solutions, especially when it comes to developing employee-friendly solutions, creating products with convincing learning results, and designing cost-efficient solutions” (Beutner & Pechuel, 2012, p. 5). At USP, contractual agreements are in place with two local mobile service providers whereby both providers have assigned a common short code to send out SMS (Sharma, et al., 2015, p. 6).

Rossing, et al. (2012) mention the ability to access popular distractions (social networking, email and games) as the biggest limitation in M-learning. This is not a new finding and is consistent across several studies like Kinash, et al. (2012), Rossing, et al. (2012), Wakefield & Smith (2012) & Wilkinson & Barter (2016). Jabbour's (2014) empirical study confirmed the same - class was disturbed by some students who engaged in activities unrelated to class. This potential distraction also explains the scepticism of many academics (Hargis, et al., 2013; Link, et al., 2012; Rossing, et al., 2012) and is apparently a pedagogical limitation (Wilkinson & Barter, 2016). Instructors should set rules and move around to manage in-class activities, allocating specific time during class for M-learning activities (Link, et al., 2012; Rossing, et al., 2012, p. 14; Wilkinson & Barter, 2016, p. 20) - this being the twelfth important factor.

The resulting model is considered wholesome since it not only takes into account the perspective of students but also the issues faced by key staff such as the academics and instructional designers. In the opinion of the authors of this paper, M-learning faces several challenges as mentioned above and below in the hypotheses which when taken together and addressed appropriately, can improve the quality of M-learning. It may even "… generate useful suggestions and insightful implications for educators, researchers, instructional designers, and developers who are interested in providing meaningful mobile learning experiences and environments"' (Hsu & Ching, 2015, p. 2). This is by no means a panacea for M-learning challenges, but presents a different perspective to universities which provide M-learning to users of different backgrounds (Botha, Cronje, & Ford, 2007, p. 2). In this way, this paper contributes towards a more wholesome framework to 'guide effective instructional design and evaluate the quality of programs that rely significantly on mobile technologies' (Galatis & White, 2013, p. 9).

H1: User types and roles affect mobile learning

H2: Collaboration affects mobile learning

H3: Technical and content related aspects affects mobile learning

H4: Technology simplicity, trialability, observability, relative advantage, compatibility affects mobile learning

H5: Ownership of mobile device affects mobile learning

H6: Support and training affects mobile learning

H7: Sufficient time affects mobile learning

H8: Protocols, rules and norms affects mobile learning

H9: Context, community, learning environment, environment or the facilitating conditions affect mobile learning

H10: Freedom from technical problems affects mobile learning

H11: Support for leaders of HELs affects mobile learning

H12: Instructors should set rules and move around to manage in-class activities affects mobile learning

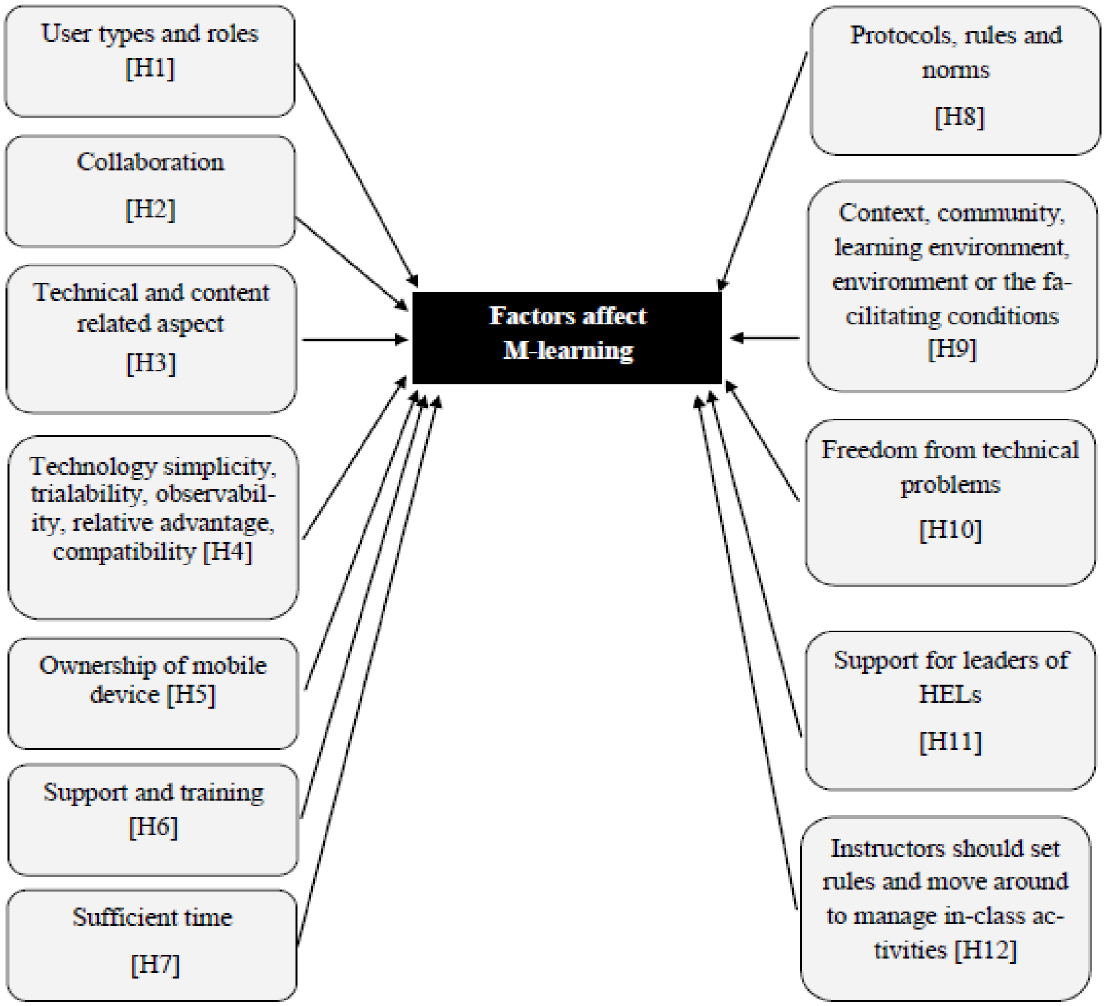

Figure 1: Factors affecting mobile learning prepared by Narayan & Sharma (2017) for this paper.

This study is a conceptual approach and the next phase should be to collect relevant primary data to test the conceptual model for empirical contributions. As it is, "there is a lack of models and frameworks grounded in empirical research conducted in developing countries' contexts" (Hsu & Ching, 2015, p. 14). In this regard, researchers can conduct a survey amongst students, academics, instructional designers, flexible learning department staff at tertiary institutions like the USP followed by some in-depth interviews, and focus groups with prompts for examples and description of feelings/emotions of all respondents.

A combination of qualitative and quantitative approaches is recommended since a qualitative approach allows for deeper understanding of benefits and challenges while quantitative provides quantifiable measurements and analysis (Clark & Andrews, Peer Mentoring in Higher Education: A Literature Review, 2009). Questionnaires are useful for their ability to obtain data from a large population (Bryman, 2015). The open-ended responses can be compiled and recorded in an Excel spreadsheet (Rossing, et al., 2012). Rossing, et al. (2012) benefited from independent reviews of open-ended responses by a small group of academics and instructional designers to generate a preliminary coding rubric to help categorize recurring themes in the data. Classroom observation is further suggested to collect data on educational approaches and student-student and student-teacher interactions. Such a combination of methods will assist in better understanding the M-learning phenomenon from multiple viewpoints and perspectives (Bryman, 2015). The researchers can then discuss the negative or discrepant information to remove researcher bias and to modify the themes.

It is proposed that research to be undertaken in multiple courses such as one course in each discipline with a larger sample; studies of M-learning student perceptions have called for such multiple course, multiple section and larger sample future work (Enriquez, 2010; Yang & Lin, 2010). Researchers like Hocanın and Iscioglu (2014) and Long, et al., (2013) have also called for expanded sample size to increase the validity and reliability of future studies. The research population of this study should be students, academics, instructional designers, and other flexible learning department staff such as those who assist in the use of multimedia applications. All respective staff and 50 percent or more of the final year students will allow for appropriate generalizations. Because USP has campuses/centers spread out in different countries, a stratified random sampling technique should be used to come up with a representative sample from the island countries of the South Pacific region and also from the different campuses. It is not suggested that samples be drawn from the main campus only given that the very nature of M-learning has to do with learning anywhere anytime, transcending across islands and cultures.

The data can be analysed using independent t tests and within subject ANOVAs using a 95% confidence level (Wilkinson & Barter, 2016). As with any research, prior to research, appropriate formal approval must be sought from the university in order to be in line with research ethics. It is important that the ethical considerations of pedagogical research is "established at each stage within an action research project so as to not disadvantage the student learner and improve academic rigour in this field of research" (Wilkinson & Barter, 2016, p. 21). Students should be informed that survey participation will not affect their assessment/grades. To be fair to participants, students should be allowed to ask questions about the survey for clarification.

Conclusion

As there is an increase in ownership and usage of mobile technology, more emphasis needs to be placed on mobile learning as a tool in higher education. This includes the development of web-based and mobile application to help enhance the teaching and learning process. This paper suggests a conceptual framework for using mobile technology by outlining 12 factors that impact mobile learning in the south pacific region. It "can also help identify gaps in the existing literature and provide future research directions in mobile learning" (Hsu & Ching, 2015, p. 2).

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About the authors:

Dr. Jashwini Narayan is an academic (lecturer) in the School of Management & Public Administration at the University of South Pacific, Suva, Fiji since January 2006. Prior to joining USP, she worked at Carpenters Morris Hedstrom, Cost-U-Less, ANZ Bank, Reserve Bank of Fiji and HFC Finance. Email: narayan_ja@usp.ac.fj

Mr. Shavneet Sharma is also an academic in the School of Management & Public Administration in the above university. He graduated from USP in March 2015 with a BCOM in Accounting and Management. He worked for KPMG as an auditor prior to joining USP as a tutor from 2016. He is a Certified Fraud Examiner (CFE) and during his studies at USP, he was a Senior Peer Mentor. Email: shavneet.sharma@usp.ac.fj

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Editor's Note: This research examines preservice teacher technology integration in internship-based teaching. It focuses on the mentor teacher/preservice teacher relationship and its impact on classroom technology integration. Recommendations elevate the internship-based instructional paradigm from direct instruction to a more technology-integrated constructivist learning.

Factors affecting technology integration in internship teaching experiences"

David Robinson and William Sadera
USA

Abstract

The purpose of this research study was to examine preservice teacher technology integration in internship-based teaching experiences. Using mixed methodologies, particular focus was placed on the mentor teacher/preservice teacher relationship and its impact on classroom technology integration.

Recommendations are provided to elevate the overall internship-based instructional paradigm from that of direct instruction to more technology-integrated constructivist learning.

Keywords: preservice teachers, mentor teachers, technology, technology integration, loti, internship, teaching experiences, constructivist, constructivism, cognitive apprenticeship, dispositions, and resources

Introduction to the problem

The effectiveness of student-centered learning has been supported by contemporary learning theorists and historical work alike (Jonassen, 1991; Jonassen & Carr, 2000; Jonassen, Carr & Yueh, 1998; Papert, 1993; Prensky, 2009). With the evolution of the microcomputer in the 1990's, theorists, like Seymour Papert, explored the use of the computer in constructivist learning environments. Papert (1993) used LOGO software as a tool for students to direct their own learning. By programming a turtle to move across a computer screen, students developed skills to solve problems and strengthen their metacognition. Jonassen and Carr (2000) developed the Mind Tools theory in which the computer, via interactive software programs, becomes an extension of the child's mind. Ringstaff, Yocum and Marsh (1996) provided landmark, longitudinal, research indicating that in student-centered, technology-integrated learning environments, students learn better than in traditional, teacher-directed learning environments.

This research-based method (technology-integrated, constructivist teaching) for improving student performance is especially relevant to the digital world in which 21st century students live and naturally learn (Prensky, 2009).

Based on this understanding about effective instructional practice, teacher preparation programs have become more focused in promoting pedagogy aligned with technology-integrated, constructivist teaching (Gordon, 2009). As classroom technology continues to be more prominent, preservice teachers must be prepared to effectively use technology to improve student learning. Sadly, when preservice teachers enter their internship experiences, they encounter numerous barriers related to the complexities of PreK-12 classrooms (NCES, 2007). Barriers noted in research include: the influence of the mentor teacher's predispositions (i.e. skills, attitudes and beliefs) towards technology integration, access to technology resources, the influence of other variables (e.g. time for technology integration, and an emphasis on traditional teaching practices in PreK-12 schools) (Bai & Ertmer, 2008; Brush, Galeski, & Hew, 2008; Grove, Strudler, & Odell, 2004; NCES, 2007).

There has been little accounting for technology integration in internship experiences with relation to the predispositions of preservice teachers, the technology integration predispositions of mentor teachers, and classroom environmental factors unique to internship experiences. The effectiveness and growth of technology-integrated learning environments drives the need for further research on technology integration in preservice teacher internship experiences.

This article presents findings from a study examining factors affecting preservice teacher's levels of technology integration in internship experiences. Quantitative study results reveal that overall levels of technology integration in the internship experiences examined were consistent with that of direct instruction, denying preservice teachers the opportunity to practice and experience teaching in a student- centered, technology integrated learning environment. Given the effectiveness of integrating technology in constructivist teaching environments, this article presents strategies for moving preservice teaching environments from that of direct instruction to technology-integrated learning environments. This study builds further understanding of the issue of teacher preparation programs preparing preservice teachers to effectively use technology to improve student learning in constructivist learning environments, while those same preservice teachers encounter numerous technology integration barriers in their internship experiences (NCES, 2007).

Review of the literature

Constructivist teaching practices have been espoused by learning theorists dating to the progressive movements of John Dewey and Lev Vygotsky in the early 20th century (Dewey, 1916; Vygotsky, 1978). Dewey and his followers were proponents of schools in which children direct learning based on their own personal interests (Brameld, 1971; Dewey, 1916; Kilpatrick, 1951). Dewey (1916, 1938) felt it imperative for knowledge acquired in schools to be presented in a medium related to associated life. Vygotsky (1978) felt that teachers could provide good instruction by finding out where each child was in his or her development and building on the child's experiences. A consistent theme among constructivist learning theories is that an individual learner must build knowledge and skills (Bruner, 1990). With the evolution of computer technology, teacher education programs have utilized this multiple perspective, student-centered learning approach to learning in preparing preservice teachers to integrate technology in the classroom.

Papert's (1993) pioneering success in using computer applications to have students direct their own learning and problem solving, provided research-based evidence early in the evolution of the microcomputer in education, as to the effectiveness of technology applications in the classroom. Papert's (1993) research provided further evidence that the blending of constructivism and technology to optimize learning.

In the development of their Mindtools theory, Jonassen and Reeves (1996) presented the notion that technologies should be used as construction tools that students learn with, not from. Jonassen effectively incorporated the constructivist theories of his predecessors into an integrated view of technology and instruction. Jonassen's constructivism focused on knowledge construction via computer applications, not knowledge reproduction, with the belief that one constructs knowledge from one's experiences, mental structures, and beliefs that are used to interpret objects and events., Papert (1993), Jonassen (1991), Jonassen and Reeves (1996), and Jonassen and Carr (2000) demonstrated that constructivist teaching practices, when used in technology-based learning environments, help students learn in contextual fashions that better approach real world situations than traditional directed-teaching models.

Constructivist classroom technology integration for the purposes of this study is defined and measured by *The Levels of Teaching Innovation (LoTi) Digital Age Survey* (Moersch, 2009), a validated tool for assessing the technology integration levels and teaching dispositions of the mentor teachers and the preservice teachers in this proposed research study. The *LoTi* model details eight levels of technology implementation/integration as outlined in Table 1.

Table 1

LoTi levels

LoTi Level	Description
Non-use (0),	Instruction does not involve the use of any digital technology.
Awareness (1)	Technology is used for administrative purposes/the students may use technology as a non-instructional reward,
Exploration (2)	Students use technology to support direct instruction/ mastery learning.
Infusion (3)	Students use digital tools and resources to answer teacher directed questions.
Integration-Mechanical (4a)	Students use technology to answer student directed questions that dictate content, process, and products embedded in the learning experience.
Integration- Routine (4b)	Students are fully engaged in authentic learning; teacher is comfortable promoting inquiry-based learning.
Expansion (5)	Technology collaborations for authentic learning extend beyond the classroom.
Refinement (6)	Curriculum is entirely learner-based, with there being no division of instruction and digital resources.

Preservice teachers who have taken a college-based technology integration course have positive attitudes towards technology integration (Bai & Ertmer, 2008; NCES, 2007). The mentor teacher's technology integration predispositions (skills and attitudes) are a crucial factor in the preservice teacher being supported in technology integration efforts (Grove et al., 2004; Brush et al., 2008; Bai & Ertmer, 2008). The National Center for Educational Statistics (NCES, 2007) established that 53% of mentor teachers do not demonstrate a willingness to integrate technology into their classrooms. A knowledgeable mentor teacher, and adequate access to technology, is needed for preservice teachers to practice and implement "student-centered" technology lessons (Brush et al., 2008; Grove et al., 2004).

Even when the mentor teacher has positive technology integration predispositions/attitudes, the complexity of PreK-12 classrooms presents an array of potential barriers to effective technology integration. Moreover, only half of schools surveyed (1439) indicated that their preservice teachers were able to practice the technology related skills and knowledge they acquired in their coursework during their field experiences (NCES 2007). Barriers contributing to the inability to practice these skills in field experiences include (a) competing priorities in the classroom (74 %), (b) available technology infrastructure in the schools (73%), (c) lack of training or skill (64 %), (d) time (62 %), and (e) willingness (53 %) on the part of supervising teacher/mentor teacher to integrate technology in their classrooms (NCES, 2007). The mentor teacher's role is that of an expert and defines the level in which the preservice teacher (a novice) is able to integrate technology in the respective internship experiences. The essence of this relationship is defined by cognitive apprenticeship theory.

Measuring technology integration in purposeful, authentic problem-solving environments is at the core of the *LoTi* Model and an essential factor in understanding technology integration. The ideal internship experience presents the preservice teacher with authentic opportunities to integrate technology under the direction of the mentor teacher. The preservice teacher serves in the role of an apprentice, while being guided by the mentor teacher's pedagogical practices and beliefs. The internship-based teaching experience has historically resembled an apprenticeship where the preservice teacher serves as an apprentice to the mentor teacher (Szuberla, 1997).

Theoretical framework

Cognitive apprenticeship theory served as the theoretical framework for this research study.

Cognitive apprenticeship theory, as it applies to the internship-based teaching experience, builds on the foundation of a traditional apprenticeship, with the mentor teacher serving in the role of master teacher and the preservice teacher serving as the apprentice (Keough, Dole, and Hudson, 2006). Collins, Brown and Newman (1989) noted that a cognitive apprenticeship differs from the traditional apprenticeship in that the cognitive apprenticeship is more focused on learning through guided experience. As with constructivism, the preservice teacher assumes responsibility for their own learning under the guidance of their mentor teacher. The role of the mentor teacher changes in this process, moving from a traditional mentor to a guide for the preservice teacher to construct their own knowledge (Keough, et al., 2006).

The role of the mentor teacher is pivotal in preservice teachers' ability to integrate the technology integration strategies embedded in teacher preparation program coursework. PreK-12 students learn best when technology integration strategies are embedded in a constructivist learning environment (Jonassen, 1991; Jonassen & Carr, 2000; Jonassen et al., 1998; Papert, 1993; Prensky, 2009; Ringstaff et al., 1996). Every teacher preparation program using mentor/apprenticeship, must examine factors impacting the learning environment. This is imperative to provide optimal learning for all participants in the internship experiences. The context of this research acknowledges the limitations and assumptions regarding the multiple variables in classroom environments affecting the integration of technology.

Statement of the problem

Preservice teachers have been prepared to effectively use technology to improve student learning, but as preservice teachers enter their internship-based teaching experiences, they encounter numerous barriers to technology integration related to the complexities of PreK-12 classrooms (NCES, 2007). Little data exists to account for technology integration opportunities in internship experiences. Technology integration predispositions of the preservice teachers and technology integration predispositions of their respective mentor teachers, along with classroom environmental factors are unique to internship-based teaching experiences and require further examination.

Research questions

The following questions were used to guide this study. The questions are drawn from factors outlined in the literature review.

- What is the relationship between preservice teacher predispositions towards constructivist technology integration and the level in which preservice teachers integrate technology in internship experiences?

- What is the relationship between mentor teacher predispositions towards constructivist technology integration and the level in which preservice teachers integrate technology in internship experiences?
- What is the relationship between technology resources available and the level in which preservice teachers integrate technology in internship teaching experiences?
- What is the relationship between other variables (e.g. time, emphasis on traditional teaching methods etc.) and the level in which preservice teachers integrate technology in internship experiences?

Methods

Research design

This research study was conducted using elements of concurrent and sequential mixed-methods design. Concurrent design involves the concurrent, but separate, collection and analysis of qualitative and quantitative data (Creswell, 2003). Given the multitude of factors influencing learning interaction in the internship experiences, both quantitative and qualitative methodologies were needed to address the research questions. This mixed-methods approach provided the strengths of qualitative and quantitative methodologies, while providing a stronger corroboration of research findings than the use of a single methodology (Creswell, 2003). Data collection for this research was done in three phases. The initial phase of the study was conducted prior to the internship experiences and involved distributing an online survey instrument, the *Select Project Skills Survey Items (SPSSI)* to the preservice teachers. Concurrently, mentor teachers completed the *LoTi Survey (LoTiM),* designed by Moersch (2009) to assess the levels of technology implementation in their respective teaching environments prior to the internships.

The second phase of the study involved data collection, via journals, at three intervals during the internship experiences. This is reflective of sequential design as the collection of data during the internship experiences sequentially followed the concurrent collection of data via the mentor and preservice teacher surveys (Creswell, 2003). To account for the range of classroom challenges and the unpredictable nature of instructional environments, preservice teachers maintained semi-structured journals, via the *Preservice Teacher Technology Journal Entries (PTTJE)*. The final phase of the study involved the preservice teachers completing the *LoTiP*, upon completion of the internship experiences to assess the levels of technology implementation achieved during the internship experiences.

Participants and research setting

A convenience sampling technique was used and consisted of the preservice teachers and their respective mentor teachers engaged in internship experiences. The preservice teachers, involved in this study, were enrolled in a teacher preparation program at a mid-Atlantic University, while the mentor teachers were employed by a local public school system. From a pool of 106 preservice teachers and 106 mentor teachers, 35 preservice teachers and 46 mentor teachers participated in the study. Twenty-nine preservice teachers completed all of the assessment tools.

All participants were provided with an overview of the research study, notified that results of all data collected would remain confidential, informed of the data collection instruments used, informed that their involvement was voluntary, and asked to sign a consent form. The study adhered to the IRB policies of the University and the school system.

The preservice teacher participants completed their internship experiences in K-12 classrooms. Demographic data indicated the following profile of the preservice teachers: 31 (89%) were placed in elementary school settings; 34 (97%) had no previous teaching experience; and 32 (91%) were daily computer users.

The descriptive mentor teacher data portrays a group of highly educated mentor teachers (78% with master's degrees) who use varied instructional styles (78%). These same mentor teachers acknowledged the significance of technology integration as either important or very important (98%). Only 26% had received more than 30 formal hours of technology training over the past five years, but 98% participated in technology sharing sessions. These data indicate that mentor teachers were receptive to technology integration in their classrooms.

Instrumentation

Data were collected using the three aforementioned instruments: *SPSSI, LoTiP/LoTiM* and *PTTJE.* This *SPSSI* was designed to measure technology integration in teacher preparation courses, and used to measure the technology integration competencies of preservice teachers (Anonymous, 2005). Validation of the *SPSSI* was achieved via review by experts in the educational technology field. The Cronbach's Alpha for the 28 *SPSSI* items implemented in this study was .929.

The mentor teachers and preservice teachers completed the *LoTi Digital Age Survey* (*LoTiM and LoTiP).* The *LoTi Digital Age Survey* calculates the *LoTi* score based on a participant's response to 37 questions that address student use of classroom technology.

The preservice teachers completed a series of three online journal prompts, at two-week intervals as part of the *PTTJE.* The *PTTJE* included the following open-ended writing prompts:

- What teaching resources, specifically technology resources, have you found helpful in meeting the instructional needs of your students?
- Describe how access to technology resources might have contributed to, or inhibited student learning.
- If you did not utilize technology resources during this past journal period, briefly explain the circumstances.

Data collection

Quantitative and qualitative methodologies were used to collect data. The research questions were based on the themes driven by the existing research in the field. The themes affecting technology integration in internship experiences include: preservice teacher dispositions (research question 1), mentor teacher dispositions (research question 2), technology resources available (research question 3) and other technology integration variables (research question 4).

Preservice teacher predispositions

Data were collected to assess preservice teacher dispositions prior to the internship experiences via the *SPSII* (pre) and post internship via the *LoTiP*. The quantitative analysis involved using *SPSS* to conduct a correlation analysis between the overall *SPSSI* technology competencies and related *LoTiP* competencies to determine if a relationship existed between the overall preservice teacher predispositions towards technology integration (*via the SPSSI*) and the overall level in which preservice teachers' integrated technology in the internship experiences (*via the LoTiP*). A correlation coefficient was run and reviewed using a scatterplot to determine if the graphic view of the related competency scores was consistent with the correlation coefficient. A descriptive analysis of the frequencies of responses was conducted to determine if any relationships existed not evident in the correlation analysis, and the scatter plot graph.

A correlation analysis was conducted between individual *SPSSI* technology competencies and related *LoTiP* competencies using *SPSS*. This analysis was to determine if a relationship existed between the individual preservice teacher technology integration predispositions and the overall level in which preservice teachers' integrated technology in the internship experiences.

Mentor teacher predispositions

Data were collected related to mentor teacher predispositions via the *LoTiM* and the *LoTiP*. *SPSS* was utilized to conduct a correlation coefficient analysis between the overall *LoTiM* score and related overall *LoTiP score.* This analysis was conducted to determine if a relationship existed between the overall mentor teacher technology predispositions and the overall level in which preservice teachers' integrated technology in the internship experiences. A correlation coefficient was run and then reviewed using a scatterplot to determine if the graphic was consistent with the correlation coefficient. A descriptive analysis of frequencies of responses was conducted to determine if any relationships existed not evident in the correlation analysis, and the scatter plot graph.

Process two determined if a relationship existed between the individual mentor teacher technology predispositions (measured by 37 individual competencies via the *LoTiM*) and the level in which preservice teachers' integrated technology in internship experiences for those same respective 37 competencies (measured by the *LoTiP*). Correlation coefficient analyses were conducted between the mentor teacher and preservice teacher responses for each of the *LoTi* competencies. This analysis was completed to determine if there was a relationship between the mentor and preservice teacher competencies for each of the items.

Technology resources available

Quantitative analysis.

The quantitative analysis assessed technology resources available using *SPSS.* A descriptive analysis of *LoTiM* and *LoTiP* of items related to the availability of resources was conducted. Several *LoTiP* and *LoTiM* demographic questions and survey items served as data points. These aggregate data were analyzed to provide a profile of all the barriers encountered in the internship experiences, including access to resources.

Qualitative analysis.

Qualitative data were obtained, online, through the *PTTJE* journal entries*.* All qualitative data collected were coded by the researcher and then separately by two graduate assistants. The data were coded based on themes determined by each coder. Using multiple coders to obtain inter-coder agreement in qualitative inquiry can improve the reliability of qualitative data (Lombard, Snyder-Duch, and Bracken, 2002). The merging of the three coding themes revealed accord among the coders across several categories/themes.

The resulting thematic data were then merged into consensus themes and categories. The categories were correlated with the research question. A *Master Content Coding (MCC)* scheme was used for the qualitative data in which the research instrument, categories, and themes were assigned a code. This process was based on a variation of a coding theme by Barkin, Ryan, and Gelberg (1999) in which data are converted into pile sort data and then into a quote-by-quote similarity matrix. An abbreviation code was assigned to each point in the content code. For example, the *MCC* abbreviation code of Q3aJS represents: question three (Q3a), journal entries (J), and Smartboards (S). Table 2 illustrates a sample from the *Master Content Coding (MC*C) scheme used for research question 3a.

Building on the *MCC*, journal responses were organized, by adding categories associated with the themes, into a *Research Question Responses Database* (*RQR*). The *RQR* includes: a unique identifier for each response; the *MCC* scheme determined for each response; the preservice teacher's responses from the *PTTJE*; and the categories and themes assigned to each respective response. A portion of the *RQR* classification for question 3 is represented in table 2.

Table 2

Sample master content code

Research Question	Research Instrument	Themes	Content Code
(Q3a) The relationship between technology resources available and the level in which preservice teachers integrate technology in internship experiences.	(J) Journal Entries	(S) Smartboard/Promethean Board Use	Q3aJCS
		(A)ActivInspire	Q3aJCA

Note. Within the first table entry, Q3a = the research question correlated with the data, (J) = the research instrument (*PTTJE*) used to collect the data, and (S) = the specific theme (Smartboard) identified by the researcher. The content code (e.g. Q3aJCS) = a combination of the abbreviations for each heading in the *MCC*.

Table 3

Sample research question responses database (RQR)

Research Question (RQ)	Master Content Code (MCC)	Participant (P)	Preservice Teacher Responses (PR)	Categories	Themes
3a	Q3aJCS	1	ActivInspire on the Smartboard, ELMO, Brain Pop Jr!, Safari Montage, (Internet source)	(C) Contributing Resources	(S) Smartboard/ Promethean Board Use

Note. Within the first table entry, Q3a = the research question correlated with the data, (J) represents the research instrument (*PTTJE*) used to collect the data, C = the category correlated with the guiding question, and (S) = the specific theme (Smartboard) identified by the researcher. The content code (e.g. Q3aJCS) = a combination of the abbreviations for each heading in the *MCC*.

Triangulation of data.

Data triangulation worksheets were used to analyze the qualitative and quantitative data. The *Decision Making Matrix* (*DMM*) was included in the data triangulation worksheets to analyze the *LoTiM, LoTiP* and *PTTJE* data. Figure 1 contains a sampling of the *DMM* for research question 3a.

Other technology integration variables

Quantitative analysis.

The quantitative analysis, for assessing other technology integration variables, involved using *SPSS* to conduct a descriptive analysis of *LoTiP* items related to other technology integration variables. The *LoTiP* survey prompted the preservice teachers to rank their greatest obstacles to technology integration in their internship experiences. Several *LoTiP* demographic questions and survey items served as data points for question 3b (other variables related to technology integration). *SPSS* was used to aggregate the responses to provide a profile of the barriers encountered in the internship experiences including access to resources.

Greatest obstacles to technology integration

Criteria	N
Access to technology	29 (24%)
Time to learn, practice, and plan	32 (27%)
Other priorities (e.g., statewide testing, new textbook adoptions)	30 (26%)

Computers in the preservice classrooms

Criteria	N
More than five computers	2 (6%)
Three to five computers	17 (45%)
One to two computers	14 (40%)
Zero computers	2 (6%)

Summary of *PTTJE* Data
MCC for contributing resources

Category	Themes	N (use)
(C) Contributing Resources	(S) Smartboard/Promethean Board use	11 (52%)
	(A)ActiveInspire	3 (14%)
	(EL) ELMO (Document Camera)	9 (43%)
	(S) *Safari Montage* (Multimedia Database)	4 (19%)
	(C) Computers /Laptops/IPods(general)	4 (19%)
	(V) Video, Audio, and Images File	1 (4%)
	(G) General Contributions	

Figure 1. Decision making matrix –research question 3a

Qualitative analysis.

The *PTTJE* survey data provided an open-ended *PTTJE* prompt directly related to assessing other technology integration variables providing an opportunity for the preservice teachers to reflect technology resources that contributed to, or inhibited student learning. Data triangulation worksheets were again used to analyze the qualitative and quantitative data for research question 3b. The *Decision Making Matrix* (*DMM*) was included in the data triangulation worksheets to analyze the *LoTiP and PTTJE* data. Applicable data from the *LoTiM* and *PTTJE* were posted in the worksheets.

Results

Forty-six mentor teachers completed the *LoTiM.* Twenty-six (56%) of the mentor teachers self-rated scores were at *LoTi* levels 1 and 2. Seven (15%) of the mentor teachers scored at level 3, 7 (15%) scored at level 4a, and 6 (13%) scored at level 4b. None (0%) of the mentor teachers scored at the levels 5 or 6, the highest levels of the *LoTi* scale. The overall mentor teachers' *LoTi* level was at level 2, the exploration level.

The preservice teachers completed the *LoTiP* at the conclusions of their internship experiences. Thirty-one (60%) of the preservice teachers self-rated scores were at *LoTi* levels 1 and 2. Four (11%) of the preservice teachers scored at level 3, 9 (26%) scored at level 4b, and 1 (3%) scored at level 6. The overall preservice teachers' *LoTi* level was a level 2, the exploration level; this is consistent with the overall *LoTi* level of the mentor teachers. "At, *Loti* level 2 the exploration level, the instructional focus emphasizes content understanding and supports mastery learning and direct instruction. Teacher questioning and/or student learning focuses on lower levels of student cognitive processing (e.g., knowledge, comprehension) using the available digital assets" (Moersch, 2009, p.4). This profile of the preservice teachers' technology competency skills, derived from the *LoTiP* data provide a baseline context for the analysis of each research question.

Preservice teacher dispositions

Preservice teachers completed the SPSSI in an effort to measure dispositions. The overall *SPSSI* mean was 3.53 and the mean *LoTiP* score was 2.63. The overall scores of both survey instruments were not significantly correlated (r = .190, n = 29, p = .324). There was no significant relationship between the overall preservice teacher predispositions towards technology integration and the level in which preservice teachers' integrated technology in internship experiences.

The second part in examining preservice teacher dispositions, involved determining if there were significant relationships between the preservice teachers' individual predispositions and technology skills, and the actual levels of implementation of those skills (as measured by the SPSSI and *LoTiP*) in the internship experiences. These analyses indicate no relationship existed between the overall preservice teacher competency levels (and preservice teacher competency preparation) with preservice teacher *LoTiP* rates of implementation in the internship experiences among the following competencies: assistive technologies, audio, video and multimedia, blogs, digital tools for research, spreadsheets, presentation software, and collaborative productivity tools.

The statistical analysis revealed that significant positive relationships existed between several individual *SPSSI* and *LoTiP* technology integration cross-referenced competencies including: web page development (r =.540, n = 29, p = .003); wikis for multimedia projects (r =.588, n =29, p = .001); wikis for communication to parents, peers and students (r = .378, n = 29, p = .043); assigning web projects (r =.477, n = 29, p =.009); digital tools to collaborate, publish or interact (r =.429, n =29, p = .02); and using technology resources for higher order thinking (r = .389, n = 29, p =.037). These analyses indicate a relationship existed between these individual preservice teacher competency levels (and preservice teacher competency preparation) with preservice teacher rates of implementation in the internship experiences. A common theme among these significantly correlated competencies was the use of the Internet/Web based tools for classroom use (see Table 4).

Table 4

SPSSI individual competencies and LoTiP competencies

Competency	*SPSSI* Mean	*LoTiP* Mean	N	r	Sig.
Assigning web projects	1.96	1.82	29	.477**	.009
Digital tools to collaborate	3.10	3.17	29	.429*	.020
Using technology resources for higher order thinking	3.00	3.62	29	.389*	.037
Web page development	3.00	1.79	29	.540**	.003
Wikis for communication	2.76	2.66	29	.378*	.043
Wikis for multimedia projects	2.76	1.79	29	.588**	.001

*p < .05, two-tailed. **p< .01, two-tailed.

Additional analysis, of the significant correlations included using frequency charts in conjunction with scatter plot graph data to further investigate any potential relationships that might exist among the data not revealed with the correlation coefficients. An example of this scatter plot graph and frequency table analysis is illustrated in figure 2. An examination of the scatter plot graph and the frequency tables of responses for assigning web projects (r = .477, n = 29, p =.009) provides a visual representation of the relationship between the *SPSSI* and *LoTiP* responses for assigning web projects. The frequency chart data indicates that, while there was a significant relationship between the preservice teachers' levels of preparation (as measure by the *SPSSI*) and the preservice teachers' levels of implementation of assigning web projects (as measured by the *LoTiP*), 15 of 29 preservice teachers never assigned web projects in their internships. The *SPSSI* data discloses that 15 preservice teachers indicated nonuse or basic awareness of assigning web projects. An examination of the scatter plot graph, in figure 2, reveals that those who were not prepared to assign web projects, largely did not assign web projects in the internships.

Conversely, the scatter plot graph reveals a cluster of data in the upper right quadrant indicating that those who were prepared to implement web projects did assign web projects in their IBTE. The scatter plot graph regression line reveals a coefficient of determination of .22 indicating that 22% of the *LoTiP* score can be accounted for by the corresponding *SPSSI* score and vice-versa.

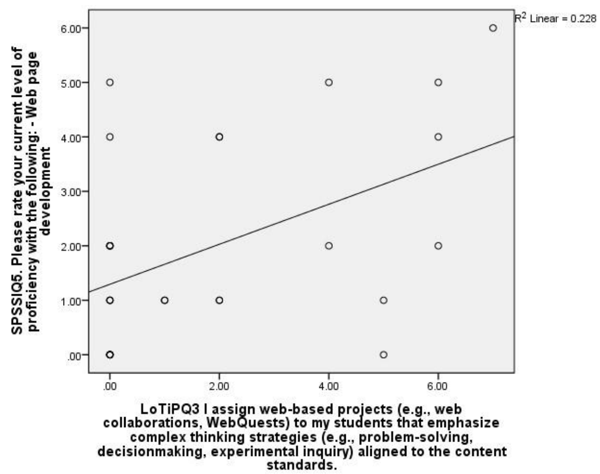

Figure 2. Frequency chart and scatter plot graph for assigning web projects (r=.477)

A similar pattern of responses is seen in the scatter plot graph (see figure 3) for web page development (r =.540, n = 29, p = .003). This example presents a cluster of data points in the lower left quadrant indicating little or no-use in preparation as measured by the *SPSSI* and low use in the IBTE as measured by the *LoTi;* and conversely higher levels of preparation are correlated with higher levels of use.

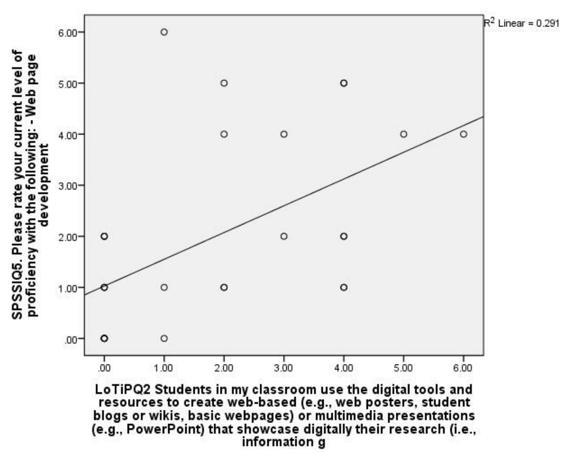

Figure 3. **Scatter Plot Graph for Web Page Development (r=.540)**

A final example is presented in a comparison of the scatter plot graphs for wikis for multimedia projects (r =.588, n =29, p = .001) (figure 7), and for wikis for communication to parents, peers and students (r = .378, n = 29, p = .043). Figure 4 reveals clusters of data in both graphs indicating non-use of wikis in internships, consistent with a lack of preparation in the use of wikis. The remaining data points are scattered among a range of scores indicating preservice teacher preparation in the use of wikis correlated with levels of implementation and use of wikis in internships.

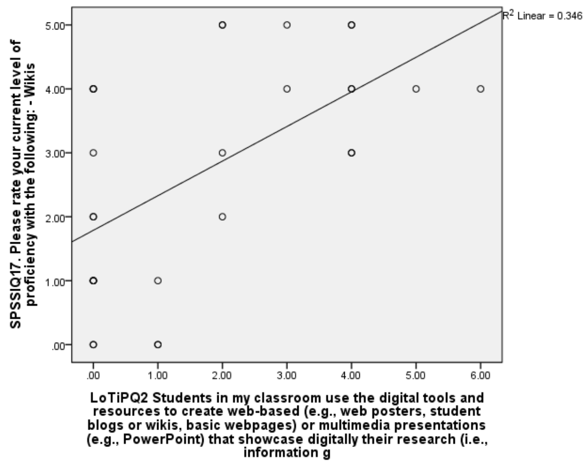

Figure 4. Scatter Plot Graph for Wikis for Multimedia Projects. (r=.588)

In the cases of insignificant correlations, outlying data points were noted and the correlation coefficients were recalculated without the outlying data to determine if any significant results could be found. No other significant results were found.

Mentor teacher dispositions

A correlation coefficient was calculated between the overall *LoTiM* and the *LoTiP* scores to determine if there was a relationship between the mentor teachers' overall technology skills and predispositions, as measured by the *LoTiM,* with the preservice teachers' overall levels of technology implementation in the internship experiences, as measured by the *LoTiP*. The overall *LoTiM* mean was 2.58, and the mean *LoTiP* score was 2.78. At a *LoTi* level 2 (Exploration), the instructional focus emphasizes content understanding and supports mastery learning and direct instruction. Teacher questioning and/or student learning focuses on lower levels of student cognitive processing (e.g., knowledge, comprehension) using the available digital assets (Moersch, 2009, p.4).

The overall scores of both survey instruments were not significantly correlated (r = .087, n = 18, p = .730). These results indicate that there was no significant relationship between the overall mentor teacher predispositions towards technology integration and the level in which preservice teachers' integrated technology in internship experiences.

The analysis of mentor teachers' individual predispositions and technology skills, as measured by the *LoTiM* items and the preservice teachers' implementation revealed two significant relationships between the mentor preservice teachers' responses among the 37 competencies assessed in the *LoTiP* and *LoTiM* surveys. The two significant relationships were for modeling students the safe and legal use of digital tools and resources (r = -.628, n = 18, p = .005), and students identify important real world issues or problems then use collaborative tools and human resources beyond the school to solve them (r = .-563, n =18, p = .015). The negative correlations are indicative of higher preservice teacher scores in relation to their respective mentors' scores for the competency. These inverse relationships are represented in Figure 5. Frequency charts were used in conjunction with the scatter plot graph data to further investigate any potential relationships that might exist among the data, not revealed with the correlation coefficients. In some cases, outlying data points were noted and the correlation coefficients were recalculated without the outlying data to determine if any significant results could be found. No other significant results were found. The frequency charts and graphs supported that no significant relationship existed among corresponding *LoTiM* and *LoTiP* competencies.

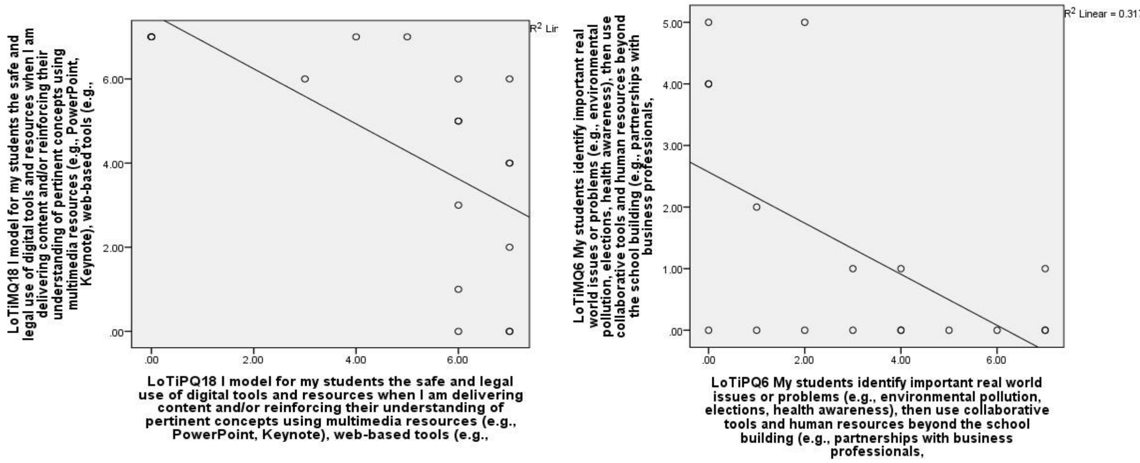

***Figure 5*. Scatterplot for modeling safe and legal use of resources (-.628)**

Technology resources available

Technology resources available were analyzed using quantitative data from the *LoTiP* survey and qualitative data from the *Preservice Teacher Technology Journal Entries (PTTJE)*. The *PTTJE* survey consisted of three open-end journal prompts to provide a "picture" of the technology resources used in the internship-based experiences. The *LoTiP* survey prompted preservice teachers to list obstacles to technology integration in their internship experiences. The selection criteria were based on four research- driven variables. Those criteria, as listed in Table 5, are: access to technology; time to learn, practice, and plan; other priorities (e.g., statewide testing, new textbook adoptions); and lack of staff development opportunities. Access to resources was an overriding theme from the *PTTJE*. The journal entries were largely positive reflections regarding access to resources. The journal entries from the preservice teachers indicated the effectiveness of using interactive whiteboards in the classroom; eleven preservice teachers (52%) cited using interactive whiteboards with their students.

Table 5
Greatest obstacles to technology integration

Criteria	N
Access to technology	29 (24%)
Time to learn, practice, and plan	32 (27%)
Other priorities (e.g., statewide testing, new textbook adoptions)	30 (26%)
Lack of staff development opportunities	26 (21%)

Three (14%) preservice teachers specifically cited using *ActivInspire* software which is an indication of using whiteboards at a higher level of interaction than just displaying computer content via the whiteboard, for example. Nine (43%) preservice teachers referenced using "the

ELMO" which is a document camera. Eight preservice (38%) teachers used websites designed for student educational use. Eight (38%) preservice teachers noted using websites designed for teachers including for designing instruction. Three (14%) preservice teachers cited using *PowerPoint*; one student noted advanced use of *PowerPoint* via the inclusion of animations in the *PowerPoint* presentations. Four (19%) preservice teachers indicated general use of computers during their internship experiences. While not systemic, three (14%) of the preservice teachers noted limited access to resources as a barrier to technology integration. Two of the three preservice teachers noted a lack of resources in their classroom, while the other noted problems with the technology not working in their classroom.

Two preservice (6%) teachers noted, via the *LoTiP*, not having any computers in their teaching environments. While computer hardware may have been readily available in a majority of the teaching environments, 29 (24%) of the preservice teachers, via the *LoTiP,* noted access to resources as their primary obstacle to technology integration. This is confounded by only three (14%) of the preservice teachers having cited access limitations in their journal entries.

Other variables and technology integration

The *LoTiP* survey asked preservice teachers to list their greatest obstacles to technology integration in their internship experiences. Twenty-nine (24%) preservice teachers noted access to technology as the primary obstacle, 32 (27%) noted time to learn and practice as the primary obstacle, 30 (26%) noted other priorities (e.g., statewide testing, new textbook adoptions) as the primary obstacle, and 26 (21%) preservice teachers noted lack of staff development opportunities as the primary obstacle.

The *PTTJE* survey data was also used to analyze other variables related to technology integration. One of the open-ended *PTTJE* prompts permitted preservice teachers to reflect on how access to technology resources might have contributed to, or inhibited student learning.

Preservice teachers' responses to this journal prompt were largely focused on descriptors related to the effect on technology integration. Non-thematic or general concerns by individual preservice teachers included: "students needed a computer class as they lacked the basic computer skills which got in the way of learning"; "technology can be restricting if used incorrectly; students can be inhibited if tech is overused"; "technology can't be exclusive of processes"; "technology provides opportunities for cheating; hardware is unreliable, and sources on the Internet are not permanent".

Eleven (52%) of the preservice teachers cited ways in which technology was used to help and/or expand student learning. This included comments like, "the internet resources help students think beyond themselves"; "technology helps students with different learning styles"; and "resources help me develop more challenging lessons."

Eight (38%) of the preservice teachers cited ways in which the technology was engaging; seven (33%) cited ways in which the technology was motivating. Responses included, "the students want to pay attention because the technology is more fun than direct instruction", "technology engages and motivates students - they want to be the one who gets to press the buttons for Brain Pop or come up and write on the ELMO", and "technology motivates students to participate in the lesson, this usually contributes to their learning."

Four preservice teachers (19%) noted instances, in which technology was inhibiting, particularly when the use of technology is not well-planned, over-used or not used properly, and when resources are not working or are temporarily unavailable (e.g. Internet connection is lost). Three (14%) preservice teachers cited instances where the technology provides too much information, and gets in the way of learning. There was no mention, in the *LoTiP* survey or the *PTTJE*, of the mentor teachers as an obstacle to technology integration.

Discussion: preservice teachers and mentor teacher dispositions

The mentor teacher's technology integration predispositions are a crucial factor in supporting preservice teacher technology integration efforts (Bai & Ertmer, 2008; Brush et al., 2008; Grove et al., 2004). Twenty-nine (63%) of the mentor teachers, who participated in this study, had taken technology integration coursework, and 31 (67%) of the mentor teachers rated technology integration as very important. This figure (67%) compares favorably to the NCES (2007) figure of 53% of mentor teachers who nationally did not demonstrate a willingness to integrate technology into their classrooms.

Analysis of the *LoTiM, LoTiP and PTTJE* indicated no relationship existed between the overall mentor teachers' predispositions and the preservice teachers' levels of technology integration in this study, however, there were still instances of preservice teachers integrating individual technology competencies based on an analysis of individual predispositions/competencies. Table 6 highlights the significant relationships determined to exist between a portion of the pre-internship individual integration skills, strategies and competencies and the levels in which preservice teachers' integrated those respective competencies in their internship experiences. A major finding in this study is that the preservice teachers were successful in implementing competencies in which they had positive attitudes and skills levels as measured by the *SPSSI.*

Table 6

Preservice Teacher SPSSI Individual Competencies and LoTiP Competencies

Competency	SPSSI Mean	LoTiP Mean	N	r	Sig.
Assigning web projects	1.96	1.82	29	.477**	.009
Digital tools to collaborate	3.10	3.17	29	.429*	.020
Using technology resources for higher order thinking	3.00	3.62	29	.389*	.037
Web page development	3.00	1.79	29	.540**	.003
Wikis for communication	2.76	2.66	29	.378*	.043
Wikis for multimedia projects	2.76	1.79	29	.588**	.001

*p < .05, two-tailed. **p< .01, two-tailed.

The *PTTJE* entries were revealing in that none of the preservice teachers listed their mentor teacher as either a positive or negative influence towards integrating technology in the internship experiences. This is supported through the data which showed no significant correlation ($r = .087$, $n = 18$, $p = .730$) between the *LoTiM* overall mean score in relation to the overall *LoTiP* mean. Based on the analysis of the *LoTiM and PTTJE* data, the influence of the mentor teachers, in this study, on technology integration in the internship experiences is not clearly defined. To further advance the research in the field, further study of the relationship between the mentor teachers' technology dispositions and levels of technology use among preservice teachers is warranted by these results.

Technology resources available

The literature indicated that, in addition to a supportive mentor teacher, access to technology is needed for preservice teachers to practice and implement "student-centered" technology lessons

(Brush et al., 2008; Grove et al., 2004). Limited access to resources was noted in 29 (24%) of the *LoTiP* responses. These findings support the NCES (2007) study of teacher education programs which noted access to resources as a barrier to technology integration, at least to some extent, in 92% of internship experiences, and as a primary barrier to technology integration.

Journal entries supported access to and the use of a variety of hardware, software and web-based technology integration tools in the internship experiences. Despite the positive access to technology cited in the *PTTJE*, 29 (24%) of *LoTiP* responses indicated access to resources as a barrier to technology integration in the internship experiences. This discrepancy between the *PTTJE* and *LoTiP* data may be attributable to the preservice teachers being more willing to share their positive efforts toward technology integration, and being less willing to focus on specific barriers to technology integration. This variance requires further study of access to technology resources in the internship experiences.

Future research

Based on the results of this study, recommendations for preservice teacher programs technology integration preparation and recommendations to advance research in the field are presented. Continued evolution of the relationship, between the University and the local school systems, should include: conducting needs assessments of issues related to technology integration, collectively sharing resources, participating in school-based technology integration professional development programs and the sharing of best instructional practices. Consistent with the cognitive apprenticeship framework, University faculty can promote technology integration by modeling integration strategies in the PreK-12 teaching environments. The University should coordinate technology integration professional development opportunities for the preservice teachers, mentor teachers and other school-based personnel. Supporting and strengthening the internship experience for the mentor teacher, is essential to have an effective application of the cognitive apprenticeship framework.

Teacher preparation programs must consider technology resources available in actual internship-based teaching environments, as well as resources that will be available in the future. Using the recommendations provided by the *LoTi Connection* and data gathered by ongoing needs assessment, opportunities for technology integration professional development should be provided for mentor and preservice teachers. These opportunities could include sponsored opportunities for mentor teachers to take technology integration coursework that will maintain their certification. The case for technology- integrated constructivist teaching practices must be carried beyond the local levels to state and national levels to those who drive policy at the state and national levels to the effectiveness of technology- integrated learning environments.

Mishra and Kolher (2006) noted that Colleges of Education are moving towards modeling technology integration strategies in all teacher preparation coursework. Consideration should be given to administering the technology integration strategies in all coursework and in coursework concurrent with the internships permitting application of coursework concepts in a co-existing clinical environment.

The levels of technology integration can be increased by requiring internship-based action research or capstone projects focused on technology integration. Dawson and Dana (2007), and Wentworth, Graham and Tripp (2008) found these types of internship-based research projects to be effective in creating opportunities for technology integration.

Conclusion

Given recent and ongoing changes in national curriculum and teacher assessment, additional research is needed to determine the impact of these changes on technology integration in internship-based teaching environments. This study should be replicated with a larger population of mentor and preservice teachers to permit multiple regression analysis for the prediction of the levels of technology integration from the known value of two or more of the identified barriers to technology integration.

Consistency must be attained in the instructional methodologies promoted by Colleges of Education and local public school systems. The instructional strategies selected should be based on research citing optimal student learning. Research presented in this study supports that PreK-12 students learn best in technology-integrated constructivist learning environments. It is imperative that teacher preparation programs and public school systems work together to provide preservice teachers with the technology-integrated constructivist learning environments in which they can teach to their highest capabilities. Failure to do so will result in preservice teachers not implementing the technology- integrated constructivist skills and strategies proven to optimize learning.

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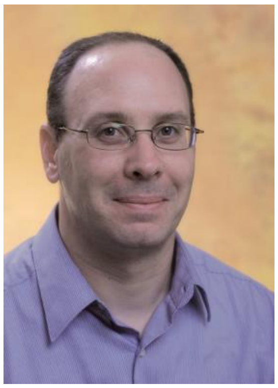
About the authors

Dr. David Robinson is an Assistant Professor Technology in the Department of Educational Technology and Literacy, College of Education at Towson University. Dr. Robinson's recent publications focus teacher technology preparation, Quality Matters and Universal Design for Learning. Dr. Robinson is a program director for Master of Science Instructional Technology Program (school library media concentration) at Towson University.

Email: derobins@towson.edu



Dr. Bill Sadera is a professor of Instructional Technology in the College of Education at Towson University. Dr. Sadera's recent publications focus on a variety of subjects including teacher technology preparation, one-to-one learning environments and Universal Design for Learning. Dr. Sadera is also the director of the Instructional technology Doctoral Program at Towson University.

Email: bsadera@towson.edu

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Editor's Note: There is little doubt that visualization of mathematical concepts can contribte substantially to interpretation and understanding of mathematics. It is especially useful as a teaching tool, and for discovery, analysis, diagnosis and problem solving by learners. It is essential for teachers and learners to test and compare the various software available to ensure maximum effectiveness and impact for their investment.

The impact of using GeoGebra software in achievement and problem solving ability

Bahjat Altakhyneh
Jordan

Abstract

The study aimed at investigating the impact of using GeoGebra software on achievement and problem solving ability on teaching functions of the elementary private schools. The study sample consisted of 100 students selected from 9th Grade of the Loulouat Tareq Private School for the 2014/2015 academic year. The sample was divided into two groups; experimental group (n=51) was taught to use functions of GeoGebra software , and the control group (n=49) was taught by conventional methods of teaching. Findings of study revealed that there were significant statistical differences in the achievement and problem solving ability in favor of experimental group.

Keywords: teaching, Geogebra software, problem solving

Introduction:

Mathematics is an academic and effective proven tool for the progress of science and technology, but there is a sense of dissatisfaction that teaching and learning of mathematics suffers from disadvantages in the content, methods of teaching, learning activities, and achievement of learners in all academic levels.

One of the most globally and locally negative aspects in teaching and learning mathematics that there is weakness in all levels of achievement, and severe shortages of students having the basic skills, the use of modern technology and the ability to employ technology in mathematics, and the inability in analytical thinking when solving math problems, as well as the inability to resolve the typical or unusual issues (Obaid, 2004).

The results of International Studies (TIMSS) in math and science that the performance of Jordan students is still low in the math skills, especially in geometry where the percentage of correct answers were (18.8%) of the whole test, also the results revealed a clear weakness in solving mathematical problems (Masri et al., 2000).

The technical changes and the rapid flow of information left obvious repercussions on education, and the reliance on technology became an urgent necessity, to correlate technology and education, and to improve the student role in the learning process, and openness to the broad prospects of developments, so the development of teaching methods, and renewing new techniques were needed to provide students with knowledge, skills and tendencies, attitudes and ways of thinking to ensure continuity in their education, and competition in the labor market, hence the idea of education emerged using computer programs that develop thinking among students and help them to raise the level of mathematical achievement.

Software contributes to make mathematics as laboratory material, through the learner's use of the visual means, and the tools offered by the software, which enhances the mathematical concepts, and the learner will reach by himself to the correct conclusions about concepts, laws and mathematical theories stemming from the graphical environment of software, and thus contribute to the development of his skills, and expand his horizon and his ability to solve mathematical problems, and offer deeper understanding of the functions, its drawing and solving the associated equations with them (Al-Jasser, 2012).

Computer is used in teaching mathematics, and development of mathematical skills, thinking skills, and the development of problem-solving skills such as planning, implementation, designing, and use of ready software in the mathematical themes, spreadsheet and databases, and others are examples of the used programs in the current teaching.

One of the most effective software applications that has emerged recently that contributes to the enhancement of students achievement is GeoGebra software. It helps students in functions drawing, and finding out the roots of the accompanying equations of functions, and infer relationships from the drawing of functions such as drag to the right, or left, or top, or bottom; it is an interesting and attractive tool, it also develops thinking.

Many studies and researches indicate many advantages of using a computer in mathematics education: contribute to solving problems, development of skills, algorithm thinking, strategic meditation to assign the steps of solution, manage the process of thinking, simulation of experiments and positive interaction with scientific material. The study of mathematics as an experimental visual subject uses various graphic representations to extract conclusions and relationships (Al-Jasser, 2012).

The National Council of Teachers of Mathematics (NCTM) confirms the need to use technology during teaching mathematics. It is an important tool in teaching and learning mathematics to support effective education and learning. It has an impact on the quality of math being taught (NCTM, 2000) and uses technology models to teach mathematics problem-solving. This model helps students to solve problems in an inductive manner, and encourages them to creatively apply induction, innovation and logical thinking to build self-reliance to solve everyday problems.

GeoGebra software is based on scientific standards approved by the Ministry of Education. This software was developed by Markus Hohenwarter with an international team of a programmers at the University of Florida Atlantic. It is designed in a manner that enables students to develop a deep understanding of the theories and mathematical facts through practical application of the discovery of the concepts. It is a set of tools that includes aids to make the learning process easy and interesting based on the constructivist theory of learning (Hohenwarter, 2012).

The philosophy of the program is that every student can learn if given an adequate opportunity to learn and solve problems, develop speed, and enhance ability. Programming is based on the concept of learning-by-doing to master different skills. The software slogan means that the student rises up to the mathematical concept by himself (Hohenwarter, 2012).

GeoGebra software aims at helping students to understand concepts and represent them in a tangible manner, connect mathematical ideas with each other, connect math to life through enactive problems, build self-confidence, develop of self-learning skills, improve math achievement, develop thinking skills, develop a positive attitude towards mathematics and achieve maximum ability (Abu Thabet, 2013).

This software is considered a dynamic mathematical database designed to teach mathematics at all levels of study; it combines Algebra, Geometry, and Calculus, and consists of three different windows: Graphic View, Algebra View, and Spreadsheet View.

GeoGebra functions as one of the important subjects scheduled in Basic Ninth Grade for Jordan students to study representation of functions graphically and find the roots of quadratic equations, by drawing functions associated with equations. The software builds confidence and educational opportunities for students to discover characteristics and rules. For example, when students are asked to solve the quadratic equation: x^2+4=zero, the student realizes, through the software, that there are no real roots oriented to the x-axis at any point. Discovery is facilitated by associations and development of the student's ability to draw. For example, to draw a $f(x) = x^2-4$, the student first draws $g(x) = x^2$ using the software, and then draws $f(x) = x^2-4$, and realizes by drawing that $f(x)=g(x)-4$ by shifting down 4 units, and so on.

A study by Ash (2005) aimed at identifying the impact of teaching with the help of educational software in the achievement of mathematics in the middle stage. The sample of the study was divided into two groups: a control group studied in a traditional way, and an experimental group studied in the traditional way with an addition of one hour of computer-aided learning with help of educational software. The results of the study showed superiority of the experimental group.

Al-Jasser (2012) conducted a study aimed at investigating the impact of GeoGebra software on student achievement in mathematics in the city of Arar. The results showed superiority of the experimental group that used the GeoGebra software for immediate and delayed achievement tests in mathematics.

Abu Thabet (2013) discussed the effectiveness of using GeoGebra software to teach “the circle” to Basic Ninth-Grade students in Nablus educational area. The sample was divided into two groups: experimental group used GeoGebra software; the control group learned in the traditional way. The study results showed superiority of the experimental group in both the immediate and delayed achievement tests.

Fattouh (2008) investigated the impact of using a program for geometric drawing to acquire the concepts of “geometrical transformations” among Ninth-Grade students. Study results showed superiority of the experimental group using geometrical drawing program for coordinates and geometrical transformations in both the acquisition of the concepts of geometrical transfers, and the development of the level of the geometric thinking and the three levels of Van Hale.

A study was conducted by (Tutkn & Oztruk, 2013) aimed at investigating the effectiveness of GeoGebra software to increase the academic achievement, and levels of geometric thinking Van Hale. 52 students in Basic Eighth Grade were divided into an experimental group using GeoGebra software and a control group that did not use computers. The study showed superior achievement and interpretation for the experimental group. However, the software was not as effective in the increasing level of thinking and there was no significant difference in level of knowledge and application. No relationship was found between achievement and the level of geometrical thinking.

Alenzi(2013) conducted a study aimed at investigating the effectiveness of GeoGebra software for acquisition of geometrical concepts by First Secondary Grade students. The sample consisted of 50 students of the Hail region – The experimental group used GeoGebra software, and the control group did not. Results of study showed a superiority of the experimental group.

Bhagat and Chun (2015) examined the effect of GeoGebra software in geometrical concepts teaching in the achievement of 50 students in the Ninth Grade in the eastern region of India. Results of study showed superiority of the experimental group that studied using the software compare to the control group.

Damrplk and Ozkale (2014) investigated the effect of GeoGebra software in achievement and trends for mathematics students in one high schools in southwest Turkey. The study results showed superiority of the group that used GeoGebra software in student's attitudes towards mathematics but did not indicate any increase in student achievement in mathematics.

GeoGebra software used in teaching mathematics and derivatives, as indicated in Verhoef et. al. (2015) study to increase conviction of Teachers of Mathematics in the secondary level in Japan to use GeoGebra software. Also Ku and Karadaj (2013) aimed to enhance performance of middle school students in the study of algebra topics by using computer programs such as GeoGebra software. The study pointed out the value of the software in understanding basic algebra concepts such as the equal sign between functions. The software provides tables and interactive graphics showing equal sign between two functions and increases the students' ability to compare and comprehend the subject of the functions

Caglayan (2014)) studied the perspectives of teachers of mathematics in middle schools for the use of GeoGebra software in functions representation, inequalities, logarithmic functions, and exponential functions. Results of the study revealed that the software provides an interactive environment to enhance understanding of mathematical concepts.

Problem of study:

Studies and international researches indicate students in Arab countries are weak in mathematics caused by lack of basics and lack of teacher's use of educational tools in teaching mathematics. Students believe that math is not important in their life. This leads to negative trends for students who study mathematics; they see it as a complex subject, feel that learning mathematics is not suitable for them, and that whatever they have mastered, learning will not be proficient.

This problem is apparent when students are faced with mathematical problems. Most educational theories and studies focus on the need to use teaching aids without losing sight of the teacher's role. It was necessary to study this aspect in order to identify the role of teaching aids in teaching mathematics, especially the Ninth Basic Grade in the circle unit, and to focus on the importance of teaching aids in mathematics education. The US National Council (NCTM) recommended the teachers of mathematics to grant an opportunity for students to use educational aids which embody mathematical concepts and help them to move from the abstract stage to the perceived stage (Abu Thabet, 2013).

In terms of teaching geometry to the primary stage, students at the global level suffer from many difficulties; the most important of them focus on the deductive aspects, and formal demonstration, without paying attention to the new mathematical operations, such as geometric sense, and the use of technology for teaching functions. (The Egyptian Association for Mathematics Education, 2007).

During the researcher's visits to schools in the Directorate of Education in the capital Amman, and through some meetings with teachers of mathematics at schools that there is a lack of using teaching aids and computer software in modern mathematics education, especially in geometrical subjects, and low achievement of student in mathematics in general, and in mathematics of the Ninth Grade in the unit of functions, that appeared in disability in the geometry concepts, included in the unit of functions, due to focus on the abstract side in teaching without trying to involve teaching aids and computer software to simplify the concepts of students instilled in their minds, as well as through field interviews with students felt by students from getting bored during their study of this unit. You must enter the incentive element of this unit. This can be achieved only through educational means, and appropriate computer software, designed to achieve specific educational goals.

Depending on the importance of the engagement of the technology component of the curriculum, and the use of modern software, such as GeoGebra software (and to ensure its effectiveness in increasing students' achievement, and developing their ability to solve problems in the unit of functions. The problem of the current study represented in an attempt to answer the main question in the study which is:

> What is the impact of using GeoGebra software in functions teaching in the achievement and the problem solving ability of elementary school students in private education sector?

This question is divided into the following sections:

1. What is the impact of using GeoGebra software in functions of teaching in the achievement of elementary school students in private education sector?
2. Does achievement in the unit of functions unit differ among private school students in functions Unit according to gender?
3. What is the impact of using GeoGebra software in the teaching functions in ability in problem solving of elementary school students in private education sector?
4. Does the ability in problem solving in the unit of functions differ among private school students according to gender?

Hypothesis of study:

H1: There is a significant statistically difference ($\alpha \leq 0.05$) between the means of the experimental group that studied using (GeoGebra software), and the controlling group who studied in the traditional method in achievement.

H2: There is a significant statistically difference ($\alpha \leq 0.05$) between the means of male and female students in achievement.

H3 There is a significant statistically difference ($\alpha \leq 0.05$) between the means of the experimental group that studied using (GeoGebra software), and the controlling group studied in the traditional method in the ability of problem solving.

H4 There is a significant statistically difference ($\alpha \leq 0.05$) between the means of male and female students in the ability of problem solving.

Importance of study:

The importance of study lies in the need to adopt the principle of technology as one of the principles of the US National Council (NCTM) in Education, and learning mathematics, and the introduction of modern advanced software in the curriculum as the principle of technology supports the students learning, supports effective education, has a significant impact on the nature of mathematics, increases the motivation of students, and encourages them to find solutions, develop the ability to think, and the functions are one of the important topics in mathematics (NCTM, 2000).

The importance of this study also stems from the importance of teaching strategy, with the help of programs that offer a great opportunity for students to participate, extrapolate information, and reach results.

This study provides models of math lessons in the subject of the functions for teachers in both private and public education programs, to take them into consideration when teaching math topics, and perhaps this strategy helps teachers in math education in public and private education schools.

Terminologies of study:

Teaching with the help of GeoGebra software: defined as the strategy of using GeoGebra software. This strategy is based on the representation of functions, and its drawing and solving problems and exercises with the help of this software.

Achievement: the set of concepts, principles, mathematical skills included in the unit of function that is acquired by students after teaching this unit, measured by the marks obtained by students in the achievement test included in the current study, and prepared by the researcher.

Ability of problem solving: means the production of new and various relations and solutions for problems, and exercises independently, and not already known to the student. It is measured by students' marks in the ability of problem solving test in the unit of functions included in the current study, and prepared by the researcher.

Limits of study and its determinants:

The current study was limited to the following:

- Unit of functions scheduled to the Basic Ninth Grade students during the first semester of 2014/2015.
- Private Schools in the Amman city.
- Results of the current study are determined by the validity, reliability and stability of the used tools.

Subjects: The sample of study consisted of 100 students from Basic Ninth Grade students for the academic year 2014/2015 enrolled in the first semester 2014/2015 at the School of Tareq Pearl, in Amman strip, the sample is divided into two groups: the experimental group consisted of 51 students, 24 males and 27females, and the controlling group consisted of 49 students, 26 males and 23females.

Tools of study:

Achievement test:

The researcher prepared the achievement test. First, the unit of functions was analyzed into its main elements (concepts, skills, principles, problem solving). The objectives of the unit were also identified and classified according to cognitive levels (remembering, understanding, application, and high thinking levels. And finally specifications table was designed to see how many questions there were in the test.

The achievement test consisted of 28 questions with a total mark 60 adjusted to be of 100. To check the reability of the test, the researcher applied the test on an exploratory sample twice a difference of two weeks, and the correlation coefficient between the two applications was calculated and it to be 0.8. In addition, to check the validity, the test was presented to a group of arbitrators of specialists and experts in the field of teaching methods of mathematics, some paragraphs were modified and some were deleted in light of observations.

Ability of Problem solving test:

The Preparation of Ability of Problem solving test passed through the following steps:

1. Access to the theoretical literature on the ability of problem solving, and to translate the concept of the ability of problem solving, represented in the application of concepts, principles, and skills, related to the functions in many different and new situations, where the student does not see a clear path to a solution.
2. Preparation of the test paragraphs, which are 16 as mentioned before, about the applications of mathematics in different subjects, in physics such as the calculation of: time, distance, and speed, and in the subject of the economy, such as the calculation of: quantities, profit increasing, loss, time, and reduce the costs, and the subject of geometry

in mathematics, such as the calculation of: areas, lengths, and mathematical games in addition to multiple uses.

3. To check the validity, the test was presented to a group of arbitrators of specialists and experts in the field of methods of teaching mathematics, some paragraphs were modified and some were deleted in the light of observations.

Test reliability:

The test reliability was tested by applying it to the exploratory sample (of the study subjects) using the internal consistency of the test paragraphs, and the coefficient of reliability was calculated using Cronbach's alpha equation (α), where it was (0.78).

Calculations of the difficulty and the ability of discrimination coefficients:

The difficulty and ability of discrimination coefficients of the test paragraphs were calculated after it was applied to the exploratory sample, where the difficulty coefficient ranged between (0.25-0.65), as well as the ability of discrimination coefficient for each paragraph of the test ranged between (0.32-0.82).

Teacher's Guide in the geometrical unit of functions:

The preparation of a guide for the teachers, according to the use of GeoGebra software in teaching the unit of functions, where the mathematics teacher training on the use of the software, as well as provide him with GeoGebra evidence included in this study, and train the students to use this software. The content is taught through this software, and the teaching of the unit lessons goes according to the following steps:

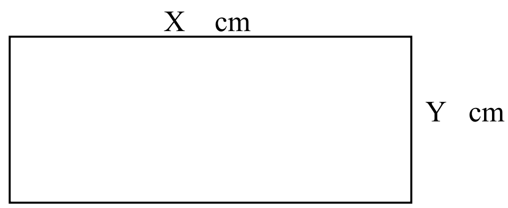
Identify the specific goals (behavioral):

- Identify the most important previous requirements.
- Present a situation from the daily life, explaining the role of the teacher and the student in resolving the situation.
- Install GeoGebra software on computers, where students are taught in the computer lab.
- Train students to use GeoGebra and motivate students to learn through the software.
- The teacher presents an example and solves it using GeoGebra software
- The teacher asks the students to solve examples and exercises through GeoGebra software.
- Identify classroom assignments and homework.

The following example explains that:

- **Title of the Lesson**: zeroes of function.
- Specific objectives:
- The student finds the zeroes of quadratic function through the graphical representation.
- The student employs GeoGebra software in solving practical problems.
- **The role of the teacher**: teacher poses the following question to stir the students: the two dimensions of rectangular changing so that its perimeter stays 24 cm, Muhammad wanted to know the length when its area became 20 cm 2, how can you find out the length of the rectangle?

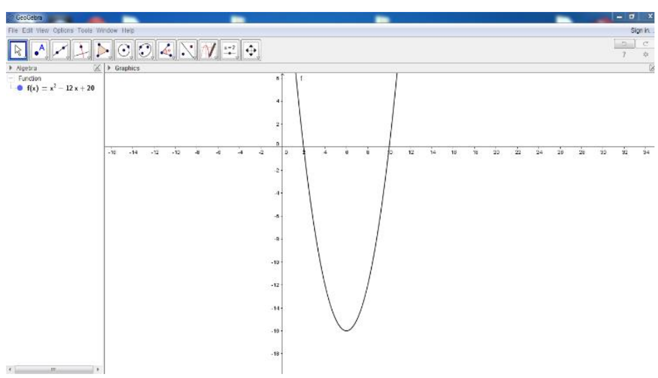
- The teacher asks the students to read the question, understand, identifying data, and the required, composition of the associated equation of the issue.
- The role of student: his role is reading and understanding the problem and determining the relationship associated with the issue.
- Associated relations: the student draws a rectangle, and assumes that the length = x cm, and width = y cm



- Rectangle perimeter = 2 × x + 2 × y, so 2x +2y= 24 and so x + y = 12 (1)
- As well as the rectangle = x × y, so x × y = 20 we can rewrite this equation as follows:

$$y = 20 / x \qquad (2)$$

- By compensation equation (2) in the equation (1) the student finds that x^2-12x +20 = zero
- The quadratic function which is associated with the quadratic equation f(x) = x^2-12x +20
- The role of the teacher: directing the students to use GeoGebra software as an assistant in finding zeroes of function.
- The role of the student: uses GeoGebra software to find zeroes of the function.
- Student draws a quadratic function through GeoGebra software.



Through the drawing, the student concludes that the zeroes of quadratic function are= {2, 10}

This means that the length of the rectangle = 10 cm, and width = 2 cm

The role of the teacher: ask the following question: are there other ways to find zeroes of the function?

The role of students: the student used the idea of analysis.

The student analyzes x^2-12x +20 = (x-2) (x -10), and then finds the zeroes of quadratic equation {2, 10}.

The role of the teacher: the teacher asks students to form quadratic equations and solve them from the drawing. And so on….

Procedures of study:

The current study have passed the following actions:

- Access to the theoretical literature on the use of modern computer software, and the employed methods in teaching mathematics.
- Training on GeoGebra software, get the manual training.
- Analysis of the unit content of study to identify concepts, principles, skills, problem solving, and to create the analysis validity.
- Prepare the achievement, and problem solving ability tests, presented to the judgments, and applied on a survey sample to determine validity and reliability.
- Choosing the sample of the study in a deliberate manner and randomly divided into two groups: one is controlling and the other experimental and verify equivalence between them both in terms of variables, such as: the previous achievement in mathematics during the previous school year.
- Teacher training / parameter-based process of teaching students the experimental group on the use of GeoGebra software.
- Teaching the unit of functions for the students of the experimental group with the help of GeoGebra software using manual, and display various examples of the teacher on educational situations to use the software and teaching at the same time for students in the controlling group using the traditional method of teaching.
- Apply both of the post achievements, and of post problem solving ability tests on the experimental and controlling group's students.
- Analysis of the results of study.
- Provide suggestions and recommendations.

Variables of the study:

Independent variable: the teaching method has two levels :(teaching strategy using GeoGebra software, and the traditional method of teaching).

Dependent variables: dependent variables in this study are: achievement, to problems solving ability.

Statistical design: to answer the questions of study, the means, standard deviations, frequent distributions, and covariance analysis (ANCOVA) were used.

Results of the study and discussion:

The present study sought to investigate the impact of the use of teaching with the help of GeoGebra software in achievement and problems solving ability in the teaching of functions of the elementary private students, to answer the first two questions:

1. What is the impact of using GeoGebra software in functions of teaching in the achievement of elementary school students in private education sector?
2. Does achievement in the unit of functions unit differ among private school students in functions Unit according to gender?

Was finding the arithmetic means, and standard deviations for signs of students in achievement test in both the experimental and controlling groups, as evidenced by the following table:

Table 1
Arithmetic means and standard deviations for grades of students in achievement test in both the experimental and control groups

		number	mean	St.dev
Experimental group	male	24	73.5	10.4
	female	27	73.1	9.9
	total	51	73.3	10
Control group	male	26	64.5	9.7
	female	23	59.9	7.6
	total	49	62.3	9
total		100	67.9	11

We notice from the above mentioned table that the arithmetic mean in achievement of the experimental group was (73.3) is higher than the arithmetic mean of the controlling group (62.3), and the arithmetic mean of the males in the experimental group (73.5) is higher than the arithmetic mean of the males in the control group (64.5), also notice the superiority of females of the experimental group, where the average (73.1) on the controlling group, where the average is (59.9).

To exploring about the significance of differences between the means of the experimental group and controlling group student's signs in the achievement, used covariant analysis (ANCOVA), as shown in the table as follows:

Table2
Analysis of covariance (ANCOVA) results for significance differences between the means of thinking styles groups in teaching skills

Source of variation	Sum of squares	d.f	Mean squares	f	Significance level
Covariance variable	63.22	1	63.22	0.696	0.406
group	3108.37	1	3108.37	34.21	*0.000
gender	98.03	1	98.03	1.1	0.302
Group*gender	99.71	1	99.71	1.1	0.298
error	8632.43	95	99.87		
total	11955.4	99			

Significance at the level of ($\alpha \leq 0.01$).

The results indicate in table (2) the existence of a statistically significant effect of the variable group ($f = 34.21$, $\alpha = 0.000$) in favor of the experimental group that used the GeoGebra software, and there is no impact of the variable gender ($f = 1.1$, $\alpha = 0.302$), and there is no impact of the interaction between the group and gender ($P = 1.1$, $\alpha = 0.298$).

So we reject the first null hypothesis, that states: there is a significant statistically difference ($\alpha \leq 0.05$) between the means of the experimental group that studied using (GeoGebra software), and the controlling group who studied in the traditional method in achievement and accepting the second null hypotheses, which states: there is a significant statistically difference ($\alpha \leq 0.05$) between the means of male and female students in achievement.

This result is attributable to the software (Doruk and others, 2013) used in teaching mathematics, it provides an opportunity for students to think , to discover the knowledge, and the conviction of teachers in the use of software has a great role in perfecting mathematical skills, and ability to solve problems.

And GeoGebra software (Hall, 2013) provides a new mechanism to improve the methods of teaching math, increase the capacity for mathematical thinking, achievement of the students, and out on the standard routine in traditional ways, and in line with the constructivist theory in the knowledge-student building itself, how the software education led to increase students' motivation to learn created alternative and modern ways of learning.

Its features are provided by the software (Botana and others, 2015) to boost funding for students in problem-solving time, and to provide evidence of the theories in a short time. Also provided software integration among branches of mathematics is integrated engineering reparation, and provides tables of data and explain the different concepts in a visible and clear manner.

To answer the 3rd and 4th questions of the study:

3. What is the impact of using GeoGebra software in the teaching functions in ability in problem solving of elementary school students in private education sector?
4. Does the ability in problem solving in the unit of functions differ among private school students according to gender?

Was finding the arithmetic means and standard deviations for signs of students in problem solving ability test in both the experimental and controlling groups, as evidenced by the following table:

Table 3
Arithmetic means and standard deviations for grades of students in problem solving ability test in both the experimental and controlling groups

		number	mean	St.dev
Experimental group	male	24	68.58	10.39
	female	27	68.22	9.86
	total	51	68.39	10.01
Control group	male	26	59.26	10.00
	female	23	55.47	7.47
	total	49	57.48	9.02
total		100	63.05	10.96

Note from the above mentioned table that the means in the ability to solve problems, the experimental group was (68.39), higher than the arithmetic average of the controlling group (57.48), and the arithmetic average of the males in the experimental group (68.58) is higher than the arithmetic mean of males in the controlling group (59.26), outweighing the students in the experimental group also notices the average (68.22) on the controlling group, where the average is (55.47).

To explore the significance of the differences between the means of the experimental group, and the controlling in the ability to solve problems, used covariant analysis (ANCOVA), as shown in the table below:

Table 4
Analysis of covariance (ANCOVA) results for significance differences between means of thinking styles groups in teaching skills

Source of variation	Sum of squares	d.f	Mean squares	f	Significance
Covariance variable	182.684	1	182.68	2.02	0.158
Group	3086.09	1	3086.09	34.23	*0.000
Gender	47.24	1	47.24	0.524	0.471
Group*gender	57.45	1	57.45	0.637	0.427
Error	8564.67	95	90.154		
Total	11894.75	99			

* Significance at the level of ($\alpha \leq 0.01$)

The results indicate the table (4), existence of the effect of a statistically significant variable group ($f = 34.23$, $\alpha = 0.000$) and in favor of the experimental group that used the GeoGebra software, and no impact of the variable sex ($f = 0.524$, $\alpha = 0.471$), and no impact of the interaction between the group and gender ($f = 0.637$, $\alpha = 0.427$).

Thus, we reject the third null hypothesis that states: there is a significant statistically difference ($\alpha \leq 0.05$) between the means of the experimental group that studied using (GeoGebra software), and the controlling group studied in the traditional method in the ability of problem solving.

And accept the fourth null hypothesis that states: there is a significant statistically difference ($\alpha \leq 0.05$) between the means of male and female students in the ability of problem solving.

This result is attributable to teaching with the help of GeoGebra software, A modern software. Through programming a student discovers the information all by himself. Programming and able student use easily, advantages of this software ability to increase motivation for students, and increase the thrill of demand element interactive.

Programming Educational (Wan & Sulaiman, 2013), provides place for students to connect each other's information, and provide the opportunity for students to discover the knowledge of themselves, as well as being an alternative to the traditional methods of teaching.

And it is also used in (McGuffey, 2015) to understand playing strategies, and the development of theories of sports that lead to students' understanding of concepts in greater depth, and students can develop their discoveries through play, and increase their ability to solve problems.

Educational software (Prodromou, 014) has the ability to illustrate concepts, and ability to solve problems in different mathematics: Algebra, Geometry topics, Statistics and Probability, Associations, Conic sections, Calculus, calculate areas and volumes, and educational programming shortens the time, provides effort, and immediate feedback to the learner.

Recommendations:

The researcher recommends using software GeoGebra in teaching mathematics, introduction of technology element in teaching of mathematics various topics, and training of teachers of mathematics, and students on the use of modern programs such as: GeoGebra software that increase student achievement, and develops the ability to solve problems in mathematics, and increases students' motivation to learn.

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About the author:

Dr. Bahjat Altakhyneh is from the Arab Open University - Jordan Branch.

eMail: B_takahyneh@aou.edu.jo

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Editor's Note: This study takes us beyond evaluation of learning outcomes and learner satisfaction to embrace the perception of relevance and quality by other stakeholders such as instructional designers and developers, university administrators, funding managers and sources, and future employers.

Recommendations for implementing quality in classless e-learning systems

Tamer Sameer AbdEl-Badea AbdEl-Gawad
Egypt

Abstract

The research aims to identify quality in e-learning, describes the development of a model, based on original research, describing the characteristics associated with the successful deployment of technology evidenced in higher education, and the recommendations for implementing quality in e-learning. Further, a discussion of "the classless e-learning" terminology is presented. Research findings illustrate the importance of quality for the accreditation of e-learning systems and demonstrate the proposed model that, based on the motivations arising from the challenges: improving the quality of learning, identify the possible stakeholders in determining the quality of e-learning systems, improving access to teaching and learning, and reducing the costs for providers. The suggested model incorporates: stakeholders' satisfaction; learning outcomes; environment facilities; and evaluation during development. The findings also revealed groups of recommendations for learners, designers, and administrators to accomplish quality in e-learning systems.

Keywords: e-learning, quality in e-learning, critical success factors, Egyptian higher education, e-learning in higher education, recommendations for implementing quality in e-learning

Introduction

"Excellence, by definition, is a state only the few rather than the many can attain"
Logan Wilson's foreword to Cartter's report (Cartter, 1964)

The constant search for quality in face-to-face (FTF) learning without reaching a solid framework to accomplish the desired quality in the learning environment might have generated a state of disbelief in the existence of such terms in the field of education. Quality in education is an issue of great debates that greatly exercise politicians as well as the academic commentators (Ehlers, 2004).

Similarly, in the field of e-learning, many attempts have been made to reach the desired framework for conceptualising and structuring quality in e-learning systems. This research outlines the formation stages of a framework (model) for identifying quality in e-learning systems. This research tries to answer the next questions: what is the meaning of quality in e-learning? Why quality in e-learning? How to implement and evaluate quality in e-learning systems? And what are the recommendations to attain such quality in e-learning systems?

Quality in e-learning systems

The researcher's suggestion is to identify "classless e-learning" as a means to facilitate the smooth integration of modern technologies inside the Egyptian higher education.

"Classless e-learning" is an idea that came to mind during prayer time. The talking was about the pilgrims and their standing over the mountain 'Arafaat' wearing the same two simple sheets that cover their body without any discrimination between poor and rich or educated and ignorant. The idea of equality among the Muslims that has driven ideas about e-learning as a possible method of delivering learning to all learners without any distinctions, regardless of their learning style and preferences, or background and perceptions. To be able to address all the possible audiences, this is the origin of the term "classless learning" AbdEl-Gawad (2010: p. 1). The concept of 'classless e-learning' is built around concepts that are fully developed in western education: egalitarian, equality, equality of opportunity, regardless of: race; creed; colour; gender; physical ability, special education need, finance or location. (Baker, 2009; Ball, 2012; Calo-Blanco, 2009; Frio, 2012; Lazin, 2010; UNESCO, 2012)

This research explores the recommendations for integrating quality in e-learning arising from the Egyptian higher education learners' views and identifies the pertinent factors that could affect the accomplishment of such quality.

E-learning in Egypt is in its developmental stage. Government conferences, educational organisations and educators have noted that more research that is systematic is needed to develop the best theory and practice of e-learning according to the Egyptian circumstances. Despite impressive advances in hardware and software functionality, the problem of under-utilised new technologies continues. Thus, it is important to understand the conditions under which the Egyptian educational institutions and their learners will embrace e-learning. Because of this, an accelerating movement toward theorising the adoption of e-learning appeared. In particular, theoretical and empirical support has been given to the Technology Acceptance Model (TAM) (Davis, 1989).

The TAM model identifies that an individual's behavioural intention to use a system is determined by two beliefs: 1. Perceived usefulness, defined as the extent to which a person believes that using this new technology will enhance his/her job performance and will increase their opportunities to find better jobs; 2. Perceived ease of use, defined as the extent to which a person believes that using the system will be free of effort (Davis, 1989: p. 320).

With regard to establishing the quality of e-learning, one can identify three categories of research. The first is that research focused on the learning situation provided by the e-learning system, such as Raab (2002) who identified e-learning as "a learning situation where instructors and learners are separated by distance, time, or both". The second category are researchers interested in the technological side of e-learning, such as Sun et al (2008) who identified e-learning as "the use of telecommunication technology to deliver information for education and training". Whilst, the third category evaluates e-learning from the perspectives of relating the above two considerations such as Rosenberg (2001) who identified e-learning as: "the use of Internet technologies to deliver a broad array of solutions that enhance knowledge and performance". One can notice this equality between technology and the pedagogic when he stated that, e-learning is using technology to create an array of solutions and that these two parts have to work together in order to succeed.

This categorisation agrees with the observation of (Smulders, 2003) that a great proportion of the online discussion within the e-learning environment is focused on troubleshooting the technical failings and logistical flaws of the course, with very little discussion about the actual course content focusing on questions, does current e-education benefit from the convenience of the e-learning environment or, are the learners learning something through e-learning courses? The developer has to be aware of the available technologies to create an e-learning system as well as considering the pedagogical strategies used within the e-learning system to best benefit from the e-learning affordances in achieving his/her goals from the e-learning system. The researcher asserts that seekers of quality in e-learning systems try to achieve a balance between the technological and the pedagogical parts when designing an e-learning system. This is a warning not to be so attracted by the new technologies that one forgets all about good pedagogically designed e-learning systems and be too overwhelmed with the new technologies and the promises of potentials and possibilities that come with it, to an extent that these conveniences and innovations may be at the expense of jeopardizing the issue of pedagogy (Chang, 2008: p. 40).

Bates (1997) believes there are four reasons for using technology in higher education: improving the quality of learning; improving access to education and training; reducing the costs of education; and improving the cost-effectiveness of education. Thus, using e-learning is a mean for bringing quality into learning. But what makes an e-learning system a quality one? How to implement such a quality? Remain crucial questions to be answered.

As a proof of the necessity of implementing quality in e-learning systems Sims (2001: p. 2) stated "it is critical that online development projects implement levels of quality control to ensure the learners receive the most effective resources."

E-learning as a method to deliver the curriculum is a very powerful and rich method with many affordances, opportunities, and outcomes. However, it is like any other instrument of teaching, if it did not satisfy the users it will fade away and vanish. Thus, this research defines quality as a mixture of satisfaction: stakeholders' satisfaction with the e-learning system; authorities' satisfaction with e-learning outcomes; community's satisfaction with regard to the sociological impact of the e-learning on learners; the working market's satisfaction with regard to the ability of the learners who have graduated from e-learning systems.

Why quality in e-learning systems?

It could be argued that the most obvious reason for embracing quality in e-learning systems is the growth competition between universities around the world to encourage learners to participate in their online courses, one can see the broaden of MOOCs courses in universities around the world. Inglis (2005: p.2) stated "Universities have wanted to ensure that the standard of the educational products that they have been offering matches the standard of what they are offering onshore."

Ordinary face-to-face (FTF) higher education institutions are increasingly making use of e-learning to support the delivery of their courses and in particular, expanding their e-learning provision through the use of web-based technologies for delivering online and blended courses (Jara, 2009) and more recently MOOCs (Massive Open Online Courses). As a result of the increasing demand for e-learning; universities, governments, accreditation bodies are becoming increasingly interested in identifying the appropriate strategies to assure the quality of e-learning (Parker, 2008).

The definitional challenge associated with the concept of quality, along with its associated concepts (such as quality assurance (QA), quality control, quality management, and quality enhancement), stems from the multidimensional criteria of the quality of learning in higher education. Challenges to traditional perspectives of quality assurance arise, as Green (1994: p. 3) argued, "Since the mid-1980s, public interest in and concern about quality and standards has been intensified by the increasing attention given by successive governments to reforming higher education". The existing quality assurance processes have significant limitations when dealing with e-learning systems. The quality assurance procedures in higher education institutions were designed to assure and enhance the quality of ordinary FTF courses and it is not clear to what extent they remain useful for e-learning courses.

The pursuing of quality in e-learning is highly revealed in the literature showing that quality in e-learning systems is not a myth or illusion. It is a fact, explored by many respected researchers in the field of education. The reason for argument around its existence stems from the exertion that it takes to be implemented in e-learning. Thus, rather than unveiling its structure, requirements, and assurance procedures, it faces claims that it is a myth.

The most significant advantage of e-learning, which determines the quality of an e-learning system, is its ability to host one learner as well as hosting many learners; this is called Scalability – "It is the ability to host from 10 participants to 100 or even 100,000 participants with little extra effort or incremental cost (providing the infrastructure is in place)" Rosenberg (2001: p. 31). The scalability advantage is the engine that generated what is known now as "MOOCs" which have the ability to host massive numbers of students in one online course.

Methodology:

The research adopts a wide context, multi-variant case-study approach Yin (2003: p. xi) using focus group ((Bloor et al. (2001: p. 19); Cohen et al. (2007:p. 228)) and in depth semi-structured interviews to identify the participants' views regarding the factors that they consider are essential to implement quality in e-learning systems within Egyptian higher education. Current literature formed the basis for making decisions about e-learning structure and the methods of investigation. The original schedules were written in English and translated to Arabic. Expert evaluation of the translation of the schedules was made by Arabic-speaking e-learning experts. There was a similar review of the translation of Arabic responses to English before the analysis process.

Learners were given the ability to construct their own focus groups based on social preferences and circumstances because it gave e-learners the freedom to learn when, where, and how they like.

Data was collected over one and half months through "four" focus groups, during which the researcher identified the challenges which the participants found whilst studying via the e-learning system. Five one-on-one interviews (each lasting around 20 minutes) were conducted during which the researcher asked participants about their experiences with e-learning systems and how quality could be successfully implemented.

The implemented computer-maintenance e-learning course was designed for learners entering teaching in a provincial university in northern Egypt. There were over 165 enrolled in the VLE over the semester, with 65 participants completing the course.

The research contains two related steps linked to the research questions. Step one was the implementation of e-learning systems (VLE) to the Egyptian higher education learners to insure they get the experience of dealing and using e-learning systems and to get to know the affordances and the abilities of e-learning in delivering any curriculum. Step two was to collect and analyse the data that contain two stages including open coding, and specific coding process. The open coding process was centred on devising broad themes and patterns of issues or concepts arise from the data collected from the interviews and focus groups.

Following this, a second and more detailed process of classification was devised identifying nodes, sub nodes, tree nodes and utilising a data analysis program to identify the emerging themes. All these procedures are considered from the grounded methods in the qualitative research (Corbin, 1998; Glaser, 1967).

Discussions of results:

The answer of research questions

Answers of the following research questions will be considered. The first research question "What is the suggested model to guide design and evaluate quality in e-learning systems?" incorporates the sub-questions:

- What is quality in e-learning system?

- What are the recommendations to implement quality inside e-learning systems?

What is quality in e-learning systems?

Quality in e-learning is a multidimensional concept involving not only fitness for use or fitness for purpose but also reliability and durability. it means the constant seeking for excellence in the educational process (AbdEl-Gawad, 2010).

The literature on evaluating quality in e-learning systems shows that almost all the evaluation procedures depended on measuring the students' learning as the only criteria to measure the quality of teaching. Hay et al. (2008: p. 1038) stated, "all evaluation depends on measures of 'fitness for purpose', and because teaching has purpose only where it supports learning, learning is the only authentic measure of teaching." But evaluating quality according to learning as the only authentic outcome represents a conflict with the researcher's definition of e-learning quality as a combination of different types of satisfaction:

- Stakeholders' satisfaction with the e-learning system;
- Authority's satisfaction with the e-learning outcomes;
- Communities' satisfaction with regard to the sociological impact of e-learning on students;
- Working market's satisfaction with regard to the abilities of the graduated students from e-learning systems.

Depending on learning as the only authentic measure of teaching have two issues: The first is that the learning process is commonly deemed too complex for empirical measurement; the second issue depends on the obvious fact that while teaching can lead to learning, learning is not a necessary outcome of teaching.

Recommendations for accomplishing quality in e-learning systems?

Though many researchers advocated their research defining the efficacy of e-learning as a method of delivery (New Zealand Council for Educational Research, 2004; Parker, 2008), there are no guarantees that e-learning can overcome all FTF (face-to-face) learning problems. This could be due to the ambiguous provision when it comes to using e-learning as a delivery method in the Egyptian higher education. "Models of learning under e-learning are not as well understood nor accepted as those for traditional higher education learning." Connolly et al (2005: p. 61)

Measurements (metrics and procedures) need to be designed in order to guarantee the effectiveness and enduring satisfaction of e-learning systems. It is important to clarify any misunderstanding regarding the criteria that should be addressed in order to guarantee the implementation and evaluation of quality in e-learning systems. This can then enable institutions of higher education to integrate quality into their e-learning systems.

"The implementation process of quality in e-learning needs to involve all stakeholder groups to develop a relevant online learning strategy and ensure alignment of needs prior to implementation" (Newton, 2002: p. 163). One of the main goals of this research is to present a systematic and practical model capable of enabling institutions of Egyptian HE with all the possible stakeholders to integrate quality into their e-learning systems.

This model for implementing and evaluating quality in e-learning systems was originally designed to host all the possible factors that influence the quality of e-learning systems. The model was first proposed by Abd El-Gawad and Woollard (2009) as a framework to capture the multidimensional aspects of quality in e-learning systems. Further work by Abd El-Gawad & Woollard (2010) encompassed the suggested model with their own understanding of e-learning as a classless learning delivery method. In addition, the suggested model was developed using the gathered data after the implementation of an e-learning system inside the Egyptian higher education sector.

To capture the multidimensional nature of e-learning quality systems, designers and evaluators need to follow guidelines from a number of models and frameworks to design a plan that will collect vital information about whether or not system objectives were met and whether best practices were implemented. As a reflection to this challenge, the researcher proposes a model for designing and evaluating quality in e-learning systems, incorporating: (1) Stakeholders' Satisfaction; (2) Learning Outcome; (3) Learning Environment; (4) Evaluation during Development (see Figure 1 below).

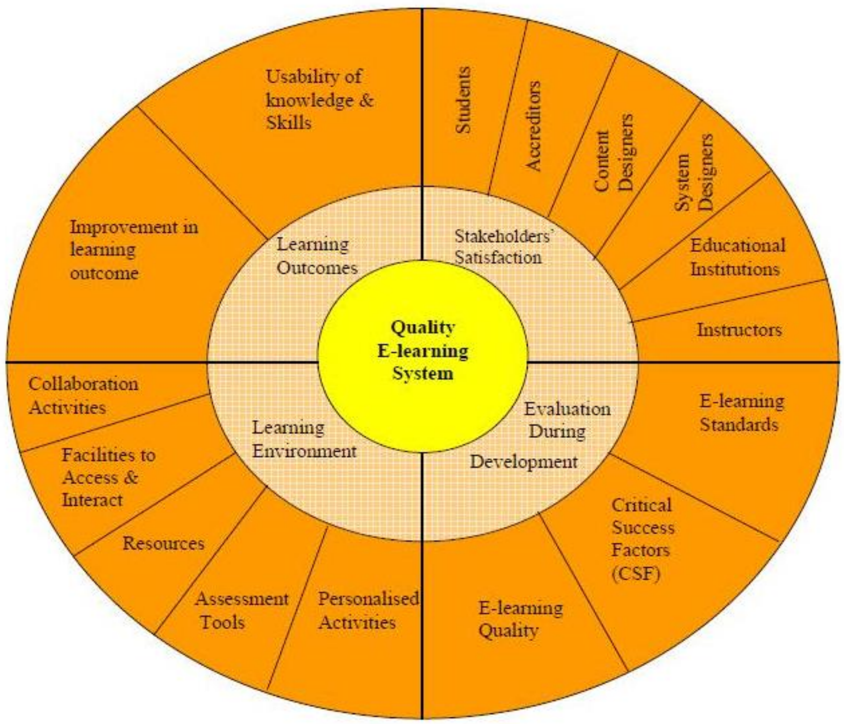

Figure 1: Quality e-learning systems model

The research participants gave recommendations to achieve quality in e-learning that have been grouped into three key categories which include: recommendations for learners; recommendations for designers; and recommendations for administrators.

Recommendations for learners:

The recommendations include changing learners' ways of thinking to guarantee learners' adoption of e-learning systems, and developing the learners' computer and Internet literacy.

Changing learners' thoughts and attitudes towards e-learning as a valuable method to deliver learning, as opposed to being thought of as time-wasting, is supported by El-Zayat & Fell (2000), thereby enabling learners to engage effectively with e-learning. Additionally, trying to change learners' thinking regarding the best method to learn; meaning instead of using solely one method of learning, they should start navigating other methods such as e-learning or blended e-learning. These two changes (from the participants' point of view) are capable of adjusting the Egyptian higher education learners' minds to efficiently engage with e-learning systems.

The participants emphasised that e-learners should attempt to master computer and Internet skills for enabling better participation in e-learning systems. As the participant FG4-2 puts it: “For learners, it is essential for them to know the basics of computer and Internet usage before we come and say to him/her you have to use the Internet in order to learn.”

Research has shown that there are some barriers to the adoption and implementation of successful e-learning systems such as the fact that users will need to master a new set of skills, including the use of online tools, communicate effectively and deal with specific procedures such as passwords, permissions, the need to be open to change, etc. (Ali, 2008; Baldwin-Evans, 2004; New Zealand Council for Educational Research, 2004; Newton, 2002). Similar issues have been noticed amongst the Egyptian higher education e-learners, who suffer from the lack of necessary skills for using e-learning efficiently, e.g. IT skills, mastering the usage of e-learning tools and activities, internet usage skills. This lack of prerequisite skills among new e-learners is supported by literature (Grigg, 1998; Health Libraries Group, 2005: p. 27; Mamary, 2000; Mattheos, 2001; Ouellette, 2002; Washer, 2001). To conclude, with regards to changing current practice, participants recommend that:

- E-learning can be a useful tool for delivering the Egyptian higher education curriculum, though this is dependent on learners perceiving this as a valuable delivery method, rather than seeing it as a waste of time. Therefore, there is a need to address learners’ attitude towards e-learning.
- Effective use of e-learning depends on learners’ mastering the necessary computing and Internet skills. Learners have to possess the necessary prerequisite skills to interact effectively with e-learning systems.

Recommendations for designers:

The participants’ recommendations to e-learning systems designers focused on the constructions of the e-learning system, and the characteristics of e-learning tutors.

The participants emphasised that the constructions of the e-learning system including the interface, the type of activities to be included inside e-learning systems, and periodical learners’ assessment are key factors for the successful implementation of e-learning.

With regards to the interface design, participants indicated that they prefer the e-learning interface to be designed in font size 14 as this size is the best comforting size for their eyes; with regards to colours, participants limited the usage of colours in e-learning interface to no more than three colours and stressed that these colours should be comforting for their eyes, otherwise it will distract their learning; participants accepted using pictures and flash images only for educational reasons, or risk diverting the learner’s attention away from the learning process; participants preferred to manage the virtual learning environment (VLE) layout in the format of weeks where they are allowed to learn about a certain matter in one week; and they suggested that there should be a descriptive title for each resource and activity in the e-learning system, which identifies the type of the resource and activity as well. This suggests that learners consider the VLE interface appearance as an important factor that any e-learning designer has to take into account when s/he tries to design a successful e-learning system.

The participants’ views regarding the construction of the VLE interface is supported by a wealth of literature. For example, Lehmann and Chamberlin (2009) explained that successful e-learning interfaces should be divided into small chunks of information to be learned easily by learners, e-learning systems should provide comprehensive text titles for all graphics and captions, written scripts and for all audio and video files. Finally, Lehmann and Chamberlin argue that red and yellow colours are difficult colours for those with poor eye sight to see online; thus they agree with the participants’ recommendation to use colours that do not strain the eyes when designing e-learning systems. Furthermore, this is supported by Ehlers (2004) calls for designers of e-learning systems to utilise various forms of media (such as audio, visual, movies, texts, etc.) rather than relying purely on text.

Regarding the type of activities to be included in e-learning systems – whether to include personalised and collaborative activities or limit the e-learning system with only one of them – the participants contended that having both kinds of activities is important to provide learners with the freedom to learn and interact as they prefer. Despite participants' preferences toward including personalised and collaborative activities inside e-learning systems, the participants were aware of the challenges of both kinds of activities, which could indicate that they are aware of the e-learning principle aimed at giving learners the freedom to learn according to their preferences. The good example will be the participant FG3-4 statement "The collaborative learning is good and not good; it is good in the collaboration between us in knowledge *and opinions and we came up with new information that we did not have any idea about before. It is not good in the differences between us in the available times: because we cannot agree on a specific time to meet online. Hence, it breaks our online meetings.*" The point this participant was making, that there are challenges with collaboration activities, is fully supported by research that has identified e-learning as a delivery method which needs to take place in "learner-centred" environments that allow for different learning styles and learners' preferences (Clarke, 2004; Ehlers, 2004; New Zealand Council for Educational Research, 2004; Newton, 2002).

Concerning the periodical assessment process to the learners' achievement levels after each unit or each week, in Egypt, there is a famous saying: "There is no learning without assessment". Due to this cultural emphasis on assessment, participants continued to embrace this saying, even in their learning with e-learning. Thus, they wanted the same type of learning (including periodical assessment) they are accustomed to. The participant FG1-1 explained this situation in "*Periodical assessment is better. Because if you evaluated me at the end of the course you will know my final level only but if you periodically evaluated me, then you will have better chances to discover the faults in the e-learning system and be able to solve these faults.*"

On the other hand, periodical assessment during learning with e-learning enables both tutors and learners to recognise their weaknesses in an early stage and try to overcome these weaknesses and continue benefiting from the e-learning system they are undertaking. The necessity of a periodical assessment process for both tutors and learners is supported by literature (Coman, 2002; Kingswood, 2011; Sun et al., 2008).

This recommendation regarding the periodical assessment and its relevant connection with the Egyptian reported above has forced the researcher to compare this statement with one used in the UK: "Assessment for learning" (Black, 2003). The comparison clearly shows that Egyptian learners' views regarding the assessment process as a burden needs to be change into a different understanding as part of the learning process rather than judging whether learning has occurred or not.

Participants explained that e-learning tutors need to obtain certain characteristics including reasonably fast feedback, which enables tutors to maintain the interactivity established with their learners. As the participant FG4-5 puts it: "The feedback should be given in adequate time; it is better to be fast not to delay it for one or two months." Thus, the successful e-learning tutor should be able to give a fast respond to his/her learners to maintain the interactivity established between him/her and the learners.

Additionally, the academic proficiency of the tutor enabling him/her to deliver a high standard of teaching; tutors' ability to monitor and observe his/her learners, which enable them to adjust learners' undesirable behaviours toward the completion of learning processes. As the participant FG3-1 puts it: "Indeed, if the tutor does not understand the curriculum s/he teaches, whatever s/he tries to explain, we will not understand anything.” As a result, it is an essential element to learners to feel that their tutor is capable of delivering the best knowledge to them whether it is through FTF or e-learning system. In addition, the tutors’ positive attitudes toward the curriculum they teach will reinforce the e-learners’ positive attitudes toward the curriculum they are undertaking.

These characteristics shared amongst the participants were also evident in a number of other studies too. For example, the literature reveals many tutors’ characteristics in e-learning systems to increase acceptance and satisfaction among learners including “tutors’ attitudes toward learners, technology mastering skills, and attitudes toward using e-learning units in classrooms” (Selim, 2010: p. 337). The Health Libraries Group (2005) also stresses the importance of tutors obtaining skills and training on IT, information literacy and e-learning development for e-learning to be successfully implemented. Additionally, Ehlers (2004) explained that tutors’ support has been seen as a very important element in judging the quality of an e-learning system, and he defined eight main dimensions of tutor support, including the importance of communication and interaction between the tutor and the learner, an active moderation of learning processes by the tutor and tutors’ abilities to cope with Learners variation in their preferences.

Recommendations for administrators:

Participant recommendations for learning administrators included the necessity of starting learning using e-learning systems at an early age. As the participant FG1-3 puts it: “Start from the younger ages not to start with our ages; we are at faculty, it is not right to start with us. No, you have to start from the beginning ages, from primary schools.” Additionally, the Participants recommended that all the stakeholders should be involved in designing e-learning curriculum. As the participant FG1-3 puts it: “All the stakeholders in the learning processes should be involved in designing the content of e-learning systems.” In addition to the necessity of decreasing learners’ attendance requirements, as the participant FG1-3 puts it: “From my point of view, if there are days off during the week, there will be a good chance for us to work and enter e-learning systems. Unfortunately, every day we come back from the faculty tired, exhausted”.

Furthermore, the need for training tutors to obtain skills and knowledge to effectively engage with online learners. As the participant FG1-2 puts it: “There are tutors are illiterate in the Internet skills, indeed, you have to eliminate their Internet illiteracy before transforming into e-learning.”

Additionally, changing the administrators’ minds regarding using modern technologies in education is an important recommendation that the participants saw critical to successful e-learning implementation. As the participant FG4-2 puts it: “We desperately need to respect computers and Internet usage in education; people need to think of it as more than a toy. We need to look at computers and Internet as an important matter because we deal with learning by computers and the Internet as a non-important matter.” Finally, the necessity of enhancing the technologies infrastructure to fit with e-learning demands was the last recommendation to the administrators.

In fact, there are many studies which support the administrative recommendations that were given by the participants. For example, Selim (2010) explained many success factors that enable the successful implementation of e-learning, including: the readiness and reliability of an organization’s IT infrastructure; computer network functionality and reliability as well as the availability of internet on campus . Additionally, McPherson & Nunes (2008) explained that the use of new technological tools and artefacts for teaching and learning require technical support by central support units. This goes with the necessity of affording strong ICT infrastructure, the absence or inadequacy of which will totally hamper the idea of e-learning adoption in universities. Lastly, Eke (2011) states that successful e-learning requires the provision of computers and high bandwidth to enable the smooth flow of classes online.

Regarding the importance of implementing training programmes for tutors to effectively engage with e-learners, McPherson and Nunes (2008) explained the necessity of a systematic identification of training needs through programmes of staff review and development and that staff saw this as a critical success factor for e-learning implementation. In addition, Baldwin-Evans (2004: p. 273) stated “Without effective on-going training, the ability of any organisation to compete successfully is under threat.” This demonstrates the importance of participants’ recommendation in support e-learning tutors by implementing training programmes for them on how to engage effectively with e-learners.

In terms of the necessity of changing officials’ minds (‘officials’ being from the Ministry of Higher Education) regarding e-learning as a delivery method, Nichols (2008: p. 10) explained that in order to achieve sustainable e-learning, it is necessary to implement it strategically with clear and open communication channels, sufficient resources, targeted professional development, and a willingness to revise institutional systems so that e-learning ‘fits’ across the entire enterprise. The participants highlighted the strong links between the desire to obtain a successful e-learning system and the willingness of changing officials’ minds regarding the importance of e-learning.

It was important to the participants that all the involved stakeholders participate in the implementing of e-learning systems for that it will be inclusive to the views and opinions of all, and may potentially reflect on the quality of the established e-learning system. . This is supported by Newton et al. (2002) who stated: “It is evident that there is a need to consider the views of range of stakeholders’ priorities for effective online learning.”

Sloman (2002: p. 164) stated that “the phrase “work-intensive” is often used to characterise modern society. For many people work is interesting, fulfilling, demanding but exhausting: there is always something else of value to do.” Participants, however, have shown their frustration regarding the heavy duties required of them and the restricted attendance requirement in the Faculty, which created an intensive work load that does not enable them to interact effectively with e-learning systems and holding them from navigating the endless possibilities and affordances that e-learning offers.

Conclusions

The purpose of this research was to present practical recommendations to establish and evaluate quality in e-learning. As a result of a review of the relevant literature, academic discussion (presentations), and the empirical evidences of analysis, a model for implementing and evaluating quality in e-learning systems is presented, along with practical recommendations for implementing quality in e-learning systems.

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About the author

Tamer Sameer Abdel-Gawad is an Instructional Technology Lecturer at Tanta University, Egypt. He received BSc, MSc in instructional technology from Tanta University-Faculty of Specific Education, and PhD. from University of Southampton- School of Education. His research interests include e-learning, quality in e-learning, VLEs, PLEs, and Social Networking.

Email: Tamer_r_r_a@hotmail.com

tamer.abdelgawad@sed.tanta.edu.eg

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Editor's Note: This research investigates five variables that contribute to the overall quality of online courses. Their findings will be especially valuable to newly establish online universities.

sFactors affecting the quality of online courses in newly established universities in Saudi Arabia: academic staff perspective

Abdulhameed Rakan Alenezi
Saudi Arabia

Abstract

In Saudi Arabian higher education institutions, online courses are growing in popularity. The widespread use of online courses is beneficial when it comes to solving certain problems that newer universities needed to deal with. As a result, the quality of these online courses must be kept high, to make sure that the institutions using them and their students have the greatest possible benefit. This paper aims to investigate the factors affecting the quality of online courses in newly established universities from an academic staff perspective. The selected universities for this research were Aljouf University (JU), University of Hail (UoH), and Northern Border University (NBU). The proposed research model includes five variables: Course Content Quality (CCQ), Course Usability (CU), Course Design Quality (CDQ), Course Continual Enhancement (CCE), and Technical Support Quality (TSQ). In addition, Service Quality (SQ) mediating influences were also examined. The outcomes showed that the suggested variables have a clear effect on the academic staff attitudes regarding the quality of online courses. Further, it was shown that Service Quality has a certain mediating effect on the relationship of Course Design Quality and Online Courses Quality. The paper ends with ideas for further research.

Keywords: online courses quality; course content quality; course usability; course continual enhancement; technical support quality; service quality.

Introduction

Initially, through the numerous courses available online, there have been many questions raised regarding the quality of online education (Peterson; 2016; Allen & Seaman, 2003). These issues have not been cleared up over the last 10 years (Yang, 2004), and hence a number of research papers have focused entirely on the quality of online courses (Peterson, 2016; Masoumi & Lindström, 2012). In addition, a number of establishments have created a unique method of evaluation for quality, involving standards, characteristics, quality assurance programs, and frameworks (Masoumin & Lindström, 2012; McLoughlin & Visser, 2003; Chen, 2009). Nowadays, employing information and communication technologies (ICT) in education environments is a widely used approach, and there are thousands of courses provided by educational facilities. The key reasons for this phenomenon are the progression of global communications bringing about change in all industries (including education), and the idea that e-learning can tackle problems related to the cost and quality of universities (Selim, 2007). Describing the quality of an online learning course accurately is difficult, and it needs the institution to concentrate on the results as well as the progress made in the course design and teaching methods through ICT. e-Learning quality is an aspect that needs to be evaluated precisely (Chen, 2009), and hence this study examined the problem from the viewpoint of the academic staff. This is in line with the existing research that looked into different appraisals of quality in online courses (Ralston-Berg et al., 2015, Chitkushev, Vodenska, & Zlateva, 2014; Paechter & Maier, 2010; Kuo & Ye, 2009).

Because of this revolutionary way of educating and being educated in the place of in-class and in-person teaching approaches (Mohammad, 2010), higher education universities in Saudi Arabia do not have substantial targeted research, and hence this research topic is justified.

Quality in e-learning

Around the world, universities have started to use e-learning to provide education to a large extent and overcome many challenges particularly with newly established universities in Saudi Arabia. A greater focus on quality measures throughout the organizations involved, and research into this aspect, has highlighted the importance of quality assurance for online learning. Even though there are a number of ways to ascertain online course quality, a degree of agreement exists with regard to defining quality in e-learning (McLoughlin & Visser, 2003).

Literature review shows that there is an increasing amount of attention given to the use of quality management philosophy within the teaching industry (Ratnasingam, 2014; Chen, 2009, Jackson & Helms, 2008). The increasing need for e-learning in higher education requires that online education remains of sufficiently high quality (Martinez Caro et al., 2014).

An issue that teachers must now deal with is finding and using the most suitable measurement tools to establish a deeper comprehension of the quality issues at hand, which might somehow affect student experiences (Neill & Palmer, 2004).

Quality in online education is able to be examined through the varying definitions of quality, aspects of quality, and the various stages of education (Ehlers, 2004). As a result, this paper implements a number of variables, which have an effect on the quality of online courses.

Quality of online courses

As there are numerous courses and degrees available online, a substantial amount of attention has been given to the issues surrounding this type of education, especially regarding the quality (Allen & Seaman, 2003). The Quality Matters (QM) programs offer quality assurance through different processes involved in the design of online courses. These procedures are made up of eight different aspects, including course overview and introduction, education targets, appraisal, materials and resources, student support, course technology, and accessibility (Quality Matters, 2010). The processes also allow educators, through online teaching and peer-reviews, to make sure that the course requirements are met as proposed, which in turn are established through targeted research over a period of many years, through the implementation of standards, and the experiences of scholars. Legon (2006) in his research compared quality matters standard to other quality standards. He concluded that QM is one of most important quality standards that could assist any organization to obtain quality assurance and accreditation.

Course content quality (CCQ)

In literature, the course content quality is found to be a significant factor that could influence the quality matter of online courses. Dedic et al. (2011) presented a collection of features that can be evaluated with the e-online environment system, and thus affect the system's quality. The paper showed that the most crucial elements were content quality and content relevance.

Ehlers (2004) stated that the course must meet the needs of the learner through its structure. The student's quality preferences denote that the presence of lessons is crucial to specific learner groups, while certain other individuals do not feel them as valuable.

Course usability (CU)

With e-learning and online environment, the matter of usability is of greater importance, as it dictates how much the students are involved with the system and how they might use it (Semugabi & de Villiers, 2010). Usability is a clear indication of user interface quality and it is a key influence when making system design decisions (Zaharias & Poylymenakou, 2009). Keller (2007) as cited in Iraklis & Ioannis (2010) stated that the usability of a community platform is closely tied with an innate need to learn, and through web design and instructional design literature, the content provided to students (or community members, in other contexts) should be interactive and easy to explore.

Web usability was a key research area from the moment the Internet became widespread (Rukshan et al., 2011). To boost learning management system usability, human-to-computer interactions must allow for greater user performance to be achieved (Sung et al., 2012). Crucially, usability problems and meeting targets can be solved to a greater extent through intelligent course design (Ardito et al., 2006).

Course design quality (CDQ)

In the work of Ratnasingam (2014), quality indicators were investigated with regard to how they were tied to online course design and delivery, and how this affected the learning outcomes for students. Paechter, Maier, and Macher (2010a) stated that during the design of an online course or establishing an e-learning environment, educators must deal with a number of issues and take into account many different elements, which can consistently impact the way in which students are instructed, as well as create and utilize knowledge.

Under varying circumstances in education, quality and standards are maintained differently. Teaching quality and course design for online courses could mean that course content needs to be guided efficiently, that there should be teaching actions, approaches, and resources tied to the course aims, contact information for the teachers, and data provided for copyright and information security (Paechter, Maier, & Macher, 2010b). Huber (2005) as cited in Dedic et al. (2011) stated that course design and online course environment establish a substantial portion of the general e-learning experience quality. The quality of learning environment and how straightforward it is to employ the learning management system can affect the success and related satisfaction of an online learning course and its learning outcomes.

Course continuous enhancement (CCE)

Crucially, this created substantial interest in Continuous Quality Enhancment (CQE) initiatives for educational institutions (Gazza, 2015; Aggarwal & Lynn, 2012; Bloxham 2010; Bernold, 2008; Babbar, 1992). When taking into account the amount of time continuous improvement has been in place for higher education, there has not been much research into the matter under this environment (Bloxham, 2010).

Barnard (1999) stated that there were clearly positive effects seen in the students' opinions of effectiveness once Total Quality Management (TQM) including continual enhancement principles were implemented (Lawrence & McCollough, 2004; Marshall, 2010). The research of Bloxham (2010), Lawrence and McCullough (2004), and Bernold (2008) offer a different classroom-tested structure for the use of Continuous Improvement. Investigation of initial case studies was implemented by Lawrence and McCollough (2004), but newer research has also been taken into account (Gazza, 2015; Bloxham, 2010). Despite the fact that course continual enhancement in terms of quality use differs across every research paper, there were five main aspects involved at the core of every model: (1) constant improvement in the learning process, (2) giving students responsibility throughout the learning process, (3) establishing a base of trust and respect, (4) defining robust performance targets, and (5) making no mistakes and maintaining 100% satisfaction, or at least limiting the need to re-do tasks.

The Harvard Business Review encourages academic institutions to take on CQI and provide millions of dollars as incentive to support the implementation of these (Robinson et al., 1991).

Sims and Jones (2002) confirmed that the continuous improvement and evaluation is considered as a key success factor to measure the effectiveness of using the online environment.

Technical support quality (TSQ)

The quality of technical support is considered as one of significant factors that satisfy both students and academic staff in online or electronic learning in general. Matuga et al. (2012) state that the quality of an online course is also based on the administrative support the staff receive. Osika (2006) states that there can be a number of management problems prevalent, which must be dealt with throughout different institutions to offer student support and assist the staff, outside the computerized learning environment. Sufficient faculty support is the main focus of distance learning literature when it comes to administrative problems (Ko & Rossen, 2010). Zeng & Perris (2004) stated that students are not satisfied with online courses with less technical support. Yang & Cornelius (2004a) highlighted that the course satisfaction and quality is often fulfilled when the administration and instructors are not able to provide technical support.

Service quality (SQ)

Service Quality (SQ) has been extensively investigated by researchers in different extents (Uppal et al., 2015; Martinez-Caro et al., 2014). Hanna (2010) stated that there is no clear agreement regarding electronic service quality overall, or specifically for distance learning at large. Martinez-Caro et al. (2014) put forward the notion that service quality is described as the extent that an occurrence or phenomenon handles a person's needs or meets their preconceptions. Also, Hanna (2010) says that education service quality is shown to be the main element affecting success, and as dynamic competition progresses, students need to be dealt with as clients and satisfied accordingly. As a result, numerous models were created to evaluate service quality in this context, including SERVQUAL. Since service quality and customer satisfaction are so important, institutions provide substantial resources into making progress in these areas (Uppal et al., 2015). The majority of research investigated that the Service Quality (SQ) has a direct or moderate effect on the quality. However, in this research, it has been investigated as a mediating variable.

Methodology

Theoretical framework and hypotheses:

Based on a literature review (Crews and Curtis, 2011; Sung et al., 2012; Ratnasingam, 2014; Huber, 2005; Bloxham, 2010; Matuga et al., 2012; Hanna, 2010), a theoretical framework relating to the principles of Online Courses Quality (OCQ) was developed to guide the design of this research. Furthermore, based on the previous inconclusive findings related to the proposed constructs in the literature review, positive hypotheses are assumed based on the research proposed model (as represented in Figure 1).

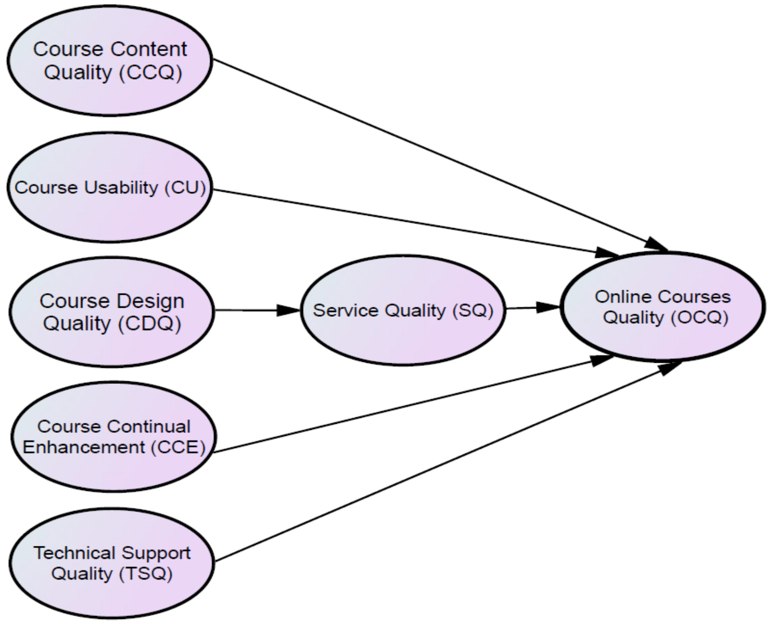

***Figure 1*: The proposed theoretical framework**

Based on the literature review and the above research model, several hypotheses were proposed:

H1: Course Content Quality (CCQ) has a positive influence on an Online Courses Quality (OCQ).

H2: Course Usability (CU) has a positive influence on an Online Courses Quality (OCQ).

H3: Course Design Quality (CDQ) has a positive influence on an Online Courses Quality (OCQ).

H4: Course Continual Enhancement (CCE) has a positive influence on an Online Courses Quality (OCQ).

H5: Technical Support Quality (TSQ) has a positive influence on an Online Courses Quality (OCQ).

H6: Service Quality (SQ) does mediate the relationship between the Course Design Quality (CDQ) and the Online Courses Quality (OCQ).

Research questionnaire development

An important step before organizing the survey questions is providing the respondents a clear understanding of the research. Therefore, the questionnaire started the title and the purpose from this research. Face and content validity were performed and the questionnaire was sent to an expert in both e-learning and quality area with the aim of determining the extent to which the instruments were developed to measure the investigated dimensions. The questions were grouped into two main sections: Demographic Questions and the proposed investigating dimensions, namely Course Content Quality (CCQ), Course Usability (CU), Course Design Quality (CDQ), Course Continual Enhancement (CCE), Technical Support Quality (TSQ), and Service Quality (SQ). The measured dimensions and their related number of items are given in Table 1

Table 1

The measured dimension and number of items in the questionnaire

Dimension Categories	No. of items
Course Content Quality (CCQ)	8
Course Usability (CU)	8
Course Design Quality (CDQ)	9
Course Continual Enhancement (CCE)	6
Technical Support Quality (TSQ)	6
Service Quality (SQ)	5
Online Courses Quality (OCO)	6
Total	48

Sample and data collection

A total of 112 questionnaires were obtained as valid from the academic staff at three newly established universities (JU, UoH, NBU) in Saudi Arabia. The questionnaire was distributed through the LMS utilized in these universities to ensure that all the lecturers had exposure to the e-learning environment. Thus, the questionnaire for this study was distributed after obtaining permissions from the deanship of e-learning in each university.

Profile of respondents

Table 2

Frequency and percentage of the respondents based on universities

University	Frequency	Percentage
Aljouf University (JU)	58	51.8
University of Hail (UOH)	40	35.7
Northern Border University (NBU)	14	12.5
Total	**112**	**100.0**

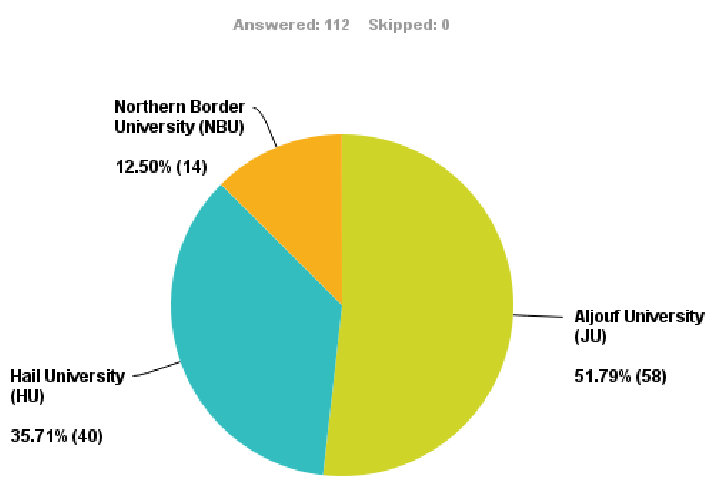

Figure 2: Respondents based on universities

Data analysis and discussion

Reliability analysis

To determine the reliability of the investigated variables, Cronbach's α was obtained. The acceptable reliability level of 0.60 was applied in this research (Hair et al., 2010). Hence, Cronbach's α was acceptable for the investigated variables (as shown in Table 3).

Table 3
Variables reliability analysis

Variables	# of Items	Cronbach's α (>0.60)
Course Content Quality (CCQ)	8	0.860
Course Usability (CU)	8	0.717
Course Design Quality (CDQ)	9	0.843
Course Continual Enhancement (CCE)	6	0.701
Technical Support Quality (TSQ)	6	0.881
Service Quality (SQ)	5	0.733
Online Courses Quality (OCQ)	6	0.805

Factor analysis

In this research, factor analysis was done to evaluate the worth of measurement as well as accurateness. The research sample size was considered as adequate in which 112 subjects suggested a minimum cut-off level of 100 subjects (Coakes et al. 2006). A cutoff value of 0.30 or more for the matrix correlation coefficients was applied (Hair et al., 2006). Bartlett's test of sphericity was significant when Kaiser-Meyer-Olkin (KMO) was more than 0.50. The factor loadings of 0.50 or higher were considered as acceptable.

As portrayed in Table 4, the examined variables of exploratory factor analysis (EFA) indicated acceptable level of KMO, which is greater than 0.50 and the sphericity test was significant for all the measured variables ($p<.05$). A high total variance was explained by the examined variables. The examined variables have shown acceptable and high factors loading ever since all the examined items showed an average greater than 0.30, which is the acceptable cutoff level in this research (Hair et al., 2010). Therefore, the proposed variables are eligible for regression analysis.

Testing of hypotheses

The assumed hypotheses were tested using different techniques including linear, hierarchical regression analysis, and product moment correlation analysis. The assumptions of Hair et al. (2010) were met. In Table 5, the analysis of correlation product moment was performed to investigate the variables internal relationship, which indicated a positive and a strong relationship between the examined variables with a high average of coefficient value as indicated above (Cohen, 1988).

Table 4
Factor loading for the examined variables

Items		CCQ (8 items)	CU (8 items)	CDQ (9 items)	CCE (6 items)	TSQ (6 items)	SQ (5items)	OCO (6 items)
Exploratory factor analysis **(EFA)** **(Factor loading)**		.907	.902	.943	.940	.939	.921	.905
		.905	.897	.921	.932	.928	.901	.881
		.901	.809	.820	.843	.847	.867	.867
		.892	.764	.825	.852	.875	.918	.879
		.883	.671	.768	.845	.653	.460	.566
		.777	.795	.694	.984	.955		.516
		.769	.725	.500				
		.474	.549	.767				
				.690				
Total variance explained		71.15	61.18	67.13	83.49	80.43	73.58	71.429
KMO		0.719	0.703	0.660	0.644	0.673	0.683	0.740
Bartlett's test	χ^2	1041.033	433.708	458.511	319.795	303.219	295.798	361.282
p.		**.000****	**.000****	**.000****	**.000****	**.000****	**.000****	**.000****

** p <.01

Table 5
Correlation coefficients of the research variables (N=112)

Variables (IVs)	OCO (DV)
Online Courses Quality (OCO)	1
Course Content Quality (CCQ)	0.691 (**)
Course Usability (CU)	0.757(**)
Course Design Quality (CDQ)	0.843(**)
Course Continual Enhancement (CCE)	0.892(**)
Technical Support Quality (TSQ)	0.874 (**)
Service Quality (SQ)	0.799 (**)

** p <.01

To examine the influence of the examined variables, the analysis of linear regression was performed and the results are depicted in Table 6.

Table 6

Multiple regression analysis between Content Quality (CCQ), Course Usability (CU), Course Design Quality (CDQ), Course Continual Enhancement (CCE), Technical Support Quality (TSQ) and Online Course Quality (OCQ)

Summary of the model

Model	R	R^2	Adjusted R^2	Std. Error of Estimate
1	.929(a)	0.863	0.857	0.215

ANOVA(b)

Model	Sum of Squares	df	Mean Square	F	P.
1	31.678	5	6.336	136.617	.000(a)
	5.008	108	.046		
	36.686	113			

Coefficients(a)

Model		Unstandardized		Sized	t	P.
		B	Std. Error	Beta		
1	(Constant)	-.259	.140		-1.844	.00**
	MCCQ	.089	.036	.102	2.469	.01*
	MCDQ	.301	.082	.262	3.654	.00**
	MCU	.222	.081	.214	2.732	.00**
	MCEE	.263	.044	.304	5.948	.00**
	MTSQ	.217	.065	.205	3.364	.00**

** p <.01,*p <.05, a. Dependent Variable: OCQ

As presented in Table 6, the results show that all the proposed variables, namely Course Content Quality (CCQ), Course Usability (CU), Course Design Quality (CDQ), Course Continual Enhancement (CCE), and Technical Support Quality (TSQ) were significantly influencing Online Course Quality (OCQ). The first most contributive variable towards Online Course Quality (OCQ) was Course Continual Enhancement (CCE) (TF), $\beta = .30$, $t\,(108) = 5.948$ ($p< .01$), two-tailed. The second variable that shows high effect is the Course Design Quality (CDQ), $\beta =.301$, $t\,(108) = 3.654$ ($p< .01$), two-tailed. The Technical Support Quality (TSQ) also indicates high influence with, $\beta = .217$, $t\,(108) = 3.364$ ($p< .01$). The fourth contributive variable is the Course Usability (CU), β=.222, $t\,(108) = 2.732$ ($p< .01$). Finally, the fifth contributive variable is the Course Content Quality (CCQ), β.089, $t\,(108) = 2.469$ ($p< .05$). Based on R^2 result, the examined variables predicted 86.3 % of total variance which indicated high influence of examined variables. A summary of the assumed hypotheses testing is illustrated in Table 7.

Table 7
Summary of the assumed hypotheses testing

Hypothesis	Statement	p-Value	Result
H1	Course Content Quality (CCQ) has a positive effect on an Online Courses Quality (OCQ).	.01*	Supported
H2	Course Usability (CU) has a positive effect on an Online Courses Quality (OCQ).	.00**	Supported
H3	Course Design Quality (CDQ) has a positive effect on an Online Courses Quality (OCQ).	.00**	Supported
H4	Course Continual Enhancement (CCE) has a positive effect on an Online Courses Quality (OCQ).	.00**	Supported
H5	Technical Support Quality (TSQ) has a positive effect on an Online Courses Quality (OCQ).	.00**	Supported

** p <.01,*p <.05

Mediating Analysis

The main technique to examine the mediating effects is Baron and Kenny's (1986) method associated with regression analysis (see Figure 3). The mediating effect of Service Quality (SQ) on the relationship between the Course Design Quality (CDQ) and the Online Courses Quality (OCQ) was examined. The service quality indicated a significant influence on the quality of online learning and majority of research has investigated the quality service as moderating variables. Therefore, the contribution of this research will be adding to the body of literature an insight in the investigated service quality as mediating variable particularly with the course design since it has been found to strongly affect the quality of online courses (Uppal et al., 2015).

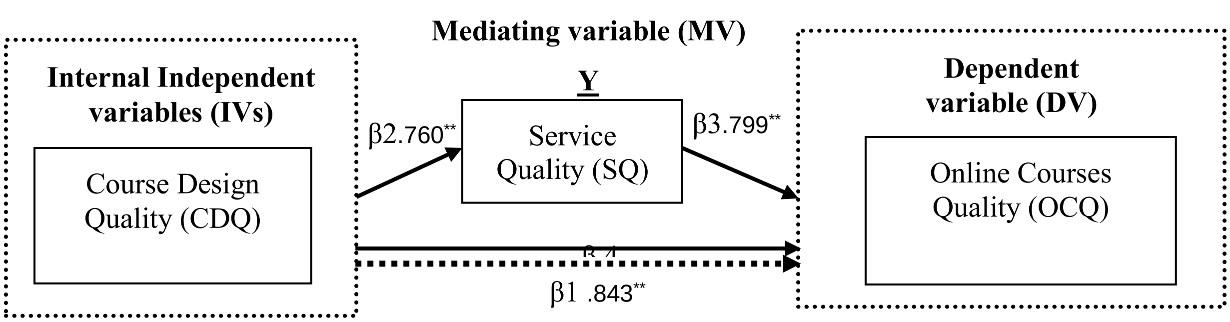

***Figure 3*: Mediation model: Baron & Kenny (1986)**

The significant criteria of Baron and Kenny were met as illustrated above and the correlation analysis indicated significant relationships between the examined variables as shown in Table 5. Thus, Baron and Kenny's approach associated with the regression analysis could be performed.

Table 8

Hierarchical regression analysis using Service Quality (SQ) as a mediator on the relationship between the Course Design Quality (CDQ) and the Online Courses Quality (OCQ).

Model		Unstandardized Coefficients		Standardized Coefficients	t	p.
		B	Std. Error	Beta		
Step 1	(Constant)	.105	.182			
(Model 1)	MCDQ	.977	.057	.849	16.993	.00**
Step 2	(Constant)	.110	.160			
(Model 2)	MCDQ	.597	.081	.518	7.325	.00**
	MSQ	.377	.064	.420	5.935	.00**

R^2 =0.721 in step 1; R^2 =0.788 in step 2
** p <.01, a. Dependent Variable: MOCQ

As depicted in Table 8, the results of the first model indicate that Course Design Quality added significantly to Online Courses Quality equation with R^2 0.721, $F_{(1, 112)} = 288.750$, p<.01. Model 1 demonstrates that *Course Design Quality* was positively related to Online Courses Quality with $\beta = .849$, $t = 16.993$ (p< .01). In model 2, Quality of Service was contributed to the equation in which $R^{2=}$ 0.788 changed meaningfully with $F_{(2, 113)} = 206.108$, p<.01. Model 2 shows that Course Design Quality trivially reduced with $\beta = .518$, $t = 7.325$ (p < .01) in testing the mediation effect of *Service Quality*: In Model 1, the Course Design Quality and Online Courses Quality relationship was significant while in Model 2, the relationship between the Course Design Quality and Online Courses Quality become significantly reduced. Hence, Service Quality partially mediates the relationship between Course Design Quality and Online Courses Quality. Hence, hypothesis six (H6) is supported.

Discussions and conclusions

The findings of this research concluded that Course Content Quality (CCQ), Course Usability (CU), Course Design Quality (CDQ), Course Continual Enhancement (CCE), and Technical Support Quality (TSQ) were significantly influencing the Online Course Quality (OCQ). The results of the research highlighted that Course Continual Enhancement (CCE) shows the most significant contribution towards Online Course Quality. These finding were not different from those of Gazza (2015), Aggarwal & Lynn (2012), Bloxham (2010), and Bernold (2008). The results also highlighted that academic staff at newly established universities have seen a coherent Course Design Quality (CDQ) significantly influence the total quality of the offered courses. The findings are consistent with the previous research that emphasized the importance of course design quality (Ratnasingam, 2014; Paechter, Maier, & Macher, 2010;

Dedic et al., 2011). Thus, the poorly designed course could lead to a poor learning result. Unfortunately, the course design quality standards in the newly established universities are not implemented. The findings revealed that technical support is a significant factor that could influence the quality of online courses. Apart from their findings, Matuga et al. (2012) and Crews and Curtis (2011) showed that technical support has a positive influence on the quality in the online environment. Moreover, Yang and Cornelius (2004b) highlighted that the course satisfaction and quality is reduced when the administration and academic staff was not able to provide technical support. Students are not satisfied with online courses with less technical skills and technical support (Zeng & Perris, 2004). The findings affirmed that course content and usability are found to be significant in ensuring the quality of online courses satisfaction (Ssemugabi & de Villiers, 2010; Velimir, 2011).

The present findings also highlighted that a greater satisfaction with learning online courses have been seen with the passage of time. These findings are more important for all newly established universities. Service Quality was found to be partially mediating the relationship between Course Design Quality and Online Courses Quality. This is not compatible with other findings since the majority of research investigated the direct and moderate effects of service quality (Martinez-Caro et al., 2014; Hanna, 2010). Therefore, service quality was confirmed to be more influencing as a moderator and preferred to be investigated in the direct relationships in future research models. The present findings are more important for all newly established universities. The quality matters or any well-known quality frameworks or standards should be implemented by these universities to obtain utmost possible benefit of using the online environment. This research is limited to one region and certain variables; therefore, future research could investigate this matter in different regions, contexts, and including further variables

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About the author

Dr. Abdulhameed Rakan Alenezi graduated with a bachelor degree in Mathematics Education and completed a Master degree in IT in education & Training from University Of Wollongong in Australia. Dr. Alenezi completed his Ph.D. in E-learning from the faculty of Education in Utara University. Dr. Alenezi has over 10 years' experience in teaching Instructional Technology related subjects. He works as the Dean of College of Computer Sciences & Information as well as Acting Dean of College of Engineering at Aljouf University in Saudi Arabia. Alenezi has published many research papers in different international journals and proceedings. Dr. Alenezi is a member of North American Simulation and Gaming Association (NASAGA), a member of International Forum of Educational Technology & Society (IEEE Technical Committee on Learning Technology), a member of Pittsburgh E-Learning Society, and a member of the Canadian Institute of Distance Education Research.
eMail: a.alenezi@hotmail.com, ar.alenezi@ju.edu.sa

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Editor's Note: The Pacific Island countries continue to be a leader in research, adoption and integration of information and communication technologies into their educational programs. Their challenging multi-national environment distributed across islands of the south Pacific has shown substantial benefits from adoption of ICTs.

Teacher training and ICT integrated pedagogies: perspectives from the Pacific Island countries

Raturi Shikha
Fiji

Abstract

The ICT integrated pedagogies is now being considered an important component for teachers in the Pacific Island Countries. Thus a "One lecture and workshop on Information Communication Technology (ICT) integrated pedagogies" strategy, which originally started as an ad-hoc service in 2013 and has now become an integral part of a curriculum studies course at undergraduate level at the School of Education in the university of the South Pacific (USP). Considering the reach of USP in the South Pacific region, this strategy should have a multiplier effect when these student teachers complete their programme and return to their home-countries. Therefore, it was deemed necessary to get the views from the student teachers undergoing this training. Focus group studies conducted with the cohort provided strengths and weaknesses of this strategy as well as reasons revealed by students to embrace ICT integrated pedagogies. In light of these findings, the paper presents implications and a way forward for teacher education providers in the region.

Keywords: teacher training, teacher education, ICT integrated pedagogies, Pacific Island countries, training strategies.

Introduction

ICT integration in learning and teaching is gaining acceptance across the globe including the Pacific Island Countries (PICs). A number of elearning/ICT in education projects are constantly being implemented in the PICs that reinforces the need for teacher education and training in ICT integrated pedagogies. In light of the TPACK model (Mishra and Koehler, 2006, 2007; Koehler and Mishra, 2009), it is imperative that efforts are made to ensure that teachers have the necessary skills to practice ICT integrated pedagogies together with their content expertise. The paper discusses the issue of *teacher education/training in ICT integrated pedagogies* with reference to a case study that involves undergraduate Education (pre and in-service teachers) cohort. The "one lecture and one workshop on Information Communication Technology (ICT) integrated pedagogies" started as an ad-hoc service in 2013. In order to fulfill the needs of the region, the School of Education at USP responded by making this ad-hoc strategy a permanent component of its two courses in curriculum studies at second and third year undergraduate level. These two courses (at second and third year levels) previously focused on pedagogy of delivering content and the design format of content. The inclusion of one lecture and one workshop in ICT integrated pedagogies in these two courses attempts to address the need for systematic introduction of technology in pedagogy and content knowledge. The fact that USP is spread across 33 million square kilometers of ocean in the region of the South Pacific places USP in a powerful position to reach out far and wide. Thus, USP reaches out to not only its twelve member countries but also the other island countries in the region. Therefore, any training/activity conducted by USP has a multiplier effect such that the trainees upon returning to their home countries can further share their knowledge and skills. However, there is a need for ongoing support for teacher training in all areas after the teachers' formal education.

> Teacher training and continued, on-going, relevant professional development for teachers are essential if benefits from investments in ICTs are to be maximized. In the absence of sustained and various opportunities for teachers further enhance and improve their skills and knowledge base, the use of technology can still (potentially) make good teachers better, but (often) can actually make poor teachers worse. (Trucano, 2013a)

It is becoming quite clear that with the advent of technology, the scene in education around the world is undergoing transformation and need for teacher training cannot be emphasised enough. Trucano (2013a) poses a valid argument to caution teacher education providers across the globe. The infusion of technology places a demand on teacher and the teacher education providers to ensure that the 21st century teachers have the necessary Information Communication Technology (ICT) competencies together with other skills and knowledge. Thus, an ideal teacher's skill set exists at the union of technology, pedagogy and content knowledge as highlighted in TPACK framework (Koehler and Mishra, 2009).

The context

The University of the South Pacific (USP) served as the ground for this study. The USP is a regional university, which was established to serve the region of the South Pacific in 1968. The twelve member countries (Cook Islands, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu) are spread across 33 million square kilometres of ocean with its islands sparsely populated (Figure 1). The culturally and geographically diverse and sparsely populated region of Pacific Island Countries presents educators and other professionals a challenging scenario in terms of access to educational resources. The students come to USP not only from its member countries but other PICs too. The students do a four year degree programme (BA GCED, BCom GCED and BSc GCED) after finishing high school where the focus is on two teaching subjects with final year spent on training to become a teacher. On the other hand, in-service teachers come back to university after having taught in schools for some years to continue with higher education and pursue a BEd degree.

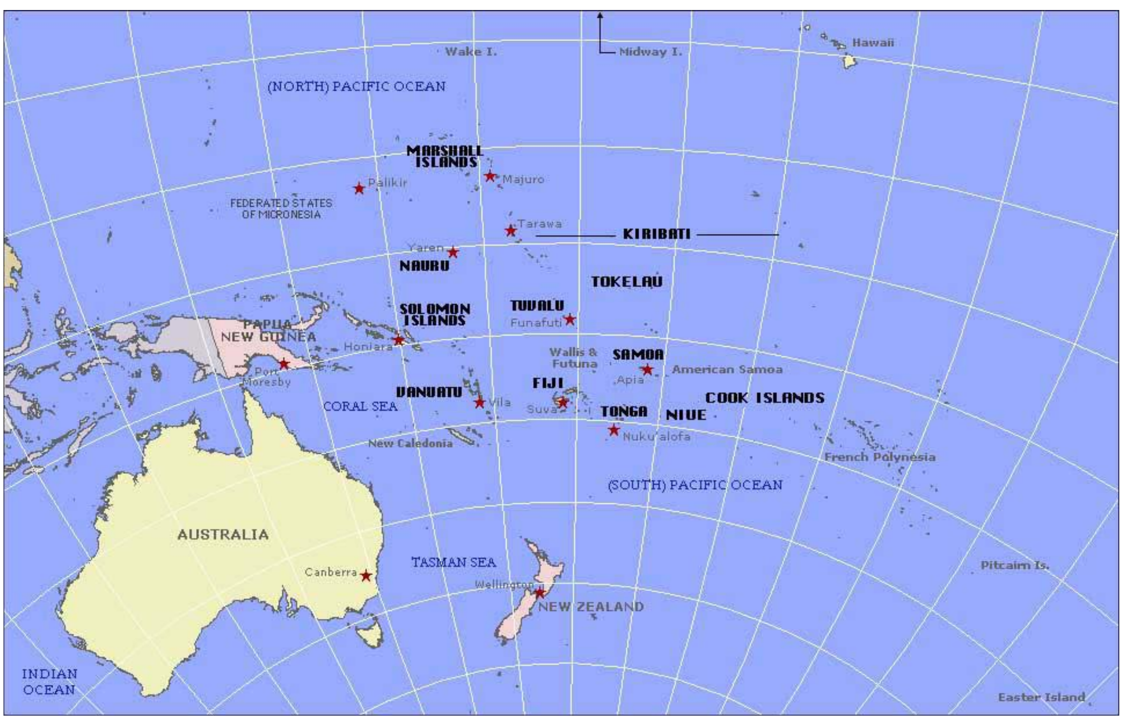

Fig 1. Twelve member countries are highlighted in map of South Pacific region
Source: http://www.usp.ac.fj/jica/resources/documents/pdf_files/ANNEX.PDF

The need for ICT integration in teacher training has been highlighted by educators, experts and organisations around the world (ADB Report, 2008; Farrell & Isaacs, 2007; Haddad & Draxler, 2002; Mann, 2014; SchoolNet Africa report, 2004; Trucano, 2013a, 2013b; Weller, 2013; Wells, 2014) and in Pacific alike (Lingam, Raturi and Finau, 2015; Raturi, 2015; Raturi and Kedrayate, 2015; Sharma, 2008). Raturi and Kedrayate (2015) discuss the importance of training for ICT integration in learning and teaching for the teachers who were part of the "One Laptop Per Child" pilot project in Fiji and how teachers felt more confident with more exposure to ICTs. Similarly, many emphasise on the need for continuous professional development for schoolteachers to help them use technology confidently and gain further expertise (Haddad & Draxler, 2002; Kidd 2013; Luque, 2013; Mann, 2014; Ofsted report, 2013, Trucano, 2013b). Some countries make use of recognition based systems to track and monitor teachers's progress in ICT competencies (Park, 2013). However, one could argue whether teachers should be pushed to acquire and sharpen their ICT competencies or this needs to be left at the teachers' will - which one do we think would work the best?

In accordance with Sustainable Development Goal 4 "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" and its corresponding targets, Incheon declaration 2015 highlights the importance of ICTs in achieving this goal. Moreover a number of ICT in education projects in the schools around the PICs make it imperative to ensure teachers undergo training in ICT integrated pedagogies. The USP has always acknowledged the current trend of ICT integration in learning and teaching and the need for school teachers to have ICT based pedagogical competencies which is evident in its attempts since its inception (Lingam, Raturi and Finau, 2015) till now. In its continued efforts, USP's School of Education initiated a "One lecture and workshop on ICT integrated pedagogies" strategy which originally started as an ad-hoc service in 2013. This practice has now become an integral part of curriculum studies course at 2nd and 3rd year level at the School of Education in USP. A combination of pre-service and in-service student teachers forms the typical cohort every year. The pre-service cohort comprises students doing a degree in Art, Science and Commerce with a combination of Education to become a teacher.

The students are given a one hour lecture followed by one 2 hour workshop on ICT integrated pedagogies. A variety of hand-on activities include Open Educational Resources (OERs), use of multimedia and other technologies available in the Teachers' Educational Resource and Elearning Centre (TEREC) at the School of Education. An introduction to OERs comprises identifying licenses for OERs and copyright issues, searching for appropriate OERs and adapting OER to fit the curriculum in its local context. The use of multimedia mainly involved making short clips of audios, videos using free software. The overall outcome was integration of ICTs in a lesson plan in the context of their country's education system and schools. This one-hour lecture and 2-hour workshop has been generally well received, however, it seemed necessary to evaluate if this service was valuable and enough to satisfy student teachers' needs.

Thus, there were two important research questions that needed to be addressed:

1. What are the student teachers' perceptions of current sessions on ICT integrated pedagogies?
2. How important do teachers consider ICT integrated pedagogies?

Research design

A focus group strategy was utilized to get answers to the two questions. The participants were contacted via email and those who agreed then formed part of focus group discussions. The influences of interpersonal factors, environmental factors and individual differences were considered carefully due to their effect on group dynamics (Stewart & Shamdasani, 2015). According to Kruger (1988), focus group occurs in three phases:

1. Conceptualization
2. Interview, and finally
3. Analysis and reporting.

The conceptualization phase included determination of purpose of study, sample for study and development of a plan. The interview phase was a careful combination of development of appropriate questions (the what's and how's mainly and why's to probe further) and moderating skills whereby the moderator generates discussion amongst the participants to reach a consensus for every question/topic. The last phase focused on a simple and verifiable analysis process, which led to development of a descriptive report consisting of "emerging issues". The interview guide questions were tested with a pilot group prior to carrying out the actual focus group discussions to ensure reliability of the process and the questions. The scissor-and-sort technique was applied to analyse the data. The emerging issues were then validated by sharing the findings with the focus groups again.

Three focus group discussions (targeting 6-10 student teachers per group) were carried out and a total of 20 student-teachers participated. A second discussion with the participants validated the findings. While the group did not have representation from all 12-member countries, there were participants from 6 countries namely Fiji, Nauru, Solomon Islands, Tonga, Tuvalu and Vanuatu. There were 5 male and 15 female student teachers in this study. The participants were a mixed group of pre and in-service teachers with varied teaching experience. Nearly half of the participants were teachers with a good teaching experience (5-15 years). Each participant was asked to rate their satisfaction towards the 2nd year workshop, which indicated none of them were dissatisfied. This was an important finding as even senior teachers (with10-15 years of teaching experience) indicated their satisfaction towards ICT integrated pedagogies workshops; it reinforces the need for teacher training in ICT integrated pedagogies.

The participants indicated the need for ICT integrated pedagogies for all teachers in PICs and expressed their strong support for such programmes during the discussions. The reaffirmation of high satisfaction is validated by participants' responses in several places in the following section whereby six issues emerged.

Result and Discussion:

The six main issues that emerged during this focus group discussion are presented and discussed next.

1. The process/programme

The importance of 'learning by doing' and ICT integration across the board was highlighted. On one hand importance of practical sessions with the theory was emphasized upon and on the other, embedding ICTs in all the education courses was deemed crucial too.

a. Theory with practice simultaneously

The participants unanimously agreed that doing theory and practice during the same session would be more useful rather than one-hour theory followed by 2-hour workshop. The participants felt that having done a generic course on Information and Communication Literacy (First year generic course on computer and information literacy, UU100), these sessions help them further to practice; however the numbers of sessions were considered insufficient. The participants suggested perhaps education students needed to do a course parallel to the aforementioned university wide generic course with a focus on educational technologies.

> "Lecture and practical combined would be good - even better if we can break it into small session and have more of such session. Content plus technology should go hand in hand as we tend to forget content if we do it separately in lecture".

b. Embedding ICTs across board in all Education courses

The participants were very clear on the need for ICTs to be integrated throughout their learning process in Education. They suggested even ways on how the school could do this.

> "Make it (ICT) compulsory for us to demonstrate. May be our subject teachers can make it compulsory that 1 out 3 microteaching sessions must have ICT integrated pedagogies demonstration, that way we will all do it"

2. Assessment as a means to reinforce

The participants admitted that students do not learn if it is not assessed. Assessment was perceived to act as a way to reinforce the knowledge and skills.

> "We have a tendency to focus on grades...if this (the 1-hour lecture and 2-hour workshop session) was assessed, it could have helped to make sure we practiced more".

Another one reaffirmed the need for assessment by saying that, "Some of us do not take it seriously if it is not marked (graded)"

3. Digital competencies

The participants shared even though they have done the generic course UU100, some tend to forget the skills learnt in that course making it difficult to then catch up with these sessions. All participants appreciated skills learnt in UU100 course as it taught them basic digital competencies. The discussions revolved around different ways that they could learn better and improve their digital competencies and there was a clear sense of urgency among the participants. All participants agreed that time and practice would enhance their digital competencies further. The fifth issue "time" was also seen as a crucial factor for enhancing digital competencies.

4. Resources at schools

It is a well-known fact that majority of schools in PICs are under-resourced in terms of books, computers and other teaching tools. The in-service teachers shared learning environment of their previous schools while the pre-service teachers shared their own schools that they attended as students. The ground realities were discussed at length. It became clear that schools lack basic ICT infrastructure and these acts as a demotivator. The in-service teachers in particular have the first had experience of teaching without ICTs and have to make an effort to ensure they stay motivated to learn ICTs integrated pedagogies. The participants made suggestions such as:

> "For us teachers, may be for my [country] we do not have ICT so we are not familiar with integration of it in education especially in rural areas...so taking this workshop is advantageous for us teachers, may be ministry of education and our government can now provide us tools so that we can practice what we learnt"

5. Time/Duration of the training

The duration of 1-hour lecture and 2-hour workshop for the workshop was considered very short and insufficient. The participants appreciated the experience and this is indicated by 'high rating' as shown in figure 3. However, 2 out of 20 participants rated their satisfaction as "somewhat" which needs to be understood further; this came out clearly in their discussions. They agreed that the duration/length of such sessions needs to be increased. Various options suggested ranged from having 2-two hour session per semester to a whole 1 year programme that could be added to the current 4-year undergraduate programme. However, one whole course on ICT integrated pedagogies was considered important by all the participants.

> "2-3 such sessions per course would be good, allow tutorials to practice 1 in the beginning, 1 in the middle and 1 in the end"

> "How about adding another year to our four year programme? Then we only learn about ICT integrated pedagogies in that one year."

While another participant suggested and everyone in the group agreed:

> "I think we should have another course in ICT in education workshop, a whole course would be good, make it a standalone course integrated to daily teaching plans and offer it as flexi course "

They all agreed that they could do one course if the university decides to offer it in future; they recommended such a course to be a "core course" for future students. The participants' discussion reflected urgency of situation and they were keen to work on their digital competencies. The participants added that this kind of training needs to continue once they join teaching profession in the form of continuous professional development and not just a one-off training.

> "CPD much better than one off long training. Weekly session within schools to share learning and teaching practices is very useful. Currently they are doing leadership course in june holidays so USP could do similar things in ICT in education"

It was clear that participants wanted something more than what was being offered to them currently. However, they all agreed with the importance of these trainings on ICT integrated pedagogies to help them get started/restarted in their teaching profession.

6. Relevance to PICs

The participants unanimously agreed despite the current poor ICT infrastructure and ICT access, the educational system needed to embrace ICT integration in education system at all levels starting from as early as Early Childhood Education. The teachers agreed that everything in the workshop was useful and relevant to their home country and did not find anything irrelevant.

a. Open Educational Resources

The component on OERs was considered extremely useful and wished they had more time to practice it with the instructor. The group admitted that this required practicing and spending time on their own too. Given the scarcity of educational resources in schools, this was considered an important area for training and practice by all the participants. The participants considered OERs useful to enhance their own knowledge as well as to help other teachers back in their home countries.

> "It is difficult to find resources for my students - accounting and economics resources are scarce...also to develop my own background knowledge then I will understand the subject better and produce more resources."

Another one added: "As a teacher we have limited resources, it will help me but also students can go look for more resources if we have computers."

The participants felt that they can tap into any amount of information as and when needed and make lessons interesting with information in varied format to suit learners different learning style. Oral and visual learning strategy is a common one amongst learners in PICs as opposed to reading. As one participant puts it, "It will help with resources. English students find reading boring in my country, so I can get OERs on it from other parts of the world in audio or video format and I would love to show this in in my province."

The ability to adapt OERs is what appealed some in light of need to contextualise the resource. "We do not have this in [my country] so learning it here helps us and we can also teach other teachers when we go back to our country, We know the licensing issues and can adapt these resources to fit our need and curriculum".

The participants were appreciative of having been introduced to OERs and view OERs as a tool to enhance learning for all. The participants from regional member countries seemed to appreciate OERs more due to scarcity of educational resources in their home countries and see it as a win-win situation for all stakeholders. "I did not know about OERs until I came to the class but then now i do not remember the sites, somebody should put these names somewhere for us may be in the library so that we can pull them out and go and visit these sites. Students can also go and look for info, this will make teachers life more easier."

b. Multi-media

All the participants regardless of their teaching level (classes) felt learning about use of multimedia in learning and teaching was crucial to enhance their students' learning experience. The use of audios and videos was considered useful for grabbing children's attention as well instilling and maintaining their interest in the subject or for using it in the situation where the school lacks expertise in a particular subject area. "I would make few minutes video reason being grabbing or getting the kids attention before i get to actual lesson. I am preschool educator - children like videos more than me reading out things for them in the class. I could make videos in different settings and this will keep them interested in the lesson too"

"Audio can be used to give it out to schools where they are short in staff- if video becomes difficult in case of the memory in the phone--you could use audio through your phone and pass it on. A lot of times we do not have subject-experts/ teachers in our schools and I think audios and videos of experts will be useful for our schools. We can also use relevant videos from YouTube too"

The discussion also revolved around what kind of multimedia would be useful in remote areas that lack basic resources such as electricity and computers. The audios were particularly considered useful in remote and resource-scarce areas.

c. **The Pacific Context**:

The participants unanimously agreed that despite the current poor ICT infrastructure, teachers needed to be ready. The group, therefore, considered it important that all the teachers learnt about educational technologies relevant for PICs. However, as mentioned earlier, the need to spend more "time" on these sessions was deemed essential for sufficient knowledge and skills in ICTs.

"I think we need one more hour that can act as tutorial so that we can practice and assess how far we learnt from this process we can create, demonstrate and practice...we need to get used to those resources...so that I can learn and practice to apply in my home country. Maybe we can do it fortnightly in one semester so that I can learn better. It does not matter if I cannot practice it right now back in my school in my country but I should be ready" Another participant added in agreement, "we have to use ICTs and this way we will slowly start embedding it"

The group towards the end discussed and expressed that the focus group discussions helped them reflect and realize what they needed to do from their side to ensure they sharpen the skills they were taught in these ICT integrated pedagogies sessions. These sessions will have a multiplier effect when the cohorts (from 2013-2015) will go back to their home countries and share the knowledge and skills further with other educators and education officials.

Conclusion

In light of emerging issues, it is apparent that the training sessions in ICT integrated pedagogies were considered very useful. ICT integrated pedagogies prove to be a source of teacher's empowerment as we see it opens up a whole new world of new tools, new content and new ideas for them. The fact that participants suggested longer trainings on ICT integrated pedagogies, indicates their perception towards such trainings and the need for it. It is clear that the student teachers need something more in terms of duration of ICT integrated pedagogies sessions; perhaps a full course or programme with graded assessments tasks would suffice their needs. The point on continuous professional development (CPD) indicates that student teachers are taking the whole ICT integration issue quite seriously and would like it to be a part of their life long learning programme. The teacher education providers and ministry of education in each of the PICs need to formulate a plan to provide CPD on ICT in education on a regular basis. There is a clear indication of need for a much more robust plan for a complete immersion of technological pedagogical and content knowledge in teacher education and subsequent trainings.

Despite the poor ICT infrastructure in their home countries, the participants from six member countries consider digital competencies as essential part of teacher's competencies. Therefore, ICT needs to be embedded across the curriculum; it emerged as a cross cutting theme in all areas of education. OERs are seen as an indispensable tool for teachers and their students and consider it as a means to enhance their knowledge, information gathering skills for research purpose as well as to supplement the scarcity of educational resources within a PIC. On the other hand, multimedia tools are considered to target unique learning styles of pacific island learners as well as enhance their motivation level.

It is clear that pre and in-service teachers consider skills and knowledge of ICT integrated pedagogies as an important tool for their professional development. The emerging issues indicate how teachers' training programe can lead to teachers' empowerment. Teacher training in ICT integrated pedagogies needs careful consideration if the teachers in the PICs are to utilise it effectively and efficiently. And such should be the case anywhere in the world. Trucano (2013a) rightly pointed out on the need for teacher training in ICT integrated pedagogies and their continuous professional development to enhance their teaching skills.

As is the case with focus group strategy utilisation, the findings of this study cannot be generalised, however, it provides a baseline to future researchers and teacher education providers. A number of teacher training in ICT integrated pedagogies are taking place around the world including the PICs in various forms and a lot of these are short term or ad-hoc efforts. This case study alerts donors and educators on the teachers' perception towards one-off workshops and what they would like. Though, the teachers highly value these one-off workshops but their needs are more than that. It is clear that such ad-hoc workshops fall short of systematic integration of TPACK into the curriculum. It is our responsibility to listen to the student teachers and find ways to provide them an opportunity to engage in continuous professional development programmes during their teaching career.

Implications and way forward

This study informs the University of South Pacific and other teacher education providers of the pre and in-service teachers' perceptions and needs in the area of digital and teacher competencies in PICs such that relevant training packages can be designed. Most importantly, there is an urgent need for the administrators and ministry of education in PICs to ensure there is a basic infrastructure in place in all schools so that the teachers have a practicing ground. This would in turn give rise to innovations and good practices in ICT integrated pedagogies relevant to PICs among schoolteachers.

Thus, the study proposes a way forward for teacher educators, teacher education institutions and PICs:

1. A set of digital competencies needs to be included in teacher competency framework by each PIC.
2. The teacher education institutions need to align their training with teacher competency framework.
3. A year-long ICT integrated pedagogy and practices programme with modules focusing on various skills sets and competencies needs to be designed for the teachers in the PICs in order to implement TPACK systematically.

Thus, the ICT integrated pedagogies have the capacity to empower the teachers in the PICs and at the same time properly crafted training programmes will enable the Pacific teachers professional development; a win-win situation for all.

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About the author

Dr. Shikha Raturi is an academic in the area of tertiary teaching, elearning and also co-manages the Teachers Educational Resource and Elearning Centre (TEREC) at the University of the South Pacific, Fiji. She worked as a researcher and teacher integrating technology in Chemistry interacting with learners from diverse backgrounds from Africa to Pacific Island Countries (PICs) for nearly 20 years. She made a transition to elearning/education field 9 years back, studying and researching the learning environments in Higher Education. Her work through TEREC involves working on elearning issues and projects with ministries of education across PICs. She is a certified online instructor with specialization in online pedagogy and administration. Email ids: raturi_s@usp.ac.fj or shikhanr@gmail.com

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Editor's Note: High quality media can produce significant learning in the hands of informed teachers. We are in a transition in terms of how we teach and how students learn. Increasingly, learning involves computers and individualized learning that involves visuals, interactivity, and simulations.

Pre-service teachers' perceived usefulness, ease of use, attitude and intentions towards virtual laboratory package utilization in teaching and learning of physics

Oluwole Caleb Falode and Modupe Esther Falode
Nigeria

Abstract

This study was carried out to investigate pre-service teachers', perceived usefulness, ease of use, attitude and intentions towards the utilization of virtual laboratory package in teaching and learning of Nigerian secondary school physics concepts. Descriptive survey research was employed and 66 fourth and fifth year Physics education students were purposively used as research sample. Four research questions guided the study and a 16-item questionnaire was used as instrument for data collection. The questionnaire was validated by educational technology experts, physics expert and guidance and counselling experts. Pilot study was carried out on year three physics education students and a reliability coefficients ranging from 0.76 to 0.89 was obtained for each of the four sections of the questionnaire. Data collected from the administration of the research instruments were analyzed using descriptive statistics of Mean and Standard Deviation. A decision rule was set, in which, a mean score of 2.50 and above was considered "Agreed" while a mean score below 2.50 was considered "Disagreed". Findings revealed that pre-service physics teachers perceived the virtual laboratory package useful with mean scores of 3.34 and easy to use with mean scores of 3.18 respectively. Also, respondents' attitude and intentions to use the package in teaching and learning of physics were positive with mean scores of 3.21 and 3.37 respectively. Based on these findings, it was recommended among others that administrators should equip schools with adequate Information and Communication Technology facilities that would aid students and teachers' utilization of virtual-based learning environments in teaching and learning process.

Key Words: virtual laboratory package, ease of use, perceived usefulness, attitude, behavioural intentions, technology-acceptance model

Introduction

The application of computer technology in classroom environment has a significant role in enhancing teaching and learning. For instance, the use of artificial educational environment such as simulations and virtual reality in teaching and learning is increasingly widespread and has proven to be effective in teaching difficult subjects in science (Babateen, 2011). ICTs have the potential to accelerate, enrich, and deepen skills, to motivate and engage students, to help relate school experience to work practices, create economic viability for tomorrow's workers, as well as strengthening teaching (Yusuf, 2005).

In science and engineering education, virtual laboratories have emerged as alternative or supplementary tools of the hands-on laboratory education (Mahmoud & Zoltan, 2009). Virtual laboratory is an interactive environment without real laboratory tools meant for creating and conducting simulated experiments (Babateen, 2011; Harry & Edward, 2005). It provides students with tools and materials set on computer in order to perform experiments saved on CDs or on web site (Babateen, 2011; Nunn, 2009).

The roles of virtual laboratory in teaching and learning process cannot be over-emphasized. The rapid increase in the use of educational computer has led to changes in the teaching and learning process, curricula and teachers' approach to instruction (Loveless & Ellis, 2002). These changes in instructional techniques are shaped by the fact that computer-assisted learning increases student's motivation and creates better learning environments in which rote- learning is minimized and meaningful learning can occur (Renshaw & Taylor, 2000).

Virtual laboratory enables students to become active in their learning, provides opportunities for students to construct and understand difficult concepts more easily, and allows students to repeat demonstrations that they do not understand or as a review for examinations. Empirical studies on the effects of virtual laboratory on students' academic performance revealed the effectiveness of virtual laboratory in teaching and learning process, especially in science subjects (Efe & Efe, 2011; Kevin & Rod, 2012; Mahmoud & Zoltan, 2009; Tuysuz, 2010; Yuen-Kuang & Yu-wen, 2007).

The technological development of any nation lies in the study of science. Science is the foundation upon which the present day technological breakthrough and innovations are built and every nation of the world is striving to develop and be relevant globally both scientifically and technologically (Falode, 2014). One of the core science subjects is physics and it is a requirement for many specialized science and engineering courses at the universities and other tertiary institutions.

Facilities in many conventional physics laboratories in Nigerian secondary schools are inadequate and where they are adequate, the laboratory is only opened to learners during the school working hours thereby hindering students from engaging in independent and self-paced learning of physics. To tackle the menace therefore, Falode (2014) developed a Virtual Laboratory Package on Nigerian secondary school physics concepts, evaluated its' effectiveness and found that students' performance was greatly improved when they learnt the subject through the package.

Effective utilization of the developed Virtual Laboratory Package in Nigerian secondary schools would depend largely on the level of acceptance of the package among physics teachers. Technology Acceptance Model by Davis (1989) is believed to be one of the most influential models widely used in the studies of the determinant of technology acceptance. TAM determines the user acceptance of any technology perceived usefulness, perceived ease of use, attitude and behavioural intentions to use such technology (Abu-Dalbouh, 2013).

Perceived usefulness is regarded as the degree to which an individual believes that using a particular technology will enhance his task performance. Perceived Ease of Use is described as the degree to which an individual believes that using a particular technology is free of physical and mental effort. Attitude towards technology usage determines the kind of intention to usage of a particular technology while an individuals' intention to use technology determines the actual usage (Abu-Dalbouh, 2013; Davis & Venkatesh, 2004; Davis *et al*., 1989).

A few studies on users' perceived ease of use, perceived usefulness, attitude and behavioural intentions towards technology usage were reviewed. For instance, Alharbi and Drew (2014) carried out a study on using the technology acceptance model in understanding academics' behavioural intention to use learning management systems. Findings revealed that respondents perceived ease of use, perceived usefulness, attitude and behavioural intentions towards usage of electronic learning was positive. Also, Ndubisi et al. (2001) in a study on model testing and examining usage determinants, found that users perceived usefulness of computer technology determines the actual usage of such technology. Bijeikiene, Rasinskiene and Zutkiene (2011) investigated teachers' attitudes towards the use of blended learning in the classroom and found that teachers' attitude towards electronic learning was positive.

Though the developed virtual laboratory package was found effective in teaching and learning of secondary school physics by Falode (2014), it is not clear whether physics teachers would accept and use the package in the actual teaching of the subject. Hence, this study sought pre-service teachers' perceived ease of use, perceived usefulness, attitude and behavioural intentions towards the usage of the package in teaching and learning of physics.

Research questions

The following research questions guided the study:

1. What is the perception of pre-service teachers on the usefulness of virtual laboratory package in teaching and learning of physics?
2. What is the perception of pre-service physics teachers on the ease of using virtual laboratory package?
3. What is the attitude of pre-service teachers towards virtual laboratory package utilization in teaching and learning of physics?
4. What is the behavioural intention of pre-service teachers on virtual laboratory package utilization in teaching and learning of physics?

Methodology

This study adopted descriptive survey research design. The methodology involved the use of questionnaire to elicit needed responses from pre-service teachers on their perceived ease of use, perceived usefulness, attitude and behavioural intentions towards virtual laboratory package utilization in teaching and learning of physics.

The population of the study comprised of all physics education students in Federal University of Technology, Minna, Nigeria. This was because within the study area, only the University offers bachelor's degree programme in physics education. Purposive sampling technique was used to select all the physics education students in their 4th and 5th year in the University. This was because, students in their fourth year were imminently preparing to go for a mandatory six-month teaching practice exercise in secondary schools across Nigeria while students in the 5th year just returned to the university after completing the same six-month exercise. Hence, students in the two classes were considered to have been prepared for teaching profession. A total of 66 (all the 32 students in 4th year and all the 34 students in the 5th year) was therefore selected as sample for this study.

Two research instruments were used for the study. They are: Questionnaire on Pre-service Teachers' Perception of Virtual Physics Package Utilization (QPTPVLPU) and Virtual Laboratory Package (VLP). QPTPVLPU was adapted from Alharbi and Drew (2014) Questionnaire on Technology Acceptance Model and it consists of five sections (Sections A-E). Section A was used to collect demographic data of the respondents, Section B consists of five items on respondents' perceived usefulness of VLP, Section C consists of six items on perception of respondents on ease of using VLP, Section D consists of three items on attitude of respondents towards VLP utilization while Section E consists of two items on respondents' behavioural intentions towards VLP utilization in teaching and learning of physics. A four-point rating scale of Strongly Agree, Agree, Disagree and Strongly Disagree was used in weighing responses to the questionnaire items.

VLP was adopted from Falode (2014). It was developed using Adobe Flash CS6. The programming language used was Actions script 3.0 while the Graphic User Interface (GUI) was created using Adobe Fireworks CS6. Box2D was used for the physics simulation engine and

Camstudio software was used in recording the video tutorial. The package is meant for performing secondary school physics experiments (simple pendulum experiment, Hooke's law experiment and momentum experiment). The entrance menu of the package consisted of introduction/student's registration edifice, list of practical lessons (Lessons 1, 2 & 3) and exit button. The main menu is divided into three sections, namely, lesson note section, where the learner is able to study the content for the experiments; Video section, where the learner is able to watch tutorial of how to use the package; and laboratory section where the learner is able to perform the experiments.

The questionnaire was validated by two physics lecturers, two educational technology experts and two guidance and counselling experts. Their suggestions were used to modify and improve the items. To determine the internal consistency among the items of the questionnaire, a pilot study was carried out using 3rd year physics education students at Federal University of Technology, Minna, Nigeria. The questionnaire was administered once on the pilot study sample and Cronbach Alpha's formula that was used to determine its' reliability yielded 0.78, 0.89, 0.81 and *0.76* coefficients for Sections B, C, D and E respectively. Hence, the questionnaire was considered suitable for the main study.

The virtual laboratory package as well as its user's manual are available to the study population in the university departmental library. Hence, they always have access to it before, during and after the study. However, the same package was projected to the respondents for the purpose of this study before they were requested to complete the questionnaire. The duly completed questionnaires were retrieved same day they were administered.

Data gathered from the administered questionnaires were analyzed using descriptive statistics. Mean and standard deviation were used to answer the four research questions. A four-point rating scale of Strongly Agree (SA, 4 points), Agree (A, 3 points), Disagree (D, 2 points) and Strongly Disagree (SD, 1 point) was used in weighing responses to items in the questionnaire. Responses on each questionnaire item were analyzed according to frequencies and mean rankings. First of all, total responses in each scale category (frequency) of every item were tabulated. Next, the number of points allocated to each category was multiplied by the frequency of each category (n). Lastly, the sum of these scores was divided by the sum of the frequency for each category (ΣN).

$$\text{Mean} = \frac{[4 \text{ x } N(SA)] + [3 \text{ X } N(A)] + [2 \text{ x } N(D)] + [1 \text{ x } N(SD)]}{\Sigma N}$$

A mean response below 2.50 was considered disagreement while a mean response of 2.50 and above was considered as agreement.

Results

In this section, Table 1-4 are presented with their interpretations tailored towards providing answers to the research questions raised to guide this study.

Table 1 shows the Mean and Standard Deviation of pre-service teachers' response on their perceived usefulness of Virtual Laboratory Package. The table reveals the computed mean score of 3.55 with Standard Deviation of 1.55 for item one, 3.27 with Standard Deviation of 0.77 for item two, 3.24 with Standard Deviation of 0.74 for item three, 3.33 with Standard Deviation of 0.83 for item four, and 3.33 with Standard Deviation of 0.83 for item five. The table reveals further that, the grand mean score of responses to the five items was 3.34 which was greater than the decision mean score of 2.50. This implies that pre-service teachers agreed to the items generated and perceived Virtual Laboratory Package useful in teaching and learning of physics.

Table 1
Mean and standard deviation of pre-service teachers' response on perceived usefulness of virtual laboratory package

S/N	Item	N	SA	A	D	SD	Mean	St. Dev	Decision
1	Using virtual laboratory package in my teaching career would enable me to accomplish tasks more quickly.	66	40	22	4	0	3.55	1.55	Agree
2	Using virtual laboratory package would improve my teaching performance.	66	18	48	0	0	3.27	0.77	Agree
3	Using virtual laboratory package as a teacher would increase my productivity.	66	20	44	0	2	3.24	0.74	Agree
4	Using virtual laboratory package would enhance my effectiveness as a physics teacher.	66	28	32	6	0	3.33	0.83	Agree
5	Using virtual laboratory package would make it easier to teach physics.	66	26	36	4	0	3.33	0.83	Agree
	Grand Mean						**3.34**		**Agree**

Table 2
Mean and standard deviation of pre-service physics teachers' response on perceived ease of using virtual laboratory package

S/N	Item	N	SA	A	D	SD	Mean	St. Dev	Decision
1	I feel that using virtual laboratory package would be easy for me.	66	24	42	0	0	3.36	0.86	Agree
2	I feel that my interaction with virtual laboratory package would be clear.	66	20	46	0	0	3.30	0.80	Agree
3	I feel that it would be easy to become skillful at using virtual laboratory package.	66	26	36	4	0	3.21	0.71	Agree
4	I would find virtual laboratory package flexible to interact with.	66	24	36	6	0	3.09	0.59	Agree
5	Learning to operate virtual laboratory package would be easy for me.	66	26	38	2	0	3.30	0.80	Agree
6	It would be easy for me to get virtual laboratory package to teach physics.	66	12	34	16	4	2.81	0.31	Agree
	Grand Mean						**3.18**		**Agree**

Table 2 shows the Mean and Standard Deviation of pre-service teachers' response on their perceived ease of using Virtual Laboratory Package. The table reveals the computed mean score of 3.36 with Standard Deviation of 0.86 for item one, 3.30 with Standard Deviation of 0.80 for item two, 3.21 with Standard Deviation of 0.71 for item three, 3.09 with Standard Deviation of 0.59 for item four, 3.30 with Standard Deviation of 0.80 for item five and 2.81 with Standard Deviation of 0.31 for item six. The table reveals further that, the grand mean score of responses to the six items was 3.18 which was greater than the decision mean score of 2.50. This implies that pre-service teachers agreed to the items generated and perceived Virtual Laboratory Package easy to use in teaching and learning of physics.

Table 3
Mean and standard deviation of pre-service teachers' response on attitude towards virtual laboratory package

S/N	Item	N	SA	A	D	SD	Mean	St. Dev	Decision
1	I believe it is a good idea to use virtual laboratory package in teaching of physics	66	24	34	8	0	3.00	0.50	Agree
2	I like the idea of using virtual laboratory package in physics classroom.	66	26	30	8	2	3.21	0.71	Agree
3	Using virtual laboratory package is a positive idea in teaching and learning of physics.	66	30	34	2	0	3.42	0.92	Agree
	Grand Mean						**3.21**		**Agree**

Table 3 shows the Mean and Standard Deviation of pre-service teachers' response on attitude towards Virtual Laboratory Package. The table reveals the computed mean score of 3.0 with Standard Deviation of 0.50 for item one, 3.21 with Standard Deviation of 0.71 for item two, and 3.42 with Standard Deviation of 0.92 for item three. The table reveals further that, the grand mean score of responses to the three items was 3.21 which was greater than the decision mean score of 2.50. This implies that pre-service teachers agreed to the items generated and have positive attitude towards the utilization of Virtual Laboratory Package in teaching and learning of physics.

Table 4 shows the Mean and Standard Deviation of pre-service teachers' response on behavioural intentions to use Virtual Laboratory Package. The table reveals the computed mean score of 3.33 with Standard Deviation of 0.83 for item one, and 3.42 with Standard Deviation of 0.92 for item two. The table reveals further that, the grand mean score of responses to the two items was 3.37 which was greater than the decision mean score of 2.50. This implies that pre-service teachers agreed to the items generated and have behavioural intentions to use Virtual Laboratory Package in teaching and learning of physics.

Table 4
Mean and standard deviation of pre-service teachers' response on behavioural intentions to use virtual laboratory package

S/N	Item	N	SA (4)	A (3)	D (2)	SD (1)	Mean	St. Dev	Decision
1	I plan to use virtual laboratory package when I become a teacher.	66	26	36	4	0	3.33	0.83	Agree
2	Assuming that I have access to virtual laboratory package, I intend to use it in teaching of physics.	66	28	38	0	0	3.42	0.92	Agree
	Grand Mean						**3.37**		**Agree**

Findings

Findings on the usefulness of virtual laboratory package reveals that pre-service teachers perceived the package to be useful in teaching and learning of secondary school physics concepts. This finding was in line with the recommendation of Davis (1989) and the views of Davis and Venkatesh (2004) and that of Abu-Dalbouh (2013) that users of a particular technology must perceive it to be useful in enhancing their performance before they can actually use it. The finding also agrees with the earlier finding of Alharbi and Drew (2014) who found that academics' perception of the usefulness of Learning Management System was positive. Furthermore, this present finding confirms the earlier submission of Ndubisi et al. (2001) that users perceived usefulness of computer technology determines the actual usage of such technology by users. Pre-service teachers perceived the virtual laboratory package useful because they know it would enhance their teaching and make them efficient in teaching of physics.

Findings on ease of using virtual laboratory package reveals that respondents perceived the package easy to use. This finding was in line with the recommendation of Davis (1989) who developed the Technology Acceptance Model (TAM), the views of Davis and Venkatesh (2004) and that of Abu-Dalbouh (2013) that using a particular technology must be free of physical and mental effort. This finding is in agreement with the earlier finding of Alharbi and Drew (2014) who found that academics perceived Learning Management System easy to use. The perceived ease of using virtual laboratory package by pre-service physics teachers was because they have been using electronic means to learn some of their university courses. Therefore, it was not difficult for them to operate and navigate through the package.

The finding of this study on attitude reveals that pre-service teachers have positive attitude towards the use of virtual laboratory package in teaching and learning of physics. This finding is not at contrast to the views of Davis (1989), Davis and Venkatesh (2004) and Abu-Dalbouh (2013) that attitude towards technology usage determines the kind of intention to usage of such technology. This present finding is in agreement with the earlier finding of Bijeikiene, *et al*. (2011) that teachers' attitudes towards the use of electronic learning in the classroom was positive. In addition, it agrees with the finding of Alharbi and Drew (2014) who found that academics' attitude towards electronic learning was positive. The positive attitude of pre-service teachers towards the use of virtual laboratory package was as a result of their perceived simplicity and enormous benefits of the package to enrich students' understanding in the classroom.

Another finding that emanated from this study reveals that pre-service teachers are willing and have positive intentions to use virtual laboratory package in teaching and learning of physics.

This finding is in line with the views of Davis (1989), Davis and Venkatesh (2004) and Abu-Dalbouh (2013) that an individual's intention to use a particular technology determines the actual usage of such. This present finding does not contradict the earlier finding of Alharbi and Drew (2014) who found that behavioural intentions of academics towards usage of electronic learning was positive. Pre-service teachers' willingness and intentions to use the virtual laboratory package in teaching and learning of physics was as a result of their positive attitude towards the package.

Conclusion

This study has revealed that pre-service teachers perceived Virtual Laboratory Package easy to use and useful in teaching and learning of Nigerian secondary school physics concepts. It reveals further that the attitude of pre-service teachers to the use of the package was positive just as they have intentions to use the package upon completion of their teaching education in the University. The use of the package would in no doubt improve students' achievement in physics and make teachers more efficient in teaching of the subject if proper measures are put in place.

Recommendations

Based on findings that emanated from this study, it is recommended that:

1. Developers of virtual-based learning environments such as Virtual Physics Laboratory Package should ensure they develop packages that are easy to use and perceived useful by teachers. This would enable them have positive attitude and intention to utilize such in teaching and learning process.
2. Administrators should equip schools with adequate Information and Communication Technology facilities that would aid students and teachers' utilization of virtual-based learning environments such as Virtual Physics Laboratory Package in teaching and learning process.

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About the Authors

FALODE, Oluwole Caleb (Ph.D), is a Lecturer in the Department of Educational Technology, Federal University of Technology Minna, Nigeria. Also, he is the Courseware Development at Centre for Open Distance and e-Learning of the same University. He obtained his Doctor of Philosophy in Educational Technology from the University of Ilorin, Ilorin, Nigeria.

E-mail: facominsight2@gmail.com;

FALODE, Esther Modupe, is a doctoral student of Educational Technology in the Department of Educational Technology, Federal University of Technology Minna, Nigeria. She obtained her Master of technology in the same discipline and from the same University in 2016.

E-mail: folarinmodupe@yahoo.com

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