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Editorial

A philosopher's approach

Donald G. Perrin

Behind every school and every teacher is a set of related beliefs--a *philosophy of education*--that influences what and how students are taught. A *philosophy of education* represents answers to questions about the purpose of schooling, a teacher's role, and what should be taught and by what methods¹.

Needless to say, because of individual differences, there are many philosophies of education. And each new experience can modify that philosophy with a change infinitesimally small, or sometimes large and visible. People debate their positions, group behind opinion leaders or become part of a movement. There are many dimensions – conservative to progressive, human to machine, theory to practice, pragmatic to research based, and so on. Educational theories and related philosophies have been influenced by scientists, engineers, technologists, mathematicians, psychologists, sociologists, educators, politicians, medical doctors, coaches, people from all walks of life, and subject matter experts in all disciplines.

In the 20th century the emphasis was on social adjustment and maximizing the potential of each individual student. In the 21st century it has moved to high tech and social media to take advantage of ubiquitous computers, tablets and smart phones widely used by students. When defined in the 1960s, instructional technology was an expansive definition, not limited to any particular medium, device, or pedagogy.

Question: Will this definition continue to support the tenets on which Western education is built, now and in the future?

Instructional technology is a systematic way to design, carry out, and evaluate the process of learning and teaching in terms of (A) specific objectives, based on (B) research in human learning and communication, and (C) employing a combination of human and non-human resources to bring about (D) more effective instruction.

A. Specific objectives

Objectives based on human essentials were defined in *Maslow's Hierarchy of needs*², predicated on fulfilling innate human needs ranging from sustenance to self-actualization:

1. **Biological and physiological needs** - air, food, drink, shelter, warmth, sex, sleep.
2. **Safety** - protection from elements, security, order, law, stability, freedom from fear.
3. **Love and belonging** - friendship, intimacy, affection and love - from work group, family, friends, and romantic relationships.
4. **Esteem** - achievement, mastery, independence, status, dominance, prestige, self-respect, respect from others.
5. **Self-Actualization** - realizing personal potential, self-fulfillment, personal growth and peak experiences.

*Carl Rogers*³ held that, for a person to reach his or her potential, a supportive and open environment is necessary for growth, acceptance and empathy. These in turn develop relationships and healthy personalities.

*Robert Maynard Hutchins*⁴ added intellect, good judgement and ethics. "The real goal of man is the fullest development of his specific powers, wisdom and goodness." Today we express this as "maximizing the potential of every individual student".

*Robert Mager*⁵ taught us how to write goals and objectives to specify what to learn, the level to achieve, and under what conditions to demonstrate that learning has reached criterion.

*Benjamin Bloom*⁶ developed taxonomies for cognitive, affective, and psychomotor learning and drew the distinction between rote learning, conceptualization, and higher levels of learning.

*Alfred Binet*⁷ invented the first practical intelligence test. His principal goal was to identify students who needed special help in coping with the school curriculum. *Lewis Terman*⁸ revised the Binet-Simon Scale to create the "Stanford-Binet" individual intelligence test.

B. Based on research in human learning and communication

There is no end to the data stream from research, theory and practice in educational methods and pedagogy: **Communication.** (*Wilbur Schramm*⁹ - communication theory; George Gerbner¹⁰ – violence on television). **Education.** (*Edgar Dale*¹¹ - Cone of Experience, *John Dewey*¹² - learning by doing; *Edward Thorndike*¹³ - connectionism, reinforcement theory, Law of Effect; *James D. Finn*¹⁴ - technology and the instructional process, *Jerrold Kemp*¹⁵ - instructional design; (*Leonard Silvern*¹⁶ - educational systems).

Social Sciences: Psychology. *Wilhelm Maximilian Wundt*¹⁷ (1832 –1920) is widely regarded as the "father of experimental psychology". He founded the first formal laboratory for psychological research that marked psychology as an independent field of study.

Behaviorism - *John B. Watson*¹⁸, *Ivan Pavlov*¹⁹, *B. F. Skinner*²⁰, *Edward Chace Tolman*²¹.

Behaviorism is primarily concerned with classical and operant conditioning and observable behavior that can be objectively and scientifically measured.

Pragmatism - *John Dewey*²² (experiential education – learning by doing). Pragmatism is a naturalistic approach that views knowledge as an active adaptation of the human organism to its environment.

Cognitive psychology - *Jerome Seymour Bruner*²³ (cognitive learning theory); *Jean Piaget*²⁴ (theory of cognitive development - known for his epistemological studies with children.) *Robert M. Gagne*²⁵ (*The Conditions of Learning and Theory of Instruction*).

Constructivism (*David H. Jonassen*²⁶) – involves theories of learning and practices of instructional design resulting in active, creative and social learning and discovery learning.

Social constructivism (*Albert Bandura*²⁷ – social learning theory, self-efficacy). Social constructivists believe that reality is constructed through human activity

Cultural-historical psychology (*Lev Semyonovich Vygotsky*²⁸ - founder of a theory of human cultural and bio-social development)

C. Combination of human and non-human resources

In 1912, Thorndike suggested a diagnostic-prescriptive model to optimize available resources. This principle has been widely used in instructional design to integrate a variety of media resources, especially interactive multimedia:

On the whole, the improvement of printed directions, statement of facts, exercise books and the like is as important as the improvement of powers of teachers themselves to diagnose the condition of pupils and to guide their activities by personal means. Great economies are possible by printed aids, and personal comment and question should be saved to do what only it can do. A human being should not be wasted in doing what forty sheets of paper or two phonographs can do. Just because personal teaching is precious and can do what books and apparatus can not, it should be saved for its peculiar work. The best teacher uses books and appliances as well as his own insight, sympathy and magnetism.²⁹

D. to bring about more effective instruction.

Performance objectives, based on the guidelines provided by Mager, determine the subject matter and context for the instructional designer. They also describe the required outcome and the conditions for criterion testing. Additional experiences can be used for reinforcement and assure meaningful learning that persists over time

Conclusion

Renaming *audiovisual* to *instructional technology* provided an expansive definition to accommodate future changes and manage faculty and learner support for new media, devices and pedagogies. As we move into new paradigms of learning and teaching, with artificial intelligence, automation, distance learning and lifelong learning, we will continue to redefine the boundaries of learning technologies and test new models for diagnostic and prescriptive teaching, learning and evaluation.

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Editor's Note: The growing body of theory, research and practice in educational technologies, specifically in instructional technology, provide a comprehensive and growing toolset for the instructional designer, teacher and administrator. These tools are changing the nature of instruction. Ubiquitous technologies and interactive multimedia deliver content anywhere anytime. Students have greater control of their schedule and learning, enabling them to be self-directed. Teachers spend less time delivering curriculum and more time in counseling, guiding and tutoring students; researching, developing, and adapting curriculum; and interacting one-on-one to meet individual student needs. This paper is to assist in making value judgements about which media and methods will be most effective for today's students.

Educational value-differentiation: new technology integration

John DeNigris III, Brent Muirhead and Jean R. Perlman

USA

Abstract

The focus of this article is an overview of educational value differentiation correlated with technology advancements. 21st Century educational pedagogy is multidimensional with new opportunities and challenges for a learner-centered teaching philosophy. Ubiquitous learning, integrated with emerging online and mobile technologies, provides effective new opportunities for adult learner education. An analysis is given of education technology stages, from 1920 to post 2015, mapped to education value differentiation. A new chronology model is proposed: the 10-Stage Educational Value-Differentiation Technology Chronology (ETVC) Model^{©2015 Perlman}. Introduced in the 10th stage is a new concept for post 2015 era educational-value paradigms: the Flexible Critical-Thinking Concept^{©2015 Perlman}. This information may be useful to course-developers in understanding how to develop pedagogies for 21st century education. In turn, adult learners may benefit from being prepared for emergent technologies and industry challenges and opportunities.

Keywords: online learning, technology, distance learning, mobile learning, educational value differentiation mapping, adult learner engagement, learner-centered teaching philosophy, 10 Stage ETVC model, flexible critical-thinking concept

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Introduction

Distance learning began with the initiation of correspondence education in the 1770s (Harting & Erthal, 2005). Correspondence education was made possible with the launch of regular postal service to the public, i.e. "new technology". Distance learning has continued to evolve in conjunction with ongoing emergence of new technologies (Banas & Emory, 1998). With each stage of technology platforms, new delivery-techniques add learning value for students. Use of educational value-differentiation, enabled by technology, is crucial to effective learning. Teaching does not remain static (Saavedra & Opfer, 2012). To keep contemporary, adult learning pedagogy needs continual changes to be in sync with new technologies. Accordingly, understanding of multidimensional educational-value differentiations is foundational to understanding mobile (i.e. distance) learning.

The article begins with a discussion of mobile learning and educational value pedagogy. Next, a time-line synopsis of technology mapped to educational value-added from 1920 through post 2015 is analyzed. A new chronology model is proposed: the 10-Stage Educational Value-Differentiation Technology Chronology (ETVC) Model^{©2015 Perlman}. Within the 10-Stage ETVC Model[©], a new concept, the Flexible Critical-Thinking Concept^{©2015 Perlman} is introduced to describe the educational-value differentiation for post 2015 era educational-value paradigms.

Details of the model components are presented in Table 1. Concluding the article are summary reflections on the connections of educational-value differentiation, technology integration, and student learning experience in the post 2015 era. Recommendations for research on effective post 2015 ubiquitous learning technologies are given.

Table 1
10-Stage Education-Technology Value Chronology (ETVC) Model^{©2015 Perlman}
An Overview of Educational Technology: 1920 to post 2015 Educational Value Differentiation

Education Technology Stage	Technology Stage Timespan	Technology	Adult Learner Engagement Focus	Educational Value Differentiation	Learning Manager
1. Visual-Media Stage	1920-1949 (Hashim & Gapor, 2010)	Visual	Visual instruction using static media	Pictures, slides, flash cards, models, charts	Professor
2. Multi-Media Stage	1950-1959 (Hashim & Gapor, 2010)	AudioVisual	Media Using Sound Recording, Radio Broadcasting, Motion Film with Sound	Instructional television, Distance Learning access to remote areas	Professor
3. IT Process Stage	1960-1979 (Hashim & Gapor, 2010)	Information technology systems, Internet beginning	Process focus: Problem identification, analysis, solution development	Problem solving utilizing Information Technology software systems	Professor and learner
4. ICTD application stage	1980-1989 (Internet society, 2015)	Internet widespread use; information and communication technology (ICT) development	Application focus: instructional technology, including personal computer, software applications	Behavioral learning theory application to develop cognitive learning theory instructional design	Professor and learner
5. ICTD Integration Stage	1990-1994 (Seels & Richey, 1994)	Internet Information and Communication Technology (ICT)	Integration focus: Student Interaction with course content integrated within course.	Technological Communication Theory. Educational applications in five ICT areas: design, development, utilization, management and evaluation	Professor with increased flexibility in course aids controlled by the learner
6. EPSS Stage	1995-1999 (Driscoll, 2000; Lee, 2005; Partlow & Gibbs, 2003; Reise, 2001)	Electronic Performance Support System (EPSS) instructional design software and hardware	Performance Focus: essential work-related information; a series of work activities	Just-In Time learning Constructivist learning theory	Professor with increased time flexibility for end goals by the Learner

Education Technology Stage	Technology Stage Timespan	Technology	Adult Learner Engagement Focus	Educational Value Differentiation	Learning Manager
7. Knowledge Systems Stage	2000- 2003 Gal & Nachmias, 2011; Roberts & Naqvi, 2010; Rowley, 2000	Knowledge Management Systems	Learn by doing.	Student enabled real-world learning environments	Professor with increased assignment activity responsibility by learner
8 Instructional Technology Stage	2004-2010 (Chang, 2010; Jones, Johnson & Bentley, 2004; Hashim & Gapor, 2010; Roberts & Naqvi, 2010)	Wireless Learning platforms	Focus on technology to generate information to problem solve	Asynchronous learning	Professor and learner
9. Smart Experiential Knowledge Stage	2010-2015 (Jennings & Wargnier, 2010; Larsen, 2004; Tucker & Lee, 2014)	Smart mobile Experiential learning platforms	Focus on action, rather than information	Student Mobility Preparation for unknown organization challenges	Learner has increased control, professor decreased control
10. Time-Space Knowledge Paradigm Stage	Post 2015 (Hayman & Smith, 2015; Papastamatis & Panitsides, 2014; Prata, Letouze, Cerri & Costa, 2016; Rowe, 2015; University Business Staff, 2015)	Mobile smart technology Game theory, Cloud Systems	New Knowledge Construction integrating cross-industry discipline learning Customized learning goals; Instantaneous feedback	Holistic Concepts New paradigms of Critical Thinking involving spatial temporal awareness concepts "Flexible Critical-Thinking Concept" ^{©2015 Perlman}	Learner

Mobile Learning and Educational-Value Pedagogy

A concise definition of mobile learning is shared by Hwang & Tsai (2011) as “using mobile technologies to facilitate learning” (p. 65). The definition stresses the nature of digital devices enabling users to learn in a diversity of ways that transcends specific places or times. Individuals are free to engage in learning activities whether individual or group oriented in a diversity of settings. Mobile learning definitions vary on their focus with a stress on the personal or individual nature of the interactions with technologies involving information and knowledge sharing. Mobile devices have several advantages over desktop computers such as being easy to carry and can be less expensive. Smart phones have become very popular due to their ability to communicate, share information and photos.

Wen-Hsiung, Yen-Chen, Chun-Yu, Hao-Yun, & Che-Hung (2012) conducted a meta-analysis of 164 articles on mobile learning and the majority of the studies focused on the issue of effectiveness. Research findings identified a pattern of significantly positive educational outcomes. The literature reflects a lack of consensus about a specific educational theory to support mobile learning. There are writers who advocate a variety of theoretical approaches: activity learning, constructivism and collaborative learning (Friedel, Bos, Lee & Smith, 2013). Constructivism has been a popular theoretical model because it offers the possibility of students developing their own knowledge.

Educators are skeptical about placing unrealistic expectations on higher education students. Muirhead (2006) related “Educators are concerned about students having to teach themselves vital knowledge content areas and whether students are truly understanding basic subject concepts” (p. 17). Therefore, there are questions about the depth of the student’s knowledge and their ability to independently build knowledge with limited teacher guidance. Also, critics have raised questions about the amount of time necessary for students to develop and finish the complex projects. For instance, the greater emphasis on discovery learning creates the need for more time so that individuals must explore and discern information before creating knowledge products. Therefore, teachers must evaluate their short and long term learning goals and potential benefits when creating assignments (Tobias, 2009).

It is important to be objective when selecting an educational theory. The literature reveals numerous writers who consistently advocate the constructivism but often fail to acknowledge the theories’ limitations or disadvantages. In a recent study using constructivism principles, undergraduate psychology students practiced complex skills through computer based simulation-based training. Vogel-Walcott, Gebirim, Bowers, Carper & Nicholson (2011, p. 1365) reflected disappointment with this approach, “while contemporary researchers continue to defend the use of constructivist strategies, our research supports earlier findings that question the utility, efficiency, and impact of these strategies in applied domains” (p. 1365).

Educators should examine how to effectively integrate smart technologies into their courses such as noting what other instructors have done. Keskin & Metcalf (2011) shared suggestions for matching technologies with learning objectives and educational theories such as using Cognitive Load Theory by using audio, video and animation. Combining theories can be an effective way to assist students who vary in their cognitive maturity. The Cognitive Apprenticeship Model involves situated learning and constructivism (Sammel, Weir, & Klopper, 2014).

The debate over educational theories will continue but teachers must identify relevant and effective ways to integrate technologies into their instruction. Therefore, the literature points to a need to understand how mobile learning represents a new educational format and how it impacts traditional relationship boundaries. Nortcliffe & Middleton (2013) related that “Delineation between study, life and work is fading and the pervasive, persistent nature of smart technology is part of that change” (p. 179). For instance, students will share a course audio or video clip with family members. University educators must recognize when integrating smart technologies into course work will require the consideration of a variety of factors, as follows:

1. Teacher and student expertise with the technologies
2. Evaluation procedures for formal and informal learning situations
3. Degree of teacher directed learning and guidance with technologies
4. Types of technologies to be used
5. Selecting the educational philosophy to best leverage the technologies
6. Learning objectives / simple to complex (e.g. knowledge creation)

7. Ways to individualize and foster personalized learning opportunities
8. Establishing boundaries for students between work/school/family/leisure
9. Peer pressures and influences when working in social media environments.

The ten factors reflect how mobile learning is multidimensional and has created new opportunities and challenges. There will be a series of teacher choices when designing an activity: identifying the best match between technologies and an activity and educational theory or theories, developing relevant goals (e.g. subject content / critical thinking) and deciding how to evaluate the student work. Adult learners want intellectually engaging and relevant assignments. Smart technologies have the potential to foster creative opportunities for students to produce original ideas and products. Csikszentmihalyi (1990, 1996) is well known for the theory called the flow and encouraging creativity. It has relevance for educators who want to foster creative learning goals with smart technologies by applying the following guidelines:

1. Create clear objectives and expectations
2. Develop a balance between competencies and skills of an individual to foster realistic challenges
3. Provide timely feedback
4. Offer opportunities for significant personal control over learning experiences
5. Promote intrinsic motivation and playful attitudes through the use of enjoyable activities.

The guidelines are based on adapting a learner centered teaching philosophy and by providing appropriate teaching strategies that recognize the developmental level of the student (e.g. scaffolding knowledge). Optimal learning situations will challenge individuals but will not overwhelm them. Ultimately, the best experiences are enjoyable and add value to the individual's educational journey. Students dislike superficial work but appreciate having meaningful projects. Mobile learning lessons can cultivate reflective and novel thinking and promote lifelong learning attitudes and study habits. In fact, the wise application of technology assignments could promote intrinsic motivation and encourage a deeper form of learning by being absorbed with studying.

Edmundson (2014) observed that "I'd say, rather, that the deep opposite of attention isn't distraction, but absorption. No one ever tells you 'pay absorption.' Absorption is what occurs when you immerse yourself in something you love doing" (p. 30). Teachers can utilize smart technologies to design relevant activities that are personal, positive and foster a desire for acquiring new knowledge and skills.

In summary, educational-value pedagogy is grounded in a creative learner-centered teaching philosophy. Adaptation to this philosophy is facilitated by an understanding of educational-value differentiation among distance learning technologies (Hashim & Gapor, 2010). Adult learner engagement focus can be correlated to effective use of these different technology platforms.

10-Stage Educational Value-Differentiation Technology Chronology (ETVC) Model^{©2015 Perlman}

There is a controversy in the field on whether technology is a tool or a product (Hashim & Gapor, 2010). However, whether classified as a tool or product, technology provides a teaching aid which enables educators to engage students in a creative way. The integrated use of technology fosters an educational value-differentiation. In this section, building from the time-line discussion by Hashim & Gapor (2010), a new ten stage chronology model is proposed. Incorporated in the model is a new mapping concept of educational value-differentiation to a chronological technology stage.

The new model is discussed below, and is presented in Table 1, 10-Stage Education-Technology Value Chronology (ETVC) Model^{©2015}

The first education-technology value stage is the Visual-Media Stage, approximately 1920-1949. The key characteristic involves use of visual media for education. Prior to this initial technology stage, teaching was done without a “technical” aid. Educators relied primarily on personal presentations and correspondence printed media (Banas & Emory, 1998; Harting & Erthal, 2005). During the 1920s, 1930s, and 1940s; *visual static media* technologies were added to the educational toolbox (Hashim & Gapor, 2010). Examples of visual media included chalk boards, pictures, slides, flash cards, models, and charts.

The second education-technology value stage is the Multi-Media Stage, approximate 1950-1959. During the 1950s, visual media learning was enriched with sound (Hashim & Gapor, 2010). During this era, instructional television was also introduced as a teaching method. As a result, television broadcasting expanded the educational audience. Students in remote areas were now enabled to be part of a class.

The third education-technology value stage is the Information Technology (IT) Process Stage, approximately 1960-1979. During this stage, more complexity in technological processes enriched instructional delivery of content. With the increased wide-spread use of technology in the 1960s and 1970s, software system processes emerged to facilitate new approaches to teaching (Hashim & Gapor, 2010). Instead of a one-way perspective of the professor presenting information to the student, the student became part of the process. The processes of information systems were integrated as problem solving tools. The student was challenged to solve problems as part of the creative learning process.

Another characteristic of the IT Process Stage was also a change in **who** had the control of the process (Hashim & Gapor, 2010). Prior to 1960, the professor controlled the visual and audio learning aids. Post 1960, learners had an increasing level of control over aspects of the learning process and timing. The learner became empowered to change parameters, situations, etc. to test problem-solving solutions.

The focus of instruction for learners during the IT Process Stage involved a basic 3-part process (Hashim & Gapor, 2010). First, students were required to read a case to determine problem identification. Second, students discussed the analysis of an issue. From their analysis, students used software to develop solutions. This approach to learning enhanced the prior approach of a one-way, visual presentation of a problem. Utilizing this systematic and logical approach to problems enabled adult learners to understand how they might approach situations in the real world. However, learners were still limited by case parameters (i.e. the details given by the professor).

The fourth education-technology value stage is the Information and Communication Technology Development (ICTD) Application Stage, approximately 1980 through 1989. This stage emerged with the wide-spread use of the internet (Hashim & Gapor, 2010). While the internet began in the 1960s, academic use first began in the 1980s (Internet Society, 2015). With the availability of this technology, academician theorists were able to incorporate the internet as part of the 20th Century educational strategies (Hashim & Gapor, 2010).

During this stage, behavioral learning theory was integrated with ICTD approaches (Hashim & Gapor, 2010). With the advent of mapping behavioral learning strategies to the internet functionality, course designers began new approaches to learning. Instructional designers developed class learning modules with integration of cognitive learning theory concepts. Adult learners were challenged with new ways of approaching learning.

The fifth education-technology value stage is ICTD Integration Stage, approximately 1990-1994. The distinction of this stage was two-fold. First, Internet and personal computer applications integration gained wide-spread availability and use (Reiser, 2001). Second, in response to this new way of working and learning, there was a change in the educational definition of information technology. During this stage, the IT education definition expanded to include both theoretical and practical application within learning processes and resources across five ICT areas: design, development, utilization, management and evaluation (Seels & Richey, 1994).

The sixth education-technology value stage is the Electronic Performance Support Systems (EPSS) Stage, approximately 1995-1999. Introduced in the early part of the 20th Century, EPSS provided instructional design software and hardware to facilitate real-time learning (Lee, 2005). With this technology capability, educators were able to integrate constructive theory principles to online learning (Partlow & Gibbs, 2003). The learning goals became focused on work specific learning. The educational approach involved a *just-in-time* approach (Reiser, 2001). Adult learners gained more control over their learning process and were enabled to learn key information which they could use in their jobs.

The seventh education-technology value stage is the Knowledge Systems Stage, approximately 2000 through 2003. This stage was an outgrowth of the EPSS Stage. From being primarily a technology tool to facilitate learning, EPSS evolved into management of knowledge systems (Gal & Nachmias, 2011; Rowley, 2000). The key differentiating educational added-value was *learning-by-doing*. As a result, increased integration of real-world learning outcomes for students became possible. To achieve this learning goal, educational activities such as tutorials, multiple perspective discussions, and learn-by-doing simulations were incorporated into course content (Driscoll, 2000).

The eighth education-technology value stage is the Instructional Technology, approximately 2004-2010. In this stage, the educational value differentiation focus was on using technology integrated with constructive teaching theory (Knowlton, 2005). Instructional designers matched course activities to targeted technology, rather than vice-versa (Hashim & Gapor, 2010). Also, during this stage, a key online educational platform was through asynchronous delivery via wireless technology, (Chang, 2010; Jones, Johnson & Bentley, 2004).

The ninth education-technology value stage is Smart Experiential-Knowledge Stage, 2011-2015. This stage developed out of an industry need for more flexibility in experiential learning outcomes. In learn-by-doing, students utilized memorization with situational applicability. When a situation arose, learned knowledge could be retrieved and applied (Larsen, 2004).

With the rapid changes in 21st Century organization environments, came the need for a different kind of experiential knowledge. Instead of expected situations, education was needed to prepare people for unknown organization challenges (Jennings & Wagnier, 2010; Tucker & Lee, 2014). A more dynamic type of retained learning was needed. This type of learning could be labeled as a *smart* experiential knowledge. The focus of *smart experiential-knowledge* is on action rather than information. Additionally, the technology platform is increasingly more mobile. A new focus on adult learner outcomes is knowledge of how and where to find applicable solutions.

The tenth education-technology value stage is the Time-Space Knowledge Paradigm Stage, with a timeline designated as “post 2015”. The focus of this education stage is 2-fold. The first aspect involves teaching adult learners how to use emergent new 21st Century technologies to resolve organization issues (Hayman & Smith, 2015). Emergent technologies will enable smaller and more mobile access to users. Game theory is being integrated into education (Prata, Letouze, Cerri, & Costa, 2016).

Emerging technologies are enabling increasingly rapid rates of information retrieval accompanied with increasing rates of robust capabilities. Devices will work together to enable the user to immediate access to current and predicted information across industry disciplines. Accordingly, the primary form of education post 2015 is forecasted to be distance learning (University Business Staff, 2015). Distance learning technology will be customized to the student, with individualized learning goals and objectives, and incorporate instantaneous feedback.

The second aspect involves development of a new kind of critically thinking. One which incorporates flexibility for knowledge which is already known (i.e. known in the present) can be transferred, into what might be known in the future (University Business Staff, 2015). To develop this critical thinking flexibility, new models of knowledge will incorporate a synthesis across different disciplines (Rowe, 2015).

In a 2015 ethnographic study, Rowe found evidence supporting the idea that learning transcends through time and space. Rowe concluded that learning exists “not only located in, but through time-space” (p. 122). This holistic approach is supported by an integrated theory of transformative learning (Papastamatis & Panitsides, 2014). A new concept is proposed for this concept: the *Flexible Critical-Thinking Concept*^{©Jrperlman 2015}. Flexibility combined with a spatial temporal awareness is the foundation for this new concept.

Educational value differentiation reflections: selective integration of new technologies and intentional design of superior student learning experiences

Ubiquitous learning refers to learning connected through and permeating all direct and indirect areas of our lives; along with electronic delivered education has become pervasive (Ogata, Hui, Yin Ueda, & Yano, 2008). Academic institutions are charged with reexamining their content delivery systems, their targeted audience and their value differentiation of knowledge generated by a managed design (Ogata, Misumi, Matsuka, El-Bishouty & Yano, 2008).

Experiential leaning refers to learning by doing within a crafted learning environment. This has been learning platform for educators and academicians for more than 20 years (Kolb, 2013). This learning approach has maintained credibility among some institutions that are in the process of leveraging technology and providing the mix of tools, content and environmental experiences created to enhance leaning outcomes.

Lewin (1941), Freire (1970) and Piaget (1977) advanced the idea that learning is a function of how we process experience and the meanings derived therein. Kolb, outlined a holistic process relating knowledge transfer with the interpretation of an experience by its constituents (Kolb, 1984). Managing a student’s total experience, which is mediated by technology as a channel of educational delivery, might provide a contemporary vista and plausible method of augmenting the value of the education received and the positioning of the institution in marketplace.

In concert, the application of ubiquitous and pervasive learning platforms along with the introduction of new online and mobile technologies, in a framework of ubiquitous learning, can capture and leverage differentiated learning models. Distilled and properly blended social networking tools, content tracking tools, collaboration tools, productivity software, research organizing software and mobility APPS, can impact the design of communication channels, protocols and environments used by educators (Craig, 1999). Emphasis, however, should not reside in software and applications components alone. Software applications and the academic tools generate opportunity, but the configuration, context, and learning environment constructed by educators and experienced by students are a function of how the components are premeditated.

Currently, the existence of an optimal technological platform may not exist. An absolute learning model and its blueprint or mapping of the mix of technology, content and learning environmental

qualities leading to higher order learning outcome are being destabilized. Academic prognosticators and subject matter experts (SMEs) continue to generate new learning delivery configurations. Technology and its variations applied in education might be more of a craft than an academic science (Haskin, 2005). Value is not created through singular or collective software applications unless the software is mediated by its linked applications and benefit and by the perceived continuity of the systems design with student outcomes and experience configuration.

Within the schematic of experiential models, lies the faculty or trainer who has a fiduciary and/or contractual responsibility to elevate learners' competencies. Faculty and trainers, in the new paradigm can create a learning space that is transparent and inspires open communication and learning. Technological advancements now can make core physical classroom and training environments highly utilitarian to those who learn from a distance. Once, traditional classroom environments provided learning intense and content rich backdrop for learners. Now, the new technological learning platforms and virtual environment have the potential of functioning with equal intensity and effectiveness but through a multitude of experiential lenses. Students can participate in online learning environments while mobile and un-tethered to a physical (traditional classroom) or virtual location (computer based location) that provide an ambiance of rich communication, visual presentations and synchronous knowledge sharing experiences (Ogata, et al., 2008). See Table 2.

Knowledge sharing and transfer can be differentiated in meaning and process and is grounded in the study of philosophy known as epistemology (Crawford, 2004), but how one learns explicitly or implicitly, can come from multiple origins including discovery and experience or purposeful engagement, be it in a classroom setting or in a virtual setting. There is evidence that other than the average attrition of information learned by an individual when learning content there is a significant reduction of retention since learners can immediately access the data or information via electronic sources (Dror, 2008)

With immediate access to electronic databases, there has been a shift by learners from personally storing or memorizing data and information from what is introduced to memory to storing less than 10% of what is introduced to memory (Dror, 2008).

Table 2
Traditional learning vs. Ubiquitous learning experiences

Categories	Traditional	Experiential
Knowledge	Faculty driven and created	Co-created by faculty and student
Relationships	Impersonal	Personal
Student Role	Passive	Active
Faculty Role	Classify students	Advance student competencies
Assumptions	Experts teach	Experts guide and work together with students
Activity Type	Competitive and empirically based	Collaborative with information sharing
Environment	Linear and controlled by faculty	Open, robust, responsive and dynamic created by faculty and students in dynamic and mobile environment

In part the shift from storing information in one's personal memory to accessing stored electronic data for use is a growing phenomenon. For example, using a Google search or retrieving data from an institutional research database, or storing and access of Cloud systems (a data utility system) as

information repositories has, in part, become the surrogate for personal memory. Such a shift from memory to using technology for immediate information retrieval is a fundamental change in the way and opportunities presented that students learn within ubiquitous learning models).

On recommending Web 2.0 tools to personalize learning

Juskeviciene, Anita; Kurilovas, Eugenijus. (2014) *Information in Education* 13 (1) 17-31.

The differences of traditional learning versus technologically ubiquitous learning in combination with technologically mediated learning vary as formal research of the topic and its applications gains momentum. Interest in designing an optimal mix of emerging technologies applications and traditional teaching models has not been cemented in since the process is ongoing and somewhat untested and abductive in reasoning (Paul & Elder, 2009).

Salient and enduring aspect of integrated learning models are subject to rapidly changing technological trends and social communication practices. As technological communicative channels become increasingly mobile and pervasive among student populations, curriculum developers are tasked with new and continually shifting challenges. Large platform ubiquitous learning systems such as Blackboard or Canvas, are charged with stylized component producers of software that allow for mobility and disruptive educational technologies (Anderson & Whitlock, 2004). Importantly consumers of education and their increasing expectation that academic institutions will immediately adjust and adopt burgeoning technological tools that are preferred and trending further changing the landscape of online learning.

Conclusions and recommendations

Wallace and Wray (2011) suggested that there are three concepts in mapping knowledge: 1) theoretical knowledge 2) research knowledge and 3) Practice knowledge. Theoretical knowledge requires the encouragement of change. Research knowledge advances improvements in the field of study. Practice knowledge provides insights based on social interaction and open environments.

The question that germinates from Wallace and Wray's studies and that requires further investigation is "How do educators translate the tripartite forms of knowledge into value laden learning within burgeoning and inconsistent technological environments?" Providing learning experiences integrated with ubiquitous learning technology may also carry the responsibility of assuring a learning environment that is vibrant, celebratory and enjoyable (RaÑiu & Negricea, 2008). Research is also needed on identification of effective post 2015 ubiquitous learning technologies.

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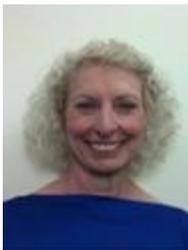
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Editor's Note: This research tests ADDIE instructional design and multimedia against traditional methods of teaching psychomotor skills for playing Futsal.

A survey of the effectiveness of instructional design ADDIE and multimedia on learning key skills of Futsal

Kobra Azimi, Jafar Ahmadigol and Hasan Rastegarpour
Iran

Abstract

The present study aimed to evaluate the impact of ADDIE instructional design and multimedia on learning key skills of futsal. The study method is experimental and is applied in terms of purpose. The study population is all female students of Kharazmi University in first half of academic year 2012-2013 being selected by convenient sampling method as 36 people (in three groups of 12 experimental and control group). The data collection measure to evaluate key skills of futsal is skill tests of Futsal as dribble, Shoot, passing and control as inspired by “physical fitness, skill and mental evaluation tests”. The reliability of test is evaluated by split half test. For data analysis, descriptive statistics mean and standard deviation and inference statistics of variance analysis/ univariate covariance is used to test the comparative difference. The study findings show that 1- The students trained by multi-media have high scores mean (performance) compared to the students trained by traditional method. 2-The studies trained by ADDIE model have high scores mean compared to the students learning Futsal by traditional method of key skills.

Keywords: instructional design, ADDIE instructional design model via multimedia, traditional training, students

Introduction

Purposeful training requires that the teacher besides required awareness regarding textbook has adequate skill regarding design, teaching, management and its evaluation. Training is via the items a person deals from the past. By progress of communities and the change in learning theories, the necessity of considering this issue is increased. Also, in the current complex and advanced world, to educate skillful force in society, we should rely on instructional system with empowerment of educating skillful and specialized forces of communities (Dick & Carey, 2001).

The definition of training can be changed based on the views of educational theorists but generally training is the set of decisions and measurements taken or implemented in order that students achieve specific instructional goals. These goals as consolidating field are the center of instructional activities and decisions and act as a criterion to determine the success or failure of training, student and teacher (Fardanesh, 2013).

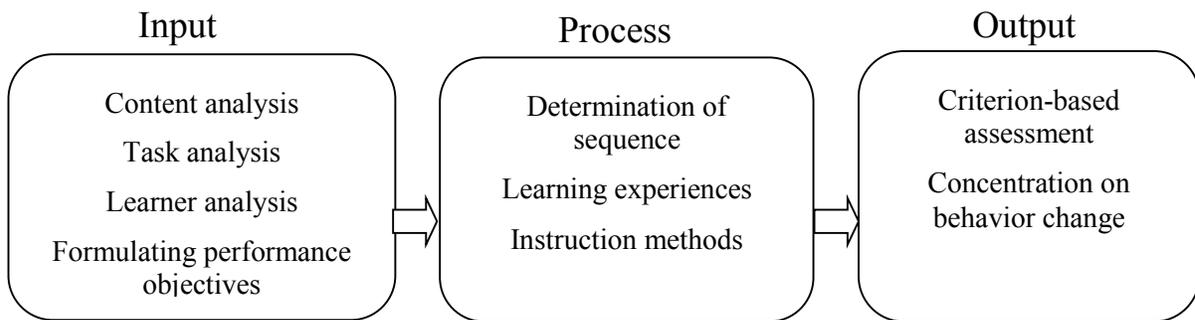
Like any other organized system, training needs previous planning and design as mentioned “instructional design” in education system. Design is a regular method for planning, development, assessment and management of an instructional process and all these elements participate one by one in instructional design (Kemp, 2004).

Thus, instructional design is prescription or prediction of good instructional methods to achieve required changes in knowledge, skills and emotions of learners. Instructional design is a systematic design to be sure of instruction quality as referred to identification, growth and development and applying specific training methods to achieve definite instructional goals for specific content and specific students (Reigeluth, 1283, as cited Fardanesh, 2009).

Although there are many instructional design models in instructional design literature, most of them are based on objective (systematic) and constructive approaches. As ADDIE model is based on objective approach, this study besides explaining systematic instructional design deals with the application of this model in training key skills of Futsal.

System instructional design

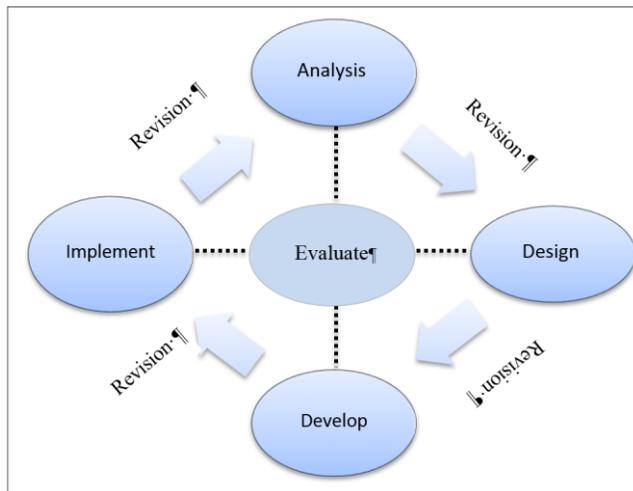
The formation of system attitude and its application in education namely in instructional planning can prepare the system instructional design models. In this approach, the underlying paradigm is general theory of systems rooted in theoretical works of Bertalanffy and some theorists as Silvern (1965), Barson (1967) applied this theory in education (Selis, 1995). The system instructional design models are shown by input, process and output. The important feature of this model is its linear nature and these stages are formulated as their time sequence is very important (Vrasidas, 2000). The process of instructional design and required activities in each stage is shown in the following Figure.



Vrasidas, 2000

Figure1. The process of system instruction design

The most general model drawing design process with systematic approach is ADDIE model. This model was presented in 1975 by Florida State University and the Army selected it as the main model of instructional planning (Clark, 2006). This model is as follows:



Analyze: Detect and evaluate existing condition.

Design: Determine how to achieve determined goals

Develop: Select media and required instructional strategies

Implement: Implementation instruction in learning environment

Evaluate: Evaluate efficiency and effectiveness of instruction presented by teacher

(Rossett, 2006).

Figure 2. Instructional design model ADDIE (Reiser, 2007)

Thus, any instruction requires a previous plan. This design includes instructional activities and all new applied tools and technologies in instruction process.

New educational technologies allow the teacher transfer many items with attraction and deep effect to students. One of the most important and new educational technologies is multimedia

(Barati, 2004). Using multimedia as Film can lead to effective communication between teacher and learner. The true application of media prevents the adverse effect of some communication barriers as distraction and audience encountering. The media can lead to high motivation in learners and easy achieving to educational goals is increased (Amirteimouri, 2003).

Thus, instruction has close and mutual relation with all dimensions of society ranging from culture to economy, politics, industry, citizenship, business. If we view instruction as specialized, we reach a type of education as our problem and why we use efficient teaching less and not only we less enjoy educational methods, we don't experience deep and stable learning?

In existing educational system, instructional interactions are not improved (Starr, 2003). Learning situations of learners are based on classroom (Kamar, 2007). The aim of instruction is collecting knowledge and memorizing the items by students; deep and stable learning, instructional design and applying new instructional technologies in learning fields higher than knowledge namely in psychological-motor field and physical education are not considered or are rare.

As one of the branches of educational sciences, physical education plays important role in fulfilling education goals of adolescents and children and this field has many physical, cognitive and social benefits as justifying its position in educational system. It is worth to mention that healthy thought is in healthy body and this important goal is achieved by regular instructional design and using new technologies in sport instruction process.

In addition to creating happiness in human morale, sport can lead to improvement of health and physical power and human behavior is based on the integrity of a person, it means that soul is based on body and body is dependent upon soul. The researches show that physical pains are with psychological disorders and vice versa (Mohammadi, 2006). To be familiar with this issue, some similar studies are evaluated briefly. Unfortunately, there is no study showing the impact of this model and multimedia on Futsal instruction. Thus, we refer some researches regarding the impact of different instructional design models ADDIE and multimedia.

Shahbeigi (2010) in a study "the impact of instructional design of Meril and ADDIE on learning and memorizing of epidemiology textbook of students of medical sciences University of Yazd" found the following results: The learning and memorizing of students being trained by instructional design model of Meril and ADDIE is higher than the students trained by common method of class and textbook. Also, in three methods, over time stability of learning was reduced but this amount was less in presented instruction by Meril and ADDIE instructional design.

Birnvand (2007) in a study "the impact of using ADDIE instructional design on academic progress of mathematics" found that : students of experiment group trained by ADDIE model had better performance compared to control group being trained by traditional method and academic achievement motivation of experiment group students is higher than that of control group.

Another study is conducted by Rasuli (2011) as "the impact of instructional multimedia on learning of students in science textbook". The study was conducted on 60 people as pre-test and post-test. The results showed the positive impact of teaching by multimedia.

Youngman (2006) conducted a study and applied ADDIE model for multimedia development based on project-based learning. He presented his instruction based on the stages of the presented model and found that ADDIE model is effective as instructional design model for this instructional unit and framework of this model facilitates these projects for learners.

As it was said, the application of sciences and educational technology findings, using instructional design and multimedia in education are the variables receiving much attention from researchers of educational technology and the unavoidable impact of using educational and multimedia design in learning-teaching process and considerable impact of sport on full physical, mental and social

aspects show the importance of this issue. Thus, this study aimed to evaluate the effectiveness of ADDIE instructional design and multimedia on learning key skills of Futsal as passing, shooting, ball control and dribble and the following hypotheses are evaluated:

1. Instruction via ADDIE instructional design model is effective on learning key skills of Futsal compared to traditional instruction.
2. Instruction via multimedia is effective on learning key skills of Futsal compared to traditional instruction.

Materials and methods

The present study evaluated the impact of ADDIE instructional design and multi-media on learning key skills of Futsal. The study method was quasi-experimental based on a pre-test and post-test with a control group. The study population was all female BA students of Kharazmi University in academic year 2012-2013. The study population was selected by convenient sampling; 36 students were divided in three equal groups of 12 people for traditional, multimedia and ADDIE methods equally. After attributing sample members to groups, based on the features of each model, an instructional program 90min was presented in 10 sessions.

To evaluate key skills of Futsal, skill tests of Futsal as Dribble, Shooting, Passing and control were used, inspired by the book “physical fitness, skill and psychological assessment tests”. At the same time and under similar conditions, the pre-test was administered to the three groups of 12 people.

For experimental group (a) learning skills via ADDIE instructional design model, a predesigned plan is implemented in 10 sessions as follows:

First to fourth sessions are dedicated to training different passing, shooting, control or receiving the ball. Each session is divided to training and practice and the players practice new skill as paired after learning each skill.

In fifth to ninth session, practice of skills and match with the learnt principles were performed. Finally, in the tenth session, the pre-test was administered to the players.

For experimental group (b), the players learned skills via instructional multimedia. After the pre-test, training was presented via multimedia software. The players before entering field were watching a Futsal instruction CD in ten sessions for 25 min and then practiced the learned skill in the field. The skills training was similar to training via the ADDIE model:

The first four sessions of skills training were via CD, then practice in the field with the rest of session dedicated to practice and match. Pretest was performed in the final session.

The control group received traditional training.

This study was based on the purpose and assumptions in study purpose descriptive statistical methods (mean and standard deviation) and inferential (variance/ univariate covariance) to test difference (comparative) hypotheses. Levene’s test was used for homogeneity of variances and Kolmogrov-Smirnov test to evaluate normality of data as one of the assumptions of univariate covariance analysis.

Test validity integrated the opinion of experts and the written purposes proposed in “physical fitness skill and psychological assessment tests”. The test stages are identified, then investigated, by 5 experienced coaches in Futsal. Some stages of tests were eliminated and some principles were replaced. Finally, a test was applied including four main skills of Futsal as passing, Shooting, control and Dribble based on the support of experts.

The reliability was performed by the split half method and the mean was 94.

Results

Table 1
Instructional Models and Number of Subjects in Each Group:

Name of instructional model	Number of subjects
Traditional	12
Multi-media	12
ADDIE	12

36 Students participated in the study as 12 people in instruction group with design model ADDIE, 12 people in multimedia instruction group and 12 people in traditional method training.

The results of descriptive indices in Table 2 show that traditional group in pretest has mean 12.50, multimedia with mean 12.92 and third group based on ADDIE model, the mean is 12.42. In traditional group, multimedia and ADDIE, after the experiment, had means of 13.75, 15.08 and 15.58.

Table 2
Descriptive Indices:

	Traditional group		Multi-media group		ADDIE Group	
	Men	SD	Men	SD	Mean	SD
Pre-test	12.50	2.91	12.92	3.03	12.42	2.61
Post-test	13.75	2.73	15.08	2.43	15.58	1.73

The number of students in each group was 12.

This study applied pre-test before the study and key skills in Futsal learning were measured. After instruction based on traditional model, ADDIE and multimedia education, key skills of Futsal were re-measured. ANCOVA test was used to remove the impact of pre-test to define whether or not the training was effective. To respond the hypotheses, descriptive indices, assumptions of covariance analysis and the values of covariance analysis test were re-used.

Study hypotheses

Instruction via ADDIE instructional design model is effective on learning key skills of Futsal compared to traditional training.

Instruction via multimedia is effective on learning key skills of Futsal compared to traditional training.

ANCOVA analysis is the statistical test in which the impact of pre-test is excluded from dependent variable (learning key skills of Futsal) and based on establishing regression coefficient in the second stage, to determine the difference between groups. Before performing this test, the assumptions were:

To evaluate the establishment of regression coefficient assumption by covariance analysis, F value shows that regression coefficient ($F_{2,30}=3.20$, $p>0.05$) are homogenized in three groups (Table 3). This assumption is shown in Figure 1.

Table 3
Covariance analysis:

	Sum of squares	df	Mean of squares	F	Significance level
Group	8.51	2	4.25	6.81	0.00
Pre-test	151.32	1	151.32	242.16	0.00
Pre-test*group	4	2	2	3.20	0.06
Error	18.75	30	0.63		

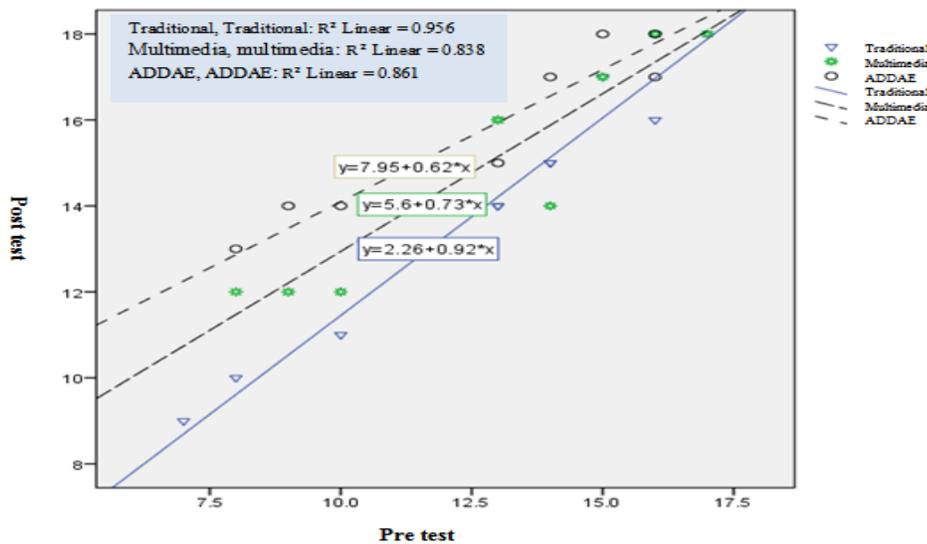


Figure 3. Homogeneity of regression coefficient

Also, the covariance analysis test ($F_{1,30}=242.16$, $p<0.00$) regarding correlation between pre-test and post-test, is supported.

The results of normality (Kolmogrov-Smirnov) showed that in three traditional groups ($Z=0.50$, $p<0.97$), multimedia ($z=0.51$, $p<0.95$) and the group based on ADDIE model, ($z=0.74$, $p<0.63$) the dependent variable distribution is normal and three groups are equal in terms of variance homogeneity ($F_{2,33}=0.85$, $p>0.05$). See Table 4.

Table 4
Homogeneity of Variance Test (Leven's):

Variable	F	df1	df2	Significance level
Post-test	0.85	2	33	0.43

After being sure of assumptions, univariate covariance analysis is implemented. The results of covariance analysis (Table 5) showed that there was a significant difference between three groups.

Table 5
Covariance Analysis (ANCOVA):

	Sum of squares	F	Significance level	Effect volume
Group	21.63	15.22	0.00	0.49
Error	22.74			

After defining difference by LSD test, we can investigate difference (the numbers in the table of difference between means) and the results of the test (Table 6) showed that traditional group had significant difference for the multimedia group and trained group based on ADDIE model. Also, the multimedia group had significant difference when compared with the ADDIE Group.

Table 6
LSD Test

No.	Group	1	2	3
1	Traditional (control)	0		
2	Multimedia	1.02*	0	
3	ADDIE	1.90*	0.88*	0

Based on the information in Table 6, the comparison of the impact of two methods of teaching is statistically significant. Thus, teaching via mobile is more effective than the traditional teaching method. Based on the significance of covariance analysis test, it is inferred that mobile-based teaching compared to the traditional method has high effect on student learning. The third question of the study is supported. Mobile-based teaching has high effect compared to traditional method on learning of students.

Also, at the end of questionnaire, a survey was performed of the trained students by mobile (experimental group) and the results are shown in Table 7.

Conclusion

The results of descriptive indices (Table 4-1) showed that group members trained by traditional method in pre-test with mean 12.50 and group members trained by multimedia method had mean 12.92 and it showed the lack of difference between the members of two groups in pre-test. As pre-test is used before study and key skills of learning Futsal are measured and are measured again after training based on traditional model, multimedia and ADDIE, univariate covariance analysis test is used to remove pre-test effect to show the required instruction was effective or not. In response to the first hypothesis, the results of covariance analysis showed that the impact of three methods of instruction on scores of students on key skills of Futsal had significant impact (at level smaller than 0.01). In other words, there was a significant difference between the scores of the students receiving training by three methods of traditional, multimedia and ADDIE. The mean of post-test of traditional and multimedia methods and LSD test showed that the group receiving training by multimedia method had better performance (mean of high scores) than the group training by traditional method. The interaction between instruction method and pre-test scores and simultaneous impact of them on post-test scores of student had not significant impact. One of the

major reasons of using instructional multimedia in training and learning process is the role of various senses in learning. This type of training involves more than one sense in learning process and it has high impact on learning. It can be said training by this learning method is maximized via senses. In instructional multimedia, textbooks should be designed as both learner processing channels, 1- visual processing channel, 2- auditory processing channel can be involved. When both visual and auditory materials are used in an instructional media to present curriculum, the learners can learn well. In present study, multimedia instruction method enables the learners to use each of useful media in instruction and have combination of them for more learning. In other words, this training method enables the learners apply other media as text, voice, image beside film to remove the shortcoming of each of media and apply their visual and auditory senses better for learning and improving key skills of Futsal.

Each of above media are used under specific conditions, For example using text is useful to perceive abstract concepts and image is used for learning and establishing required skills. It is worth to mention that in some cases the display of mentioned skill is realistic with voice and it has good impact on learning skill. This can display skill repeatedly for learner and by watching film many times and its repetition from the learner, the skill is learnt. Such educational method enables the students to observe key skills repeatedly and stop the movie and analyze its various stages and use this capability for much learning and understanding.

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Editor's Note: Saudi Arabia has a balanced approach to application of distance learning tools to enhance the quality of teaching and learning and at the same time respond to the rapidly growing demand for higher education for men and women.

Saudi distance education – developing a way forward

Angelene C. McLaren and Salim Alanazy

Saudi Arabia

Abstract

Traditional higher education has been available to Saudi citizens and residents for decades. However, with an ever-growing student population and an increasing demand for a highly-skilled national workforce, developing quality distance education programs appears to be one of the best ways to meet these needs. To that end, the Saudi Ministry of Education has established the Saudi Electronic University, the National Center for E-Learning and Distance Learning, and has opened - and continues to open - distance learning deanships in its universities. These initiatives have been put in place to utilize distance education technologies and methodologies to improve teaching and learning across the kingdom, as well as to meet the human resources needs of a growing internal labor market. This paper discusses the current distance learning landscape – challenges and opportunities; how to develop a way forward; conceptual alternatives – and finally, recommendations for future success.

Keywords: Saudi Arabia, e-learning, distance learning, policy, higher education, faculty development, student development, program development, program development, program design, e-learning development

Introduction

Saudi Arabian universities are experiencing a student capacity challenge. With an-ever increasing youth population and demands from the private sector for a more highly-skilled national workforce, the Ministry of Higher Education has had to look beyond traditional university offerings to meet current and future educational and human resources demands. Distance education in its traditional sense, learning via correspondence, has been available to Saudi students for some time. However, distance learning utilizing various technologies, mass media offerings and effective teacher-learner interactions, is something new in most settings. This paper will discuss; the current distance learning landscape: challenges and opportunities; how to develop a way forward; conceptual alternatives; and finally, recommendations for future success.

Current distance learning landscape – challenges and opportunities

Saudi Arabia spends hundreds of millions of dollars developing and improving its educational system. Higher education in the past few years has seen the greatest increase in spending and funding. Most recent are the construction and opening of King Abdullah University of Science and Technology in Thuwal, and Princess Nora bint Abdul Rahman University in Riyadh. With the first is a university specializing in ground-breaking graduate-level research and the second is a women's university that is the largest in the world. Despite these efforts, however, Saudi universities are hard pressed to meet the current needs of its growing student population located in its major cities. In addition, the current educational landscape may leave the needs of non-traditional, female and geographically isolated students unmet (Aljabre, 2012).

Distance learning in Saudi Arabia is conceptualized in two ways: e-learning and distance education. E-learning is defined as those programs that are delivered on-campus as supplements to traditional class teaching; while distance education is described as an off-campus program. These distance learning programs, for the most part, resemble correspondence courses that require a high

level of learner independence and management of the learning process by the students themselves. According to Al-Khalifa, 2009, distance education in Saudi Arabia to date has been used in instances where gender segregation is required. In these cases, female students are taught by male faculty via closed-circuit television, one-way video and two-way audio.

Currently, there are approximately 25 universities in the kingdom that have one or both of these types of programs available. Also, deanships for e-learning and distance learning have been established and are in various stages of development (Alanazy, 2015). One such deanship, which began operation in 2012, can be found at Al Jouf University located in Skaka, Saudi Arabia. When queried, the current dean noted the following challenges: perceptions of e-learning's effectiveness by faculty, administrators, students, policy makers and the larger society; technology acquisition and integration in teaching and learning; staff preparedness and development; student preparedness and development (Alanazy, 2015).

Perceptions of e-learning/distance learning's effectiveness

Distance learning, e-learning and distance education has evolved greatly from its roots in learning using correspondence via mail, radio, and television. However, it is still not widely accepted as an effective form of teaching and learning in some academic and cultural circles despite numerous studies that cite its effectiveness. For example, in their (2004) meta-analysis study, Allen, Mabry, Mattrey, Bourhis, Titsworth and Burrell found that there was no clear decline in educational effectiveness when comparing learning done via distance education technology against that done in a traditional classroom setting. In a more recent meta-analytic study that looked at learning outcomes between online and face-to-face instruction published between 1996 and 2008, the findings were equally positive for online learning's effectiveness. The authors found that students learn at least as much, or slightly more, in an online learning environment compared to traditional classroom settings (Means, Toyama, Murphy, Bakia, & Jones, 2009).

Despite studies like these, the prevailing opinion of faculty, administrations, policy makers, students and parents in Saudi Arabia is that distance education and e-learning is less scholarly than learning in traditional classroom settings and carries less prestige and opportunities for career advancement (Al-Khalifa, 2009). Unfortunately, they are not alone in these sentiments. In a 2009 Association of Public and Land-Grant Universities study, it surveyed more than 10,700 faculty members from 69 colleges and universities. They found that 70% of faculty members considered e-learning inferior to traditional classroom teaching. Teachers who had developed and taught online courses made up 15% of those who held this view, while only 6% of the total population considered e-learning superior to traditional instruction (Allen & Seaman, 2009).

To change these perceptions, e-learning leaders should first educate themselves about major studies in the field that demonstrate the effectiveness of e-learning and distance learning. Then they will be better equipped to serve as educators and advocates to faculty, policy makers, students and parents. Besides negative perceptions about the efficacy of e-learning and distance learning, another challenge arises in the area of technology acquisition and integration into teaching and learning.

Technology acquisition and integration into teaching and learning

Saudi Arabia, like many countries, has invested, and is continuing to invest heavily in Information Communication and Technologies (ICT) across the board as well as to improve teaching and learning in its national schools. Saudi Arabia is the largest ICT market in the Middle East with more than 27 million consumers (The Region's, May 15, 2015). In 2015, the nation is expected to exceed USD 37 billion in ICT spending (The Government, May 15, 2015) Also, according to Alanazy (2015) the Ministry of Higher Education has a national deal with blackboard (BB®) and

based on this deal all Saudi public universities have access to BB® and receive major training on how to manage the system. Along with that, the universities also have access to cloud hosting. He noted that Al Jouf is one of the universities currently taking advantage of this arrangement.

Despite these expenditures and developing the necessary ICT infrastructures, barriers such as lack of teacher ICT skills, lack of teacher confidence, lack of pedagogical teacher training, rigid traditional education systems, restrictive curricula, etc., tend to stand in the way of actually utilizing the technology available in everyday teaching and learning practices (Buabeng-Andoh, 2012). Teacher confidence relating to the use of technology may be the greatest barrier to technology integration for teaching. According to Brinkerhoff (2006) faculty often lack self-confidence when it comes to using technologies and, thus, tend to avoid or resist it altogether. Research has found this to be especially true when age and experience are factored into the equation. Older and more experienced instructors tend to lack confidence in utilizing technology into their teaching practices (Waugh, 2004).

Alanazy (2015) suggested that more emphasis should be placed on faculty learning and development. Faculty members should not only be encouraged to utilize existing technology, but they should be taught how to do so effectively and be shown why it's important. This rationale is also espoused in Weimer's (2002) study that focused on learner-centered teaching. This may be a strategy that can be incorporated into future staff preparation and development programs.

Staff preparedness and development

With most of the 21 or so deanships in distance education and e-learning still in their fledgling stage of development, much attention must be paid to preparing and developing staff members in order to improve their chance of success. Areas of development that have been identified at Al Jouf University include: understanding the advantages of e-learning and distance learning, using technology effectively, incorporating best practices, knowledge about copyright and intellectual property, and basic e-learning/distance learning course development (Alanazy, 2015). This is by no means an exhaustive list and decisions related to teacher preparedness and development will also be greatly guided by what's present in the current research literature.

For example, in looking at what makes successful online instructors, Savery (2005), advocates the development of VOCAL characteristics, which are to become more Visible, Organized, Compassionate, Analytical, and a Leader-by-example.

Being visible. According to Savery (2005), instructor visibility is established via public and private communication channels. He suggests: creating a web page with personal and professional information along with a photo; comment and take part in discussion forums in a timely fashion; update welcome banner and welcome pages regularly; updating shared calendars; utilizing short audio and video clips, which when used properly establish strong visibility and social presence.

Being organized. Organization was found by Simon (2000), to be not only important, but vital to online teaching success. Savery gives the following suggestions: prepare a thorough syllabus; provide course assignments and due dates early on; create documents that explain classroom rules; use the capabilities of the LMS to control access to course materials (Savery, 2005).

Being compassionate. Most adults choose online learning environments, because it fits into their schedules and helps them to balance all of the other competing priorities in their lives. Therefore, compassion, according to Savery (2005) is a characteristic that teachers wanting to be successful online must develop. He suggests: give students permission to contact you directly; use established ice-breaker techniques; introduce and *All About Me* category in online forums.

Being analytical. Being able to collect and interpret student data is part of being analytical. Current learning management systems provide instructors a summary of learner activity.

Analytical instructors will check this information regularly to ensure that students are participating and to reach out to those who may be less engaged. Suggestions to improve analytical skills include: use smaller and more frequent assessments; specify format for how completed assignments should be named and submitted; give students opportunities to evaluate the online experience midcourse and at its conclusion; provide clear guidelines and expectations for class participation (Savery, 2005)

Being a leader-by-example. Everything that an instructor does in any teaching environment, whether face-to-face or online should reflect best practices. Students will take their lead from the actions of the teacher. Therefore, Savery suggests: share information about yourself; keep promises; communicate online effectively; plan and implement and end of course activity to reinforce what was learned, review highs and lows, and recognize key contributors and standout students (Savery, 2005).

Research such as this, along with planned internal research projects will shape staff preparedness and development programs at Al Jouf. However, faculty are not alone in need for training and development in order to make the most out of e-learning/distance learning experiences. Students also need to be prepared and given the necessary tools to be successful.

Student preparedness and development

Current off-campus distance learning programs in Saudi Arabia rely heavily on student motivation and self-management for successful completion (Moore, Alanazy, 2013). As these programs are redeveloped and more technology is introduced, students will have to be trained on how to utilize these technologies effectively. Also, students must be trained on how to manage their time, be organized and be self-directed. Without developing these key skills, there may be resistance on the parts of students to engage in e-learning/distance learning programs (Al-Khalifa, 2009). Al Jouf University has identified the following areas for potential student development: how to use the technology effectively, improve time management, self-management, and self-motivation skills, copy and intellectual property rights, and ethics.

In looking at various studies that identify key characteristics of successful e-learning/distance learning students, Dabbagh (2007), found that students possessing high levels of intrinsic motivation, high internal locus of control, coupled with positive attitudes toward the online instructor and high expectations for grades and degree/program completion were more likely to succeed in distance learning environments. Seven key skills and characteristics were identified in this study (Dabbagh, 2007):

1. Strong academic self-concept.
2. Proficiency with learning technologies.
3. Strong interpersonal skills.
4. Strong internal locus of control.
5. Self-directed learning skills.
6. Need for affiliation.
7. Understand and value interactive and collaborative learning.

Opportunities

Despite challenges, Saudi universities also have many opportunities that they can capitalize on to meet these challenges head on. These include: the establishment of deanships in most national universities to better facilitate the move to e-learning/distance learning platforms; the establishment of Saudi Electronic University; appropriating necessary funds via the Ministry of

Finance to ensure monies are available for growth and development; the expansion and implementation of polices via the Ministry of Higher Education regarding the application of e-learning and distance learning in the country, and the establishment by the Ministry of Higher Education of the National Center for E-Learning and Distance Learning.

The mission of the NCELDL is to streamline and facilitate collaborative efforts of universities toward utilizing and leveraging current distance education and electronic learning applications (Alanazy, 2015). It will contribute to the development of e-learning projects and programs, support research and studies in the field, develop quality standards for electronic instructional materials design, production, and distribution, provide consultation services to related organizations, contribute to the development and dissemination of educational software, encourage outstanding projects in e-learning and distance learning at higher education institutions and hold meetings, conferences and workshops that will contribute to the development of this type of educational model (Moore & Alanazy, 2013).

Capitalizing on these and other opportunities will allow for future growth and development of successful e-learning/distance learning programs throughout the education and training realms within the country. With most programs on the cusp of full development and implementation, many might ask, what is the best way forward?

Developing a way forward – conceptual alternatives

In a review of the current state of e-learning and distance learning in the Kingdom, Moore and Alanazy (2013) concluded that there are three different forms of distance education present. Namely: on-campus e-learning programs; off-campus independent study programs; and the Saudi Electronic University. Each form is in different stages of development; therefore their paths of development need to be somewhat different as well. However, before giving recommendations it's necessary to look at current circumstances in a broader theoretical context. Moore and Alanazy (2013) recommended considering three different conceptual models: a simple model; an industrial model; and a collaborative model.

A simple model

Most universities worldwide, with the advent of Internet technologies, have implemented e-learning within classroom settings as well as extending e-learning programs to an off-campus student population. The results of this approach have been gains in terms of cost-effectiveness, quality, and an increase in the number of students that can be added to such programs. According to Moore and Alanazy (2013): "There are many reasons for this, one being the different resource investment needed for distance education compared to the classroom. Another is because the ratio of master teachers, i.e. the permanent faculty, to students remains high, typically one teacher to no more than 30 students. In such cases, the university has simply exchanged the tuition income from an on-campus class for that generated by an off-campus class of similar size. This income does not allow for amortization of the fairly large scale of investment in design, development and learner support that is needed for high quality distance education," (Moore & Alanazy, 2013, p.3).

An industrial model

Other countries have taken a radically different approach, which has been described an industrial approach. Instead individual school working on their own course design and development, the task is undertaken by a core group and the results of their efforts are distributed out to students and educational institutions. Moore and Alanazy (2015) noted: "Courses are designed and produced by teams of academics, instructional designers and media specialists working full-time and exclusively on this activity, and distributed to hundreds and usually thousands of students. Investment in design and delivery runs into millions of dollars, leading to high quality but low average costs, due to "economies of scale." A key feature of this model is the separation of the

interaction between student and instructor from the process of course design, with instruction being provided by a cadre of part-time adjunct faculty, supervised by full time faculty of the teaching institution,” (Moore & Alanazy, 2013, pp 3-4).

A collaborative model

Yet another conceptual alternative is a collaborative model or virtual organization. According to Moore and Alanazy (2013), the noted feature of this model is that there is no single entity responsible for designing and delivering every program, rather these duties are shared among collaborating institutions. They note: “This sharing might take the form of each institution taking responsibility for one whole course or program, but it might also take the form of units within several universities collaborating to produce a course or program that is the product of the best of all their resources, not the work of any single institution. For a course, the content specialists might be in three or four different institutions, the software specialists in three or four others and the learner support in a hundred others,” (Moore & Alanazy, 2013, p.4).

As noted earlier, e-learning and distance learning programs in the Kingdom are in various stages of development. This may be advantageous instead of detrimental as it offers room for experimentation in an effort to identify the best way forward to meet the higher education and the human resources needs of the country. The reviewers, after their initial assessment, offered several recommendations.

Recommendations for future success

For the three different modes of distance learning currently present in the Kingdom, the reviewers offer the following recommendations for future growth and development (Moore & Alanazy, 2013).

... for existing e-learning programs

For higher education institutions already engaged in developing e-learning programs, focus should be on increasing the number of students who have access to these programs by further developing and extending off-campus offerings. What should be noted is that emphasis should be placed on developing a small number of quality programs, and focusing on academic areas that will best meet student and societal demands.

... for off-campus independent study programs

For those institutions whose main focus has been in offering, independent, self-study programs, the focus should be on improving the quality of instructional services for existing students. Like those already developing e-learning programs, care should be taken in focusing on developing a small number of quality programs. What is desirable is that these institutions focus on developing technologies and instructional design and teaching resources needed for such quality programs.

... for the Saudi Electronic University

For the Saudi Electronic University, it is recommended that its focus should consist of refining, consolidating and quality development of already established programs. It would serve as a model of good practice in quality design and delivery for both of the previously addressed types of programs. Again, like in the first two examples, emphasis is placed on quality versus quantity.

Further recommendations include undertaking pilot studies with the aim of testing out these recommendations as well as the appropriateness of each of the three conceptual models discussed. Outcomes of these research projects will provide necessary data to further develop policy as well as identify areas of professional development needs of faculty and staff (Moore & Alanazy, 2013).

Conclusion

The Kingdom of Saudi Arabia is experiencing a student capacity challenge. There is a significant gap between what is currently being provided by higher education programs and what will be needed to meet the future human resources needs of the country. As a result, the Ministry of Higher Education is dedicated to building a quality distance education infrastructure to meet these demands and to fill the gap. In this paper, we discussed: the current distance learning landscape – challenges and opportunities; how to develop a way forward – conceptual alternatives; and finally, recommendations for future success. Saudi Arabian higher educational institutions have many advantages not present in other places. Notably: strong government support through policy development; allocated financing for future growth and development; a national center dedicated to establishing quality measures and standards as well as offering opportunities for collaboration, research and professional development; and a national online university that will serve as a model for best practices in program design, development and delivery. Being able to leverage these advantages successfully against current challenges, will be the determining factor in the development of a robust national distance education program.

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Editor's Note: This is very detailed study of the adoption of ICTs by Sudan and other countries in the region. It deals with access to the technology and how it is received by administrators, teachers, and students. The role of education in development of national economies is recognized, and progress is compared with other countries in the region.

A preliminary study of ICT's infrastructure and pedagogical practices for technology integration in Sudanese Secondary schools

Abdelrahman Mohamed Ahmed
Oman

Abstract

This purpose of this study is to investigate the current status of ICT infrastructure and innovative pedagogical practices in secondary schools in Sudan. A sample of 50 secondary schools from Khartoum state was selected using a stratified random sampling technique. A mixed qualitative and quantitative method was used for this study. In order to collect the relevant data, a semi-structured questionnaire and interviews were used. The data collection instruments' were issued to 180 respondents from identified schools (48 principals, 48 computer coordinators and 84 science and math teachers). 98% of the questionnaires were completed and retained for analysis. Statistical analyses were conducted using statistical package for social sciences (SPSS) to calculate descriptive statistics.

The findings of this investigation are also analyzed in relation to a number of selected countries (Slovenia and South Africa). The results indicated that Sudan does not yet have the necessary ICT infrastructure to integrate technology into education and is well behind many countries internationally in implementing ICT into education. It is also clear that, secondary schools in Sudan had little experience with the use of ICT in teaching and learning. The majority of schools in Sudan use ICT for administrative purposes; however, the use of technology across the curriculum is still at infancy stage. Based upon the findings, some recommendations are made for the policymakers of the Ministry of Education in Sudan.

Keywords: Information and Communication Technologies (ICT), integration, innovation, innovative-practices, infrastructure, implementation, pedagogy, technology, Sudan, Second Information Technology in Education Study (SITES).

Introduction

Although the ICT implementation policy for Sudan was launched in 2002 and most schools have computers and Internet connectivity, most principals and teachers do not really know what to do with the computers installed in their labs (Ahmed, Howie & Osman, 2013). This shows that the integration of ICT into schools was not carefully planned. Plomp, Anderson, Law & Quale (2009) state that top ministry leaders down to teachers in their classrooms all face decisions about whether and how to integrate ICT into teaching and learning. Such decisions are not easy because the choices are complex, technically demanding, and the effects are often not known. Even for the leaders in educational ICT, there is not enough research on which to base decisions. In Sudanese secondary schools at present, the ratio of students to computers is unknown because no study has been conducted to determine the ratio and pedagogical practices, but all efforts are being made to provide computer-assisted teaching and learning (Ahmed, Howie & Osman, 2013). It is important to consider such investigation regarding the ICT infrastructure and pedagogical practices of ICT in teaching and learning in Sudanese secondary schools, because the implementation of ICT in teaching and learning is a new domain in Sudanese education. Furthermore, the technology keeps

changing and there is very little literature and research regarding the use of ICT infrastructure and innovative practices in Sudanese Educational System. The purpose of this study was to investigate the current status of ICT infrastructure and innovative practices in Sudanese Secondary Schools. The study intended to focus on the following specific objectives:

- Ascertain what ICT infrastructure (equipment, software, access to the Internet and the like) are installed at secondary schools;
- Identify innovative ICT practices followed at Sudanese secondary schools.

Many countries around the world (e.g., Chile, Finland, Singapore, and United States) have all set national goals and policies that identify a significant role for information and communication technologies (ICT) in improving their education systems (Kozma & Anderson, 2002). They have made major investments to increase the numbers of computers in schools and the networking of classrooms. ICTs have become, within a very short time, one of the basic building blocks of modern society and influencing all aspects of life especially in education (Daniels, 2002). Therefore, the uses of ICT in education is making major differences in the learning of students and methods of teaching. For instance, Volman, (2005) states that schools in the Western World invested a lot for ICT infrastructures over the last 20 years, and students use computers more often and for a much larger range of applications. ICTs can increase access and improve relevance and quality of education in developing countries. Tinio (2002, p6) states the potentials of ICT in education as follows:

“ICTs greatly facilitate the acquisition and absorption of knowledge, offering developing countries unprecedented opportunities to enhance educational systems, improve policy formulation and execution, and widen the range of opportunities for business and the poor. One of the greatest hardships endured by the poor, and by many others, who live in the poorest countries, in their sense of isolation, and ICTs can open access to knowledge in ways unimaginable not long ago”.

According to Oldham (2003), ICT should not be used for its own sake. It should be used when appropriate to enhance learning by allowing the user to focus on the main aims and objectives of a lesson. In other words, it should ‘add value’ to our teaching (Oldham, 2003).

The International Association for the Evaluation of Educational Achievement (IEA) decided in the late 1990s to conduct the Second Information Technology in Education Study (SITES), which is an international comparative research program exploring the use of ICT in education (Law, Pelgrum & Plomp, 2006). SITES consists of several projects or modules (Law 2002, Kozma & Anderson, 2002). SITES M1 was a survey of principals and technology coordinators at a sample of schools in 26 countries (Pelgrum & Anderson, 2001). The focus of M1 was on the extent to which schools adopted and implemented pedagogical practices that are considered important to education in the information society (Kozma & Anderson, 2002). The study was designed as a survey of principals and technology coordinators from a representative sample of schools in each of the participating countries (Law, Pelgrum & Plomp, 2006). The study examined the student–computer ratio across countries with regard to ICT-infrastructure in schools. This ratio indicates how many students per computer there are in a school. The study found that the student–computer ratios for “lower secondary schools ranged from approximately 9 to 1 in Canada and 12 to 1 in Denmark and Singapore 23 to 1 in Slovenia and 35 to 1 in South Africa and 210 to 1 in Cyprus” (Law, Pelgrum & Plomp, 2006, p.39). SITES M2 is a series of qualitative studies that identify and describe innovative pedagogical practices that use technology (Kozma, 2003). The study adopted a comparative case study method to address research questions that aimed to shed light on the nature of the emerging pedagogical paradigm established in SITES-M1 and how this related to the broader set of contextual factors at the classroom, school, and system levels (Kozma, 2003). The results of this M2 study provided teachers all over the world with outstanding examples of how

technology can change classroom teaching and provided policymakers with guidelines on how to increase the positive impact of technology on their education systems (Law, Pelgrum & Plomp, 2006). SITES 2006, designed as a survey of schools and teachers and building on the findings of SITES-M1 and SITES-M2, examined the kinds of ICT-related pedagogical practices adopted by the participating countries and how these countries were using ICT (Law, Pelgrum & Plomp, 2006).

Today one of the widely used indicators of implementing ICT in education is the indicator of computer ratio. This indicator shows how many students share a computer at school. Equipping schools with computers can be very expensive for many developing countries. Although computers have become cheaper in recent years, they still remain too expensive to many countries (Jhurree, 2005). A student-computer ratio of one-to-one could be very desirable, but surely unattainable, even for developed countries. According to Pelgrum & Law, (2003) over the last two decades, schools in many countries were equipped with increasing numbers of computers, which often resulted in substantial declines in the student-computer ratios. Today, many schools around the world are trying to keep pace with the increasing informatization of society and wish to provide their students with the best possibilities of acquiring modern technologies. For example the study conducted by SITES-M1 in 1999 as part of IEA's *The Second Information Technology in Education Study* Module1 (SITES-M1) (see Pelgrum & Anderson, 1999) showed "the student-computer ratios for lower secondary schools ranged from approximately 9 to 1 in Canada and 12 to 1 in Denmark and Singapore and 133 to 1 in Lithuania and 210 to 1 in Cyprus".

Kozma & Anderson (2002, p.3) defined innovative pedagogical practice as "the new pedagogical practices that are emerging in schools. These emerging practices involve changes in what it is that teachers and students do and learn in the classroom. These practices are providing students with skills and competencies that they need as they extend their learning throughout their lives in the information society of the next century. These changes are often supported and enabled by the use of ICT". The frame of reference that we used to define 'innovation' was practices that prepared students for lifelong learning in the information society. Practices from the theoretical literature were suggested as examples of such practices (Law 2002; Kozma & Anderson, 2002, p.3); those that:

- promote active and independent learning in which students take responsibility for their own learning and/or assess their own progress;
- provide students with competencies and technological skills that allow them to search for, organize, and analyze information, and communicate and express their ideas in a variety of media forms;
- engage students in collaborative, project-based learning in which students work with others on complex, extended, real-world-like problems or projects; and
- provide students with individualized instruction, customized to meet the needs of students with different entry levels, interests, or conceptual difficulties.

The integration of information and communication technologies can help revitalize teachers and students. This can help to improve and develop the quality of education by providing curricular support in difficult subject areas (Ul-Amin, 2010). Therefore, teachers need to be involved in collaborative projects and development of intervention change strategies, which would include teaching partnerships with ICT as a tool. According to the study of "Teacher adoption of technology: a perceptual control theory perspective" which was conducted by Zhao and Cziko (2001), there are three necessary conditions for teachers to introduce ICT into their classrooms: teachers *should believe in the effectiveness of technology*, teachers *should believe that the use of technology will not cause any disturbances*, and finally *teachers should believe that they have control over technology*. Harris (2002) conducted case studies in three primary and three

secondary schools, which focused on innovative pedagogical practices involving ICT. His research (2002, p. 7) concludes that the benefits of ICT will be gained "...when confident teachers are willing to explore new opportunities for changing their classroom practices by using ICT". As a consequence, the use of ICT will not only enhance learning environments but also prepare next generation for future lives and careers (Wheeler, 2001).

The integration of ICT in educational systems is not an easy process. Many studies (e.g., Ertmer, 1999; Pelgrum, 2001; Herzi, 2004; Hew & Brush, 2007; and Bingimlas, 2009) viewed that the majority of educational systems around the world had encouraged some barriers regarding ICT integration in education. Ertmer (1999) described the barriers of the ICT use in education as external (lack of access to hardware and software) and internal (teacher beliefs about learning and teaching). While Pelgrum (2001) viewed these barriers regarding ICT use in education as materiel (lack of number of computer) and non-materiel (lack of teachers' knowledge and skills). Similarly Herzig (2004) stated that major barriers to ICT integration are lack of experts and need of teacher training. Bingimlas (2009) reported that lack of confidence, lack of competence, and lack of access to resources are also major barriers. Hew and Brush (2007), who analyzed experimental studies from 1995 to 2006, reported that barriers include knowledge, skills, institution, attitudes, beliefs, assessment and culture.

According to the survey report of "ICT in Education in Sudan" by Hamdy (2007), Sudan has established ICT policy and formulated national ICT strategy in the year 1999. This strategy focuses on five major areas, namely; technology infrastructure, human resource development, software industry development, content (primarily in Arabic), and geoinformation. In 2004, ICT was introduced in secondary education curricula. A number of computers were installed in schools (around 50% of secondary schools), at an average of 10 computers per school (Ahmed, 2004). In schools the connectivity is mainly through dial-up and ADSL. The country is planning to have computers available in all education levels by the year 2015 as agreed to at the ICT summit in Geneva (Hamdy, 2007). Human resource development is a top priority for the ICT policy in Sudan. However, many studies (Ahmed, 2010; Ahmed, Howie & Osman, 2013) reported that the lack of skilled trained teachers who are well conversant with ICT tools is a major constraint for ICT integration in Sudan. Based on the literature review and the specific objectives, the study was sought for answering the following questions:

- To what extend ICT infrastructure (equipment, software, access to the Internet and the like) is available in secondary schools?
- What innovative practices exist in Sudanese secondary schools?

Importance of the study

The findings of this investigation may give the primary goal of which is to benchmark performance in terms of access and use of ICT in Sudanese Secondary School classrooms. Furthermore, it may provide valuable data which could help Sudanese national policy-makers to judge the current status of using ICT infrastructure and innovative practices in education and provide a baseline for future assessments. Also, the study can offer a foundation and encouragement for further research into evaluating and assessing the adoption of ICT in education in Sudan and developing countries. Moreover, the study can inform the policy maker of difficulties to be solved in use of ICT in teaching and learning.

Research design and methods

This study used a survey approach to investigate the current status of ICT infrastructure and innovative practices in Sudanese Secondary Schools. The investigation consisted of four instruments. Three questionnaires were conducted with administrators, teachers and computer coordinators. The fourth instrument is interviews which were conducted with the mathematics and science teachers and administrators. The study focused on mathematics and science teachers in the sample because most of them possessed technological skills that help them to use computers in the teaching and learning process. Moreover, most mathematics and science teachers were interested to use computer in their teaching process more than teachers of other subjects.

Population and sample

The population featured in this study was drawn from secondary schools in Khartoum State in Sudan where there is a policy to advance development of pedagogical practice. The population was divided into subgroups of schools according to the regions of Khartoum (163), Bahri (50), and Omdurman (107). The total number of the school population was 320 schools. A stratified sample of 50 schools was drawn from secondary schools in Khartoum State, Khartoum (19), Bahri (13), and Omdurman (18). The schools were not mixed gender; size is ranged between 200 to 600 students. Table 1 shows the total number of schools according to gender.

Table 1
The of number of schools sample- gender

Region	No. of schools for boys	No. of schools for girls	Total
Khartoum	9	10	19
Omdurman	10	8	18
Bahri	9	4	13
Total	28	22	50

Table 1 shows that, thirty-six of these schools are in Khartoum, Omdurman, and Bahri localities ($n = 12$, $n = 12$, $n = 12$ respectively for each province), chosen for their relatively good use of ICTs for administration and in teaching (e.g. engage students in collaborative activities and provide students with technological skills that allow them to search for and organize information). The upper middle-class students of these schools live in the central urban area of Khartoum. The remaining fourteen schools are considered more typical (i.e. representative of an average cross-section of the population) of Sudan, and their populations come mainly from the three localities (Khartoum ($n = 5$); Omdurman ($n = 5$); and Bahri ($n = 4$)). These “more typical” school populations represent the middle and lower socioeconomic strata living in less affluent parts of Khartoum and other comparable areas. These 14 schools owned a number of computers that they had begun to use for administrative tasks and teaching at the time of the study. Learners benefiting from the use of computers were 14 to 16 years of age. Two schools from Khartoum localities did not respond to the questionnaires because of the time constraints caused by the Sudanese secondary school examinations certificate. Seventeen schools (out of 48) are from Omdurman localities, 16 schools (out of 48) are from Bahri localities and 15 schools (out of 48) are from Khartoum localities. All the students of the school sample are living in local suburban areas in Khartoum state. Regarding the sample respondents, 48 principals participated in the study as respondents to the principal questionnaire. Eighty-four teachers responded to the teacher questionnaire, and 48 computer coordinators responded to coordinator questionnaire. Five teachers, three computer coordinators, and two administrators from the Ministry of Education were interviewed.

Data collection and analysis

The data for this study was collected by applying a personal administration (paper-and-pencil) approach. The questionnaires were administered by the researcher to all sample schools. The administration of the questionnaires took place during February and March 2012 in all sample schools in Khartoum state. The researcher also used a semi-structured interview. The data analysis was done by using descriptive analysis with the aid of the Statistical Package for Social Science (SPSS) software. Processing entailed the use of frequencies, mean distributions, and percentages.

The researcher analysed the data to compare to the two countries, Slovenia and South Africa, based on the following:

1. The two countries (Slovenia and South Africa) participated in SITES studies (Module1 and /or Module3) and revealed important information and interesting findings regarding ICT implementation in education.
2. The first stage of introducing and implementing ICT in education in these two countries is, to some extent, similar to the status of introducing computers in Sudanese education. Initially, in Slovenia and South Africa, computers were used for school administration, in particular for the scheduling of timetables and keeping student records, writing exams, and as an administrative tool (Hinostroza, Hepp, Cox & Guzman, 2003 & Muller, 2003). At present, computers are used for those purposes in Sudanese schools.
3. Slovenia and South Africa encountered many problems when they began initiating ICT policies in education (for example, war and apartheid era). The limited funds for education were directed at other problems. The situation in Sudan is comparable, as the country has also encountered problems (e.g. the war in Southern Sudan and Darfur) which indirectly hampered and impeded the introduction of ICT in the Sudanese educational system.

Data analysis

Respondents' profiles

More than half of the teachers (n= 59) have Bachelor or honors' degrees. A number of teachers (n= 34) have postgraduate degrees, while only few teachers (n= 3) are unqualified. The teachers were asked if they have a Bachelor's degree in Science or Mathematics. The result indicated that, more than half of the teachers (n= 50) have degrees in Science or Mathematics. In addition, the largest group in both mathematics and science is that between four and six year's experience (n=47). This indicates that most science teachers in the schools sample were new teachers in the field. More than half (n= 49) of the teachers have access to a computer at home. One-third of the teachers use computers for teaching-related activities. Only a few (n=15) teachers have accessed to the Internet. There were 48 computer coordinators who participated in the study as respondents: 16 respondents from Khartoum, 16 from Omdurman, and 16 from Bahri. The common task of the computer coordinators in the schools is to teach ICT courses to the students. Only a few coordinators in the sample formally or informally served as ICT coordinators in the schools. Most of the computer coordinators were employed to teach the IT curriculum in the secondary schools. Approximately half of the computer coordinators have between two to six years' experience in their schools. This is because most of the computer coordinators graduated from IT field prefer to work in companies more than work in schools. As a result, most of them they left the field of education after two or three years.

To what extent ICT infrastructure (equipment, software, access to the Internet, and the like) is available in secondary schools?

To answer this question, the researcher calculated frequencies, percentages and means of the data regarding, availability of ICT infrastructure (hardware, software and Internet) at sample schools. Questionnaires were used to collect this data from the computer coordinators and school principals.

Hardware in schools

Information was collected on the quantity and quality of the ICT hardware in the sample schools. The ratio of computers to students was calculated. To ascertain the quality of the hardware, information was gathered on multimedia computers, operating systems, and available peripherals.

Student computer ratio

One basic indicator of hardware availability in schools is the number of personal computers that are available to students and/or teachers of the Grades 1 and 2 for teaching and learning purposes. In the coordinator questionnaire, respondents were asked to specify the total number of computers available to students in the target Grades 1-2. The students: computer ratio was calculated to indicate how many students on average had to share one computer. Considering all the computers available and the student population in each school, the ratio in Sudan (Khartoum) is $\pm 56:1$ for secondary schools. Figure 1 shows the position of Khartoum, Sudan regarding computer ratio indicators compared to other countries (Slovenia and South Africa) that participated in the SITES-M1 study. It is clear for Figure 1 that Slovenia has ratios in the range of 23 students per computer, while South Africa has ratios in the range of 35 students per computer. It can be seen that Sudanese schools belong to a group of schools that have high ratio of students per computer (between 40 and 90), yet it lags far behind developed countries, which have ratios in the range of 10 students per computer.

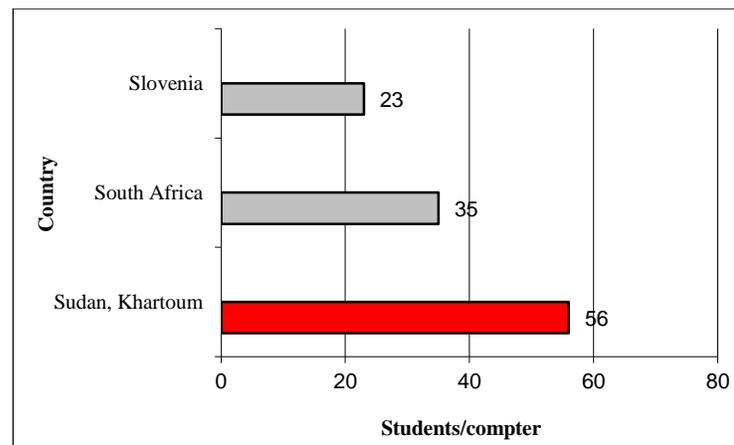


Figure 1: International results of student: computer ratio for secondary education in SITES M1 participating countries compared to Sudan

(Source: Howie, Muller & Patterso, 2005)

Multimedia facilities

Information was also gathered on the number of the computers in the school sample that was suitable for multimedia applications. The computer coordinators were asked to specify the total number of computers fit for multimedia (equipped with a CD ROM and sound card). The results

indicate that, 12 schools have a number of computers (1- 10) with multimedia. This indicates that most computers in schools lack multimedia facilities. The average number of computers with multimedia facilities in the school sample is **8%** (104 computers with multimedia out of 1300 computers). Figure 2 shows that at high secondary level, the availability of multimedia computers was high in Slovenia (greater than 25%) and in South Africa (15%), whereas in Khartoum the percentage was very low, only (8%).

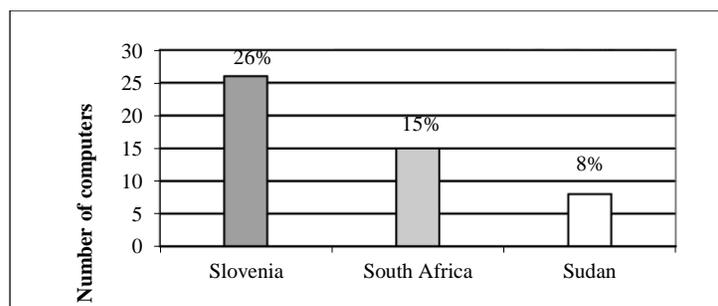


Figure 2: Availability of multimedia computers in Khartoum in comparison to other countries

Peripherals

The compute-related equipment (peripherals) available in schools for educational use is another useful indicator of hardware accessibility and functionality. The researcher considered the most up-to-date types of peripherals. Table 2 shows that more than half of schools have laser printers and their computers supplied with CD-ROM drives. Few schools have computers with CD-Writer and video projectors (31%, 19%). Interestingly, none of the schools has devices for mentally and physically disabled students nor were they equipped with LCD Panels.

Table 2
The total number of peripherals for use in the school sample

Peripheral	Yes Responses (n)	Responses Percentage
CD.ROM drive	36	75%
Laser printer	30	63%
CD WRITER (CD.R,DVD)	15	31%
Multimedia – projector	9	19%
Color printer	6	13%
Devices for digital image or video processing	3	6%
Scanner	3	6%
Devices for mentally &/or physically disabled students	0	0
LCD Panel	0	0

n= (computer coordinators)

Access to communication facilities

An additional way of evaluating the ICT infrastructure in schools is the extent to which the equipment is connected to an internal network. The results indicated that, only a quarter (n= 12) out of 48 schools have a number of computers connected to an internal network in the sample

schools. In comparison, South Africa was slightly above average with nearly a half of the schools being linked to an internal network (Howie, Muller & Paterson, 2005). Figure 3 provides descriptive information concerning the schools access to the Internet for instructional purposes. The results show that, very few schools (12.5%) use e-mail or the Internet for instructional purpose by teachers and students. Similarly, regarding broadband access, approximately only a quarter (25%) of schools had broadband access.

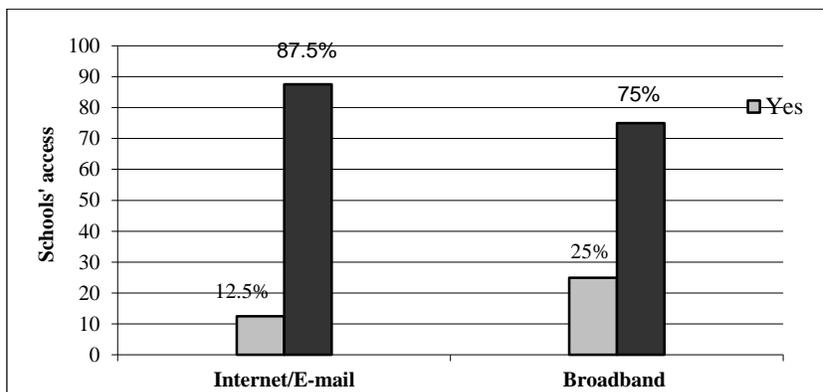


Figure 3: Schools' subscription to the Internet, broadband or wireless access

Software in schools

Two main categories of software were identified for this study – namely, general-purpose software and subject-specific software. The technical questionnaire respondents were asked to identify the type of software that is available in their schools.

Table 3
The type of software available in schools

Obstacle	Yes Responses (n)	Responses Percentage
Word processing	45	93%
Presentation software (e.g. PowerPoint)	36	75%
Databases	30	63%
Spreadsheets	27	56%
Programming languages	27	56%
Encyclopedia ON CD.ROM	24	50%
Educational games	18	38%
Drill & practice programs	12	25%
Tutorial programs (for self-learning)	3	7%
Simulations (e.g. real world simulations)	3	7%

As shown in Table 3, the most commonly available software used in Sudanese secondary schools is that of word processing (93%), presentation software (e.g. PowerPoint) (75%) and databases (63%). A few schools use other types of software (e.g. spreadsheets, programming languages, drill and tutorials programmes, simulations and educational games). Moreover, the technical questionnaire contains a question in order to understand the extent to which the schools possessed

software specifically dedicated to school subjects. The results show that the availability of subject-specific software was very low in the school sample. Computer science software is more widely available than software for other subjects with a half of schools samples having access to computers science software. The entire school sample lacked software for the following subjects: industry, principles of economy, geography, military education, family education, commerce, environmental studies, history and social science, and art and design.

Perceived obstacles regarding hardware and software infrastructure

To identify possible obstacles to future policy initiatives, schools principals and coordinators were asked about the barriers regarding software and hardware infrastructure. Table 4 shows the number of respondents who indicated the major problems for realizing the computer-related goals of the school for the students at Grades 1-2.

Table 4
Major hardware and software obstacles affecting the realization of school's computer-related goals for students

Hardware Obstacle	Yes (n=48)	Yes (%)	Software Obstacle	Yes (n=48)	Yes (%)
Insufficient number of computers	38	79%	Not enough copies of software for instructional purposes	40	84%
Insufficient peripherals (printers, scanners, etc.)	38	79%	Not enough types (variety) of software	36	75%
Insufficient computers with access to the Internet	38	79%	Software not specific enough and/or not adaptable for use in subjects	33	69%
Outdated or lack of school network or LAN	36	75%	Software too complicated for teachers and/or students to use	18	38%
Slow or unreliable network performance	33	69%	Lack of information about software or its quality prior to purchasing	18	38%
Too complicated to connect to the network	15	31%	Most of the software is not in the language of instruction	18	38%
			Curriculum incompatibility of imported instructional software	18	38%
			Cultural incompatibility of imported instructional software	12	25%

School principals and computer coordinators were asked about particular software and hardware problems that prevented schools from achieving their computer-related goals. Table 4 shows that the majority of schools in the sample (79%) do not have sufficient computers, Internet and peripherals. A significant number of schools (75%) suffered from a slow and outdated network. It is clear that there were many constraints regarding the realization of the computer-related goals of the schools. Also it is clear from Table 4 that the most frequently mentioned obstacles faced by school principals (83.3%) and coordinators (84%) were "not enough copies and types of software for instructional purposes".

What innovative practices exist in Sudanese secondary schools?

The study provides information regarding the teachers' ICT activities in the scheduled learning time and presents data on the use of ICT in assessment. Eight four respondents' teachers were asked whether they had used scheduled learning time for the activities, as well as whether they use ICT when these activities took place.

Table 5
Mean scores for the ICT activities by science and math teachers in scheduled learning time in the schools

Learning activities	Learning activities			ICT use	
	n	Mean	Std. Er.	Mean	Std. Er.
Extensive courses	84	1.89	0.102	1.23	0.046
Producing creative works	84	1.62	0.081	1.14	0.038
Self-accessed courses / learning activities	84	2.14	0.103	1.17	0.041
Scientific, research	84	2.02	0.066	1.32	0.051
Teacher's lectures	84	2.13	0.111	1.19	0.043
Exercises to practice skills and lesson procedure	84	3.11	0.110	1.14	0.038
Discovering mathematics principles and concepts	84	2.76	0.109	1.18	0.042
Studying natural phenomena through simulation	84	1.88	0.092	1.14	0.038
Processing and analyzing data	84	2.10	0.117	1.15	0.040

Table 5 shows that the ICT activities used in scheduled learning time were *the exercises to practice skills and lesson procedure* (mean= 3.11(0.110)) and *discovering mathematics principles and concepts* (mean= 2.76(0.109)). The table also shows that *producing creative work* presented as the weakest activity in scheduled learning time. However, overall the use of ICT in all these activities was very limited.

The use of ICT in assessment

Table 6 shows that the most common assessments used in the school sample are *written test or examination* (mean= two (0.00)) and *written task or exercise* (mean= two (0.00)). The table also shows that few teachers use *project report and/or (multimedia) product assessment* (mean= 1.12(0.045)). However, the table shows that only a few teachers used ICT in those assessments.

Table 6
The use of ICT in assessment by science and math teachers

Assessment methods	Present assessment			ICT use	
	n	Mean	Std. Error	Mean	Std. Error
Written test/examination	84	2.00	0.000	1.20	0.044
Written task/exercise	84	2.00	0.000	1.10	0.032
Individual oral presentation	84	1.87	0.037	1.07	0.028
Group presentation (oral/written)	84	1.85	0.040	1.08	0.030
Project report and/or (multimedia) product	84	1.21	0.045	1.10	0.032
Learners' peer evaluations	84	1.90	0.032	1.18	0.042
Assessment of group performance on collaborative tasks	84	1.77	0.046	1.14	0.038

ICT innovative practices

Science and Mathematics teachers were asked to describe the one most satisfying pedagogical practice (that they applied in the target class) in this school year, in which their learners used ICT extensively with content specifically related to Science /Mathematics. The results show that, only twelve (n=12) schools experienced the use of ICT with content specifically related to science and mathematics. This result is not surprising given the short history of ICT use in Sudanese secondary schools.

Teacher's role and change regarding the use of ICT in the learning activities

The results of the interview showed that the teachers have gained experience from using computers and the Internet and their roles were changing. One teacher commented *I have already designed my lessons and I used it in my teaching in the class, but not always. So, I saved more time than before.* The teachers also have seen that the teaching methods have changed. One teacher commented *...the learning performance and the comprehension rate of the students were increased.* Other teachers mentioned that using ICT helped them to present more information in their lessons with different teaching strategies and they saved time.

Kinds of activities reported

A variety of activities using ICT in teaching and learning was reported by the school, in the example. The activities provided by the teachers revealed that there was generally greater emphasis on *information processing and production activities*. The result regarding school activities, which were provided by the teachers, showed that most of activities focused on searching information from the Internet, creating a product, and using multimedia programs. In addition, the activity practices focused on conducting research, tutorials, drill and practice, communications, designing materials, and collaborating with colleagues. Interestingly, some teachers wrote that they conducted small projects with their student (e.g. using the Internet for writing reports on Physics, Biology and Chemistry).

Discussion

ICT infrastructure (equipment, software, access to the Internet and the like) available in secondary schools

Today one of the widely used indicators of implementing ICT in education is the student:computer ratio. During the 1990s, student:computer ratios of approximately 30:1 were quite common (Pelgrum & Law, 2003). The present study (Figure 2) shows that the position of Sudan regarding the indicator of computer ratio is high compared to other countries participating in the SITES-M1 study (Slovenia and South Africa). Most of the schools in the sample have lacked computers in their classrooms. Significantly, only 104 computers (out of 1300) (8%) were equipped with multimedia facilities. Thus, the availability of multimedia computers was very low in Khartoum, compared to Slovenia and South Africa (Figure 2). Only a quarter of the sampled schools (out of 48) have computers linked to an internal network (Figure 3). In comparison, South Africa was slightly above average with nearly a half of the schools being linked to an internal network (Howie *et al.*, 2005). Moreover, few schools have computers with CD-Writer and video projectors and none of the schools has devices for mentally and physically disabled students and LCD Panels (Table 2). This is not surprising given the lack of support from the ministry of education to provide schools with computers and peripherals. And most of the budgets in Sudan were invested in the war in Darfur and other regions (Ahmed, 2010; Ahmed, Howie & Osman, 2013). Haddad and Draxler (2002) reported that ICTs in schools require supporting infrastructure that includes electricity, communication, and special facilities. However, these findings demonstrate that few schools in the sample are connected to the internet for communication and instructional purpose. This is because of the lack of money and support. Therefore, the results reveal that Khartoum

schools belong to a group of schools that have a high ratio of students per computer between 40 and 90, yet it lags far behind developed countries, which have ratios in the range of 10 students per computer.

There were many problems faced by schools regarding the implementing ICT in schools (hardware and software) (Table4). Insufficient number of computers; insufficient peripherals; insufficient computers with simultaneous access to the Internet and outdated or lack of school network or LAN were seen as major obstacles affecting the realization of the computer-related goals of the schools. In addition, the most frequently mentioned obstacles by schools principals and coordinators were limited software in schools with not enough copies and types of software for instructional purposes. All these obstacles regarding the hardware and software aspects found in Khartoum are similar to those found in other countries (e.g., Slovenia and South Africa) (Hinostrroza *et al.*, 2003; Pelgrum & Anderson, 2001; and Howie *et al.*, 2005).

The most commonly available software in Khartoum secondary schools is that of word processing, presentation software (e.g. PowerPoint) and databases. These results are very similar to the results obtained in Slovenia and South Africa in SITES Module1 study, where the most commonly available software was word processing, spreadsheets, and databases for students to access (Howie *et al.*, 2005). It is also important to point out that the subject coverage software was very low in the school sample. Computers science software is more widely available than software for other subjects. The entire school sample lacked software for industry, principles of economy, geography, military education, family education, commerce, environmental studies, history and social science, and art and design. These results showed the limitation of the educational software in Khartoum schools. Therefore, the ministry of education should encourage and support the design and development of educational software for those subjects.

In recent years, steps were taken in many countries to provide schools with an ICT infrastructure, in the hope that technology will support innovative pedagogies and improve the teaching and learning processes (Pelgrum & Anderson, 2001). Science and math teachers were asked to describe the one most satisfying pedagogical practices that they had applied in the target class, in which their learners used ICT extensively with specific content related to Mathematics/Science. The teachers' responses regarding ICT pedagogical practices were focused around searching information from the Internet, creating product, tutorial and drill and practice, communications, design materials, and collaborating with colleagues. Interestingly, some teachers wrote that they had conducted small projects with their students (e.g. using the Internet for writing reports on Physics, Biology and Chemistry) and a school reported that it has a team (development team) that designed educational software for science and math subjects. The findings of this study found that the majority of schools in the sample had little experience with the use of ICT in teaching and learning.

Similarly, the findings of SITES-M1 (2001) for example, the results of the Slovenia and South Africa studies, showed that quite a number of schools principals reported on the contribution that ICT has made to new curriculum approaches (such as cross-curricular approaches), different roles for teachers and productive learning activities for students (Howie *et al.*, 2005). Most school activities in those countries are implemented through a specific group of highly motivated students and teachers using ICT. Teachers can carry the important mission of being agents of change, not only in ICT, but also in the whole system of education since ICTs are the instruments that can launch an important and general paradigm shift.

Findings

- In most countries, there are programs to improve the infrastructure of ICT equipment in schools (e.g. in countries like Slovenia and South Africa). For that, the indicator of the computer ratio is very low in these countries (i.e. between 23 – 35). While in Khartoum State, Sudan, the indicator of computer ratio was very high compared to these countries (between 55 –105). This indicates that there is a lack of computers in Sudanese secondary schools.
- There were substantial differences in the quality and functioning of ICT equipment in schools around the world. Some countries (e.g. Slovenia and South Africa) are equipped for multimedia purposes, whereas in (Sudan – Khartoum State) only 8% out of 16 schools had computers with multimedia facilities and these equipment were very old.
- Many countries and schools also differed in their access to the Internet for instructional purposes. Most schools in Slovenia and South Africa had access to the Internet for instructional use, whereas in Sudan, only two schools (out of 48 schools) provided Internet access to their students. Consequently, the gap between Sudan and those countries regarding the access and use of the Internet was very high. This study also found that most teachers do not use information from the Internet for education because of restricted access to the Internet or complete unavailability.
- Insufficient number of computers; insufficient peripherals; insufficient of computers with simultaneous access to the Internet and outdated or lack of school network or LAN were seen as major obstacles affecting the realization of the computer-related goals of the schools.
- The most commonly available software in Sudanese secondary schools is that of word processing (15 schools out of 16).
- The subjects' coverage software was very low in the school sample. Computer science software (computers science subject) was more widely available than software for other subjects; approximately half of schools (out of 16 schools) have access to computers science software, while only three schools (out of 16) have access to science software (e.g. science, chemistry, biology, mathematics, and Sudanese Certificate examinations Examples "Drills").
- The majority of schools in the sample in Khartoum State (N= 38 (out of 48 schools)) have no budgets to spend on hardware and software
- Overall, schools in the sample (N= 47 schools (out of 48)) had little experience with the use of ICT in teaching and learning.
- The range of satisfying experiences reported in this study tended to be narrower, in terms of the kinds of activities and the kinds of learning gains reported.
- The focus of the learning activities at the secondary schools in Khartoum tended to focus more on searching information from the Internet, creating product, conducting research, communicating, tutorial and drill and practice. These were all indications consistent with the fact that the use of ICT across the curriculum to improve teaching and learning has a very short history in Sudan.

Conclusions

It is noted that the small sample size limited the generalizability of the study. Therefore, the researcher cannot claim to generalize the findings of this study to all Sudanese states. But, because the Sudanese secondary schools in other states are equally or less developed than the secondary schools in Khartoum state, the researcher can generalize the findings of this study which was drawn from 50 secondary schools in Khartoum to the all secondary schools in other Sudanese states. This study presents data and information that will enable policymakers to make judgments on the current situation regarding the use of ICT and will help them to take bold new steps to utilise ICT more intensively in Sudanese educational system. The conclusions of this study are summarized in two main conclusions, these are:

- Sudan does not yet have the necessary infrastructure to integrate ICT into education and is well behind many countries internationally in implementing ICT into education. The evidences for this conclusion were:
- There is a positive although traditional approach towards implementing ICT in Sudanese schools.

Limitation

Like all research, this study is not free of limitations, some of which can be solved by future research. Two main limitations were encountered: sampling and research.

First, the focus on Khartoum secondary schools (n=50) places the research in a particular cultural context. Furthermore, the teacher responses were limited to those who teach science and math in Khartoum secondary schools (n=200). Consequently, the results may not adequately represent the total teacher population in Sudan. Future research on the current ICT infrastructure and innovative practices could be extended to include a wider demographic base to further explore the extent to which the findings are generalizable.

Second, there was a deficit of previous studies conducted in Sudan compared to other countries regarding the current status of ICT infrastructure and pedagogical practices. Future studies should also be conducted with schools from different Arab countries in order to better understand whether different socio-cultural contexts may influence adoption of innovative pedagogical practices. A future study that compares different samples of countries can shed light on this issue and this effort would provide a great helpful insight of ICT infrastructure and Pedagogical practices.

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Editor's Note: Research not only refutes or confirms our expectations, it also determines whether the difference is statistically significant. Access, communication skills, and familiarity with technology influence instructional design and choice of information and communication technologies. Technologies in widespread use for personal communications are now being adopted for educational use.

The effect of mobile phones on increasing public information: a comparison between the students of Kharazmi and Allameh Tabatabai University

Jafar Ahmadigol and Pourandokht Fazelian

Iran

Abstract

The present study aims to compare the impact of mobile devices on increasing public information of students of Kharazmi and Allame Tabatabayi Universities in 2013. The study method is quasi-experimental with pretest/posttest design for control and experimental groups. This study is based on a researcher-built test composed of 20 questions. To evaluate face validity and content validity, the opinions of lecturers of educational technology, ICT and sociology were used. The reliability of measure is Cronbach's alpha coefficient (0.89). A random cluster method was used to select 160 students. A 20-item test-pretest was administered. Then, the experimental group received training via mobile devices and the control group received training by traditional methods. The posttest was performed with the same questions. Finally, a survey questionnaire was presented to the experimental group. SPSS software version 19, t-test and covariance analysis were used for data analysis. There was no significant difference between the mean of two groups in the pre-test (experimental 7.57 and control 7.75) but there was a significant difference in the posttest (experimental 17.25 and control 12.90). The training by traditional and mobile methods is effective but training via mobile devices has a significantly higher impact. Students are more interested in being trained by this method.

Keywords: training via mobile, traditional training, public information, students.

Introduction

One of the basic expectations of higher education is change and it currently active in adoption of social progress and technology. It incorporates new views regarding education. Many authorities in education and learning are advocating adoption of new and innovation educational methods such as multi-media and digital technologies (Godwin, 2008). New education methods are introduced to stimulate growth of skills and abilities in people. Also, they can facilitate learning high level skills such as analysis and problem solving using participative and active strategies. These new methods arise from new technology development and their application in routine life, training and the workplace. Internet based ICT applications (including word wide network, e-mail, teleconference, computer-based participative learning and learning management systems) are of considerable value for higher education (Zamani & Abdollahi, 2011).

In Universities, improving the quality of learning and teaching is an important issue. Technology to support the teaching-learning process can increase learning opportunities. For example, students can have permanent access to lectures. Students can get training when needed (just-in-time training) and get faster response to their questions. In the existing educational system, interactions remained at an unacceptably low level (Starr, 2003). Classroom learning is not continuous and the interaction in learning between students and between the students and lecturers is low (Kamar & Ong'ondo, 2007). In many classes, handouts are used for textbooks. Time dedicated to preparing handouts and scoring tests sources makes the instructor less available to students (Gregson & Jordaan, 2009). Information is delivered slowly so that most students can comprehend the

material. For the fast learner, the system is not flexible and responsive and cannot sustain interest and motivation (Peters, 2007).

Students need guidance and techniques to help them better understanding and learn from textbooks. Also, students need comprehensive, global and up-to-date information. To have access to current information, technology has an obvious advantage (Chase & Herrod, 2009). Due to the familiarity and competence of today's students with technology, most of educational centers are transitioning to technology-based educational content and creating electronic educational environments (Balasundaram & Ramadoss, 2008). Electronic learning presents and manages learning opportunities via internet and computer networks to improve knowledge and skills in education and training. Generally, e-learning is a method of learning based on application of ICTs including computers and networks (Aminpoor, 2005). E-learning includes computer applications, interactive computer- and web-based learning, electronic classrooms, and collaborative electronic networks. Generally, e-learning is a method of learning based on application of ICT and other computer networks and mobile learning is a subset of e-learning developed since 2000 in organizations, institutions and schools (Saiedipoor, Sufi, Moraddiymokhles & Usefli, 2011). This method was used since 2007 in Britain, Sweden and Italy and students aged 16 to 24 years leaving the school were covered and also this technology develops literacy and numerical school and self-confidence, independent learning and self-centeredness are developed (Sadpoor, 2008). Mostly, adults believe that this type of education let them continued their work full-time and perform their family duties during training in everywhere and anytime virtual environments (Gilbert, 2001). Brown considers mobile learning as a subset of e-learning and e-learning is a broad concept that includes both online training and mobile training (Brown, 2003).

Mobile learning is sending and transferring learning via mobile devices such as laptop, pocket computer, tablets and other mobile devices to facilitate learning at any time and place (Bull, 2007). Mobile learning provides easy access to various education resources. Students conduct research, download resources, discuss ideas, prepare reports and complete homework, and send email to their teacher. This is a method providing continuous learning for students (Ciffci ON & Tabak, 2012). Some studies of topic regarding review of literature in Iran and abroad are investigated.

One study compared of the impact of two methods of learning - mobile and lecture -for students of the Agriculture institution of Khushehaye Zarinshahr of Ravansar town. 30 male students were selected and are divided into two similar groups based on age and level of educational. A pretest was administered; control group then received training via lecture and the experimental group received training via mobile. A posttest with the same questions was administered and the data were tested statistically by t-test. Results showed that both teaching methods (mobile and lecture) were effective but mobile teaching resulted in greater learning (Papzan & Soleymani, 2010).

Another study as training anatomy via mobile compared to lecture learning on learning of medical students was performed on 62 medical students of Medical Sciences University of Bushehr. The results showed that training via by methods improved learning and memorization of medical students and that mobile learning was more effective than traditional methods (Nasiri, Nasiri, Adarvishi & Hadigol, 2014).

A study evaluated the impact of e-learning by mobile text message on metabolic control of Diabetes type 2 patients of Karaj city, Iran. The study aimed to evaluate the impact of e-learning on metabolic control with emphasis on training via mobile. In this study, 81 patients suffering from diabetes type 2 referred to diabetes association of Karaj city were selected based on inclusion criteria as randomly and were divided into experimental (n=43) and control group (n=38). The result showed that positive impact of using mobile in presenting health services and management of efficient chronic diseases (Goodarzi & Ebrahimzadeh, 2014).

Another study evaluated the impact of mobile training on motivation and attitude of English students and also investigated the impact of teaching method via mobile on attitude and motivation of students to English language. 76 students were selected by convenient sampling method and were divided into experimental group (38) and control group (38). The experimental group received mobile teaching and control group received traditional training. Finally, the comparison of the mean of two groups showed that mobile phone teaching had positive impact on motivation, interest, and attitude to English language, complementary direction and tendency to learning English language among students (Ayati & Sarani, 2012).

In an evaluation of the amount and type of using mobile by high school students, the results showed that most students had mobile and considered it as a necessary tool and girls applied mobile more than boys (Hasanzadeh, Latifi, Hoseini & Ebrahimi, 2011).

Another study as e-learning in low-populated regions stated that mobile learning leads to flexibility in learning and any learner in any time and place can learn based on his speed (Daichendt & Magdaş, 2009). In other study researchers in proposed plan of mobile learning model stated that mobile-based applications changed the method people communicated and had access to the information sources and facilitated it (Yau & Joy, 2010).

The old methods of classroom and lecture are used in schools and universities and its highest advantage is presenting information to more people (Lake, 2001). Despite new educational methods, it is retained as an educational method (Cooper, 2003).

Based on little efficiency of traditional training methods and the need to the presence in definite place and time, limited access to learners to teachers, learning content and sources and the lack of improving the motivation of learners to learning, restrict the efficient of these methods. Based on the evaluation of review of literature, abilities of mobile phone applied by most of adults namely students, availability and user-friendly of mobile, saving the time of teacher and student, providing learning at any place and time, creating interest and motivation in learners can lead to the evaluation of adaptation of these technologies with teaching and learning grounds by researchers. The above items define the necessity of present study. This study has the general aim of comparison of the impact of mobile on increasing general information of students of Kharazmi and Allametabatabayi University and the following hypotheses are evaluated:

First hypothesis: Traditional teaching has positive impact on learning public information of students of Allame Tabatabayi University.

Second hypothesis: Mobile teaching has positive impact on learning public information of students of Kharazmi University.

Third hypothesis: Mobile teaching has high effect compared to traditional teaching method on learning public information of students.

Material and methods

The present study is quasi-experimental in which value of one or some independent variables is changed and its effect on one or some dependent variables is evaluated (Biyabangard 2009). The present study is composed of an independent variable (mobile learning) and its effect on a dependent variable (public information) is evaluated. Also, the results are compared with traditional classroom method (control group). The study population is all BA students of Kharazmi and Allame Tabatabayi Universities during 2012-2013, of this population, 160 people are selected by the cluster random sampling method. It means that at first three colleges and of each college, two classrooms are selected by random method. Then, they are divided into 80 people. The students of Kharazmi University are selected as the experimental group being compared with Allame Tabatabayi University in control group. It was possible to distribute sending SMSs among

the students and this affected the results of the study and control group was selected among Allame Tabatabayi University. These groups were divided in terms of age and education into two similar groups (80 experimental and 80 control group). The data collection measure is 20-item researcher-built test and at first by researcher-built test, pre-test is performed and then SMSs with public information are sent to the sample selected among Kharazmi University students (experimental group). The information was given as pamphlet to control group and the required explanations were presented to the students and then post-test was performed of two groups (experimental and control) and finally a researcher-built questionnaire regarding the interest and attitude of experimental group regarding mobile teaching was presented. For the analysis of pre-test and post-test data of both groups and determining their learning, t-test is used and to compare the difference of the man of experimental and control groups, uni-variate covariance analysis test is used.

The validity of 20-item test of learning is tested by experts and face and content validity of test are confirmed by 7 lecturers of educational technology, ICT and population. The reliability was calculated as 0.89 by Cronbach's alpha and this showed good reliability.

Results

Table 1

The features for comparison of experimental and control group:

Groups	Age mean	Education
Control group	3.1 ±5 /21	BA
Experimental group	2.4 ±5 /21	BA

To evaluate the public information of students in control and experimental groups, pretest and posttest are performed. This test included 20 questions of four multiple choice of the sources of public information evaluation. The results for two mentioned groups are regarding the tests of learning in Table 2.

Table 2

The mean and standard deviation of public information in pre-test and post-test based on groups:

Variable	Test	Traditional group		Mobile group	
		SD	Mean	SD	Mean
Public Information	Pre-test	1.41	7.70	1.74	7.57
	Post-test	1.69	12.90	1.49	17.25

As shown in Table 2, the mean of traditional teaching and mobile teaching in public information is increased from pre-test to post-test but the mean of training group via mobile phone is increased. In pre-test of public information in control group students, the mean is 7.70 and standard deviation 1.41. These results in comparison with experimental group with mean 7.57 and standard deviation 1.74 is not different and we can say the groups have the same levels. After applying experimental variable (mobile-based teaching method), post-test scores as follows, the mean of experimental group is 17.25 and standard deviation 1.49 and posttest is performed on control group and the data (mean 12.90, SD 1.69) show the superiority of experimental group compared to control group (the difference of mean and standard deviation of two groups in post-test). To evaluate each of study hypotheses, the hypotheses are tested by inferential statistics.

The findings of study hypotheses

First hypothesis: The traditional teaching method has positive impact on public information learning of students of Allame Tabatabayi University. To evaluate the first hypothesis, t method for dependent groups is used. Is the difference between learning of control students in pretest and posttest is due to the sampling error or significant difference. A summary of findings of these calculations is shown in Table 3.

Table 3
The results of t-test, comparison of pre-test and post-test of public information for first hypothesis:

Test	N	Men	SD	Degree of freedom	t	Significance
Pre-test	80	7.70	1.41	79	-20.40	0.001
Post-test	80	12.90	1.69			

As shown in Table 3, the mean of pre-test and post-test of public information is significantly different and teaching via mobile increases public information. There is a significant difference between the mean of pretest and post test scores of control group in traditional teaching at level 0.001 ($t=-20.40$). It means that traditional teaching has positive and significant impact on learning public information of students in Allame Tabatabayi University and first hypothesis is supported.

Second hypothesis: Mobile teaching has positive impact on learning public information of students in Kharazmi University. To test the second hypothesis of study, t test is used for dependent groups. This method shows the difference between learning of public information of students (experimental group) receiving teaching via mobile in pre-test and post-test. A summary of the findings of these calculations is shown in Table 4.

Table 4
A summary of the results of t-test to compare pre-test and post-test of public information

Test	N	Men	SD	Degree of freedom	t	Significance
Pre-test	80	7.57	1.74	79	-36.36	0.001
Post-test	80	17.25	1.49			

The data of Table 4 shows that there is a significant difference between the mean of pre-test and post-test scores of public information. We can say that teaching via mobile increases public information of people. As shown in Table 4, there is a significant difference between the mean of pre-test and post-test scores of experimental group in mobile teaching at level 0.01 and $t=-36.36$ means that mobile teaching has positive and significant impact on learning public information of students in Kharazmi University. Thus, second hypothesis is supported.

Third hypothesis: Mobile-based teaching compared to traditional teaching method has high effect on learning of public information of students. To evaluate the significance of the difference of groups (mobile and traditional) in posttest of public information scores, uni-variate covariance analysis is applied. At first we should be sure of the homogeneity of variances, then Levene's test is used. The results of test are shown in Table 5.

Table 5
The results of Levene's test to evaluate the equality of variance of groups

Variable	F ratio	Degree of freedom of nominator	Degree of freedom of denominator	Significance level
Public information	0.232	1	158	0.631

As shown in Table 5, Levene's test shows the equality of variance of groups as observed F value is not significant and variance homogeneity is established and covariance analysis can be used.

Table 6
The results of covariance analysis of the comparison of the impact of mobile-based teaching on public information:

Variable	Sum of squares	Degree of freedom	Mean of squares	F	Significance
Pretest	2.26	1	2.26	0.885	0.348
Group	752.43	1	752.43	295.37	0.001
Error	399.94	157	2.55	-	-

Based on the information of Table 6, the comparison of the impact of two methods of teaching regarding public information is significant statistically. Thus, teaching via mobile is effective than traditional teaching method. Based on significance of covariance analysis test, it is inferred that mobile-based teaching compared to traditional method has high effect on learning of public information of students. The third question of study is supported. Mobile-based teaching has high effect compared to traditional method on learning of students.

Also, at the end of questionnaire, survey is performed of the trained students by mobile (experimental group) and the results are shown in Table 7.

Table 7
Survey of experimental group students regarding mobile teaching:

Questions	Very much	Much	Average	Low	Never	Sum
1-Can we use mobile for teaching?	19	38	17	6	0	80
2-Are you interested to receive the textbook by mobile phone?	12	24	31	9	4	80
3-Do you agree with receiving SMS regarding generation information on holidays?	21	42	14	3	0	80
4-When do you want to receive sms?	8 - 11	12 -15	16 - 18	20 - 22	-	-
	32	2	7	39	-	80

First question: Is Mobile applied in teaching? 74 students of experimental group in three levels (very much, much and average) believe that we can use mobile in teaching and learning and 6 people believe that mobile is used less in learning and teaching.

Second question: Are you interested to receive the textbook by mobile? 67 people in three levels of very much, much and average agree to learn via mobile. 9 people have low interest and 4 people are not interested at all.

Third question: Do you agree to receive sms regarding public information on holidays? 77 people at levels (very much, much and average) receive sms regarding public information on holidays and only three people are less interested to do it.

Fourth question: When is appropriate to receive sms? IN this question, 38 people select 8 to 11 a.m., 2 people 12 pm to 3pm, 7 people 3 pm to 6pm and 39 people select nights for learning. These results show that most students know mobile effective on their learning and are interested in learning by this method as even they agree with mobile-based learning on holidays and other periods.

Conclusion

In a general conclusion, we can present the results of study as mobile is effective on increasing learning of students of Kharazmi University as not only the learning of students in pre-test and post-test is increased, by comparing this group (experimental) with control group (students of Allame Tabatabayi University) receiving traditional teaching, the results show the superiority of experimental group. In other words, both teaching methods (lecture and mobile) are effective on learning of learners but training via mobile has greater effect on learning. This method increases the motivation, interest, attitude of students to learning. The results of survey of students to learning via mobile show that the students are interested in learning by this method as on holidays or other times, they are interested in mobile learning. As mobile increases motivation, excitement of learners in learning even in non-educational days, the lecturers should use less lecture teaching and identify the abilities and advantages of mobile in education and try to apply more of this new technology.

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