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UNIVERSITY OF NORTHERN COLORADO

Greeley, Colorado

The Graduate School

EVALUATING EDUCATORS' COMPETENCY IN THE USE OF
COMPUTER TECHNOLOGY TOWARD INTEGRATING
TECHNOLOGY INTO LIBYAN HIGHER EDUCATION

A Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Philosophy

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College of Education and Behavioral Sciences
Department of Educational Technology

August, 2018

This Dissertation by: Ilham A. Hbaci

Entitled: *Evaluating Educators' Competency in the Use of Computer Technology Toward Integrating Technology into Libyan Higher Education*

has been approved as meeting the requirement for the Degree of Doctor of Philosophy in the College of Education and Behavioral Sciences in Department of Educational Technology

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ABSTRACT

Hbaci, Ilham. *Evaluating Educators' Competency in the Use of Computer Technology Toward Integrating Technology into Libyan Higher Education*. Published Doctor of Philosophy dissertation, University of Northern Colorado, 2018.

The primary purpose of this quantitative survey research with supplemental qualitative data was to evaluate issues related to the integration of technology into Libyan higher education from Libyan educators' perspectives. All participants were Libyan educators who worked at the main universities in Eastern Libya (Benghazi and Omer Al-Moktar). The study focused on four critical computer technology skill areas: basic computer operation, use of application software, use of the Internet, and use of peripheral technologies (equipment that could be connected to computers such as printers and cameras). A total of 161 Libyan educators participated in this study by completing an Arabic version of the Competency in Using Computer Technology Scale; additional qualitative questions generated data about broader aspects of technology integration in Libya and demographic information.

The first objective of this study was to evaluate educators' competencies in using computer technology in the four areas. The results of a quantitative analysis showed statistically significant differences in educators' technological competency depending on the competency type. Libyan educators' perceived levels of competency in the different skill areas ranked in the following order: basic computer operations, use of peripheral technologies, use of Internet resources, and use of software applications. A follow-up

analysis determined levels of perceived competency in each skill area differed significantly from perceived competence in each of the other areas. Taken together, the results indicated many Libyan educators had some basic computer skills but they needed to add skills in using Internet resources, software applications, and peripheral technologies for educational purposes.

Second, the researcher investigated a Libyan stereotype that implied Libyan educator disciplines would influence the details of efforts to integrate technology into Libyan higher education. Therefore, differences in technological competence in the four areas between technically oriented and nontechnically oriented educators were evaluated. A multivariate analysis of covariance (MANCOVA) showed a statistically significant difference between the discipline groups (technical and nontechnical) in overall competence (across skill areas) in using computer technologies after controlling for gender and educator source of degree (either Arabic university or Western university). In addition, MANCOVA showed there were significant differences between educator groups in basic computer operating skills and in competency in the use of software skills but there were no significant differences between educator groups in the areas of use of Internet resources and use of peripheral technologies. Educators in technical disciplines expressed more competence in the general use of computers and software applications. All in all, this comparison indicated a need to tailor training and implementation efforts to the needs of educators in various disciplines rather than using a standardized approach.

Barriers to technology integration in Libya and advantages of using technology in Libyan classrooms from the educators' perspectives were also key elements the researcher explored. Therefore, the survey included forced-choice and open-ended

survey questions directed at obtaining information about participants' perspectives on issues related to technology integration into Libyan higher education systems. Response frequencies and lists of statements from educators provided data summaries for this group of questions. These supplemental data indicated fundamental infrastructure issues must be addressed before training Libyan educators could be effectively implemented. The researcher attempted to document all participants' comments from the qualitative data to record and ensure each opinion about integrating technology into Libyan higher education was heard.

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various resources to do so. My academic achievement was her first concern, which was apparent in the balance between the amount of work she required and my class obligations. As an international student, I have been grateful that she was always open to sharing my culture and to teaching me about American culture as well.

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DEDICATION

This work is dedicated to my generous husband and beautiful daughters. To my loving parents, supportive siblings, and husband's kind family. All of you have made me stronger, motivated, better, and more fulfilled than I could have ever imagined to be.

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CHAPTER I

INTRODUCTION

There has been rapid growth during the past several decades in the use of technology, computers, and the Internet to facilitate teaching and learning in many institutions around the world. However, the Arabic region, specifically Libya, is still using traditional instruction throughout its educational settings (Rhema, Miliszewska, & Sztendur, 2013). To successfully compete in today's technological world, students at each level and area of education require exposure to and experience with technology in academic settings (Palak & Walls, 2009). Before educational reforms can be undertaken, however, a thorough analysis of the challenges associated with the integration of technology into educational settings, especially for educators in Libyan classrooms with no prior experience in teaching with technology, could identify issues that need to be addressed in order to guide effective and efficient integration efforts.

Successful integration of technologies into classroom learning is associated with many factors but one of the main supporting determinants is user competency (Abouchedid & Eid, 2004; Gorder, 2008; Sadik, 2006). Users, mainly educators, perceive technology to be an effective tool for teaching and learning if they feel comfortable using it (Masrom, 2007). Spotts and Bowman (1995) found through their research that once educators started to use technology in their classrooms and became

more comfortable using it, they tended to use it more often. Furthermore, educators who were comfortable in using one technology were more likely to explore a new technology (Kagima & Hausafus, 2001). Hence, as part of an initiative to improve the Libyan education system as a whole, this study focused on the competencies of educators (teachers in universities) relative to the implementation of technology in Libyan higher education. Educators were selected because they serve as models for perspective teachers. Other stakeholders such as students, administrators, and other staff members were beyond the scope of this study.

In addition to the focus on educators' competencies in the use of technology, the academic specialty of each educator was investigated because of a unique characteristic in Libyan higher education (Rhema et al., 2013). Some disciplines in Libya are considered to be technical disciplines, (e.g., engineering, science, and economics) where the curriculum content already has some built-in technologies such as computers. This consideration has led Libya to assume educators within these disciplines are already skilled in using technology (Rhema et al., 2013) and would not struggle with implementing educational technologies into Libyan classrooms. Because of this assumption, more attention has been given to incorporating technology into the more scientific disciplines.

On the other hand, disciplines considered to be nontechnical (e.g., law, arts, and education) consist of curricula that might not require the use of technology, leading to the speculation that these disciplines might encounter many obstacles in the implementation of technology into Libyan classrooms (Rhema et al., 2013). This speculation has been driven in part by the belief that incorporating technology into these disciplines was not

necessary. Moreover, research conducted in other countries around the world indicated social studies educators were not fully skilled in the development of tailored content using computer technology (Beck & Eno, 2012). Therefore, a careful investigation of educator competencies among different disciplines needed to be conducted before integrating technology into Libyan higher education. Because of the assumptions related to a discipline's influence on technology integration in Libya, this study included participants from both technical and nontechnical disciplines in order to understand whether or not educators in different academic areas had different competency levels. Would the discipline matter when integrating technology into Libyan higher education?

In summary, to successfully integrate technology into Libyan higher education, it was essential that educators be competent in using basic computer technologies and apply them to the classroom. An important part of establishing a plan for integrating technology into Libyan higher education was to assess the current competencies of educators in the use of technology in order to establish an initial baseline of skills and areas in need of development. Because the majority of research in Libya has focused on educators in institutions in Western Libya, this research focused on educators from Eastern Libya, mainly Benghazi and Omer Al-Moktar Universities. This study evaluated educators' competencies in the use of computer technologies (such as computer software or applications, Internet, and peripherals) with a view toward evaluating potential differences in technological competencies between educators who specialized in a technical area and those who specialized in a nontechnical discipline. In addition, challenges or barriers related to the future of integrating technology into Libyan higher education classrooms are presented as part of this study's findings.

Statement of the Problem

Libya has always ensured access to suitable education for all members of society --male and female. The Libyan government has sought to improve its entire educational system. In addition to curriculum development and the appraisal of its scientific content, integrating education technology mainly in the higher education sector is an indispensable element in Libya's inclusive plans (Rhema & Miliszewska, 2010). Furthermore, Libya has sought to play an important role in leading educational reform in neighboring countries in Africa such as Chad, Niger, and Rwanda (Rhema & Miliszewska, 2010).

Education in Libya is free from elementary to post-graduate levels; students can attend institutions either at home or abroad. Full scholarships are provided to students in pursuit of their education (El Zoghbi, Kumar, & Naidu, 2010). The education system in Libya has several levels (Bukhatowa, Porter, & Nelson, 2010). The first level is the primary stage starting at age six and is mandatory for six years. The second level is preparatory school or middle school; it is mandatory, lasts for three years, and ends with a national exam. At the third level, students have various options; they can choose either to attend high school (general or specialized high schools), intermediate vocational centers, or teacher training institutions. The third level also ends with a national exam for all types of institutions. Depending on the type of institution students attend, successful graduates receive a general high school certificate or a diploma (Clark, 2004). Students who receive a high school certificate/diploma with high marks are able to advance to higher education (Bukhatowa et al., 2010).

Libyan education needs development and renovation because most students in Libyan universities continue to experience and regard physical, non-technological classrooms (in contrast to classrooms with computer technology) as the only place to learn, receive materials, meet face-to-face with instructors and classmates, and have questions answered by instructors or colleagues. In addition to communication and resource access issues, students are inhibited in having enough time to ask questions as interruptions are interpreted by their professors and peers as wasting the time available for the lecture (Rhema & Miliszewska, 2010). If students cannot attend a class, they lose their chance to obtain instructional material, learn about a presented topic, or ask questions.

In the case of educators, restriction to the physical classroom has become increasingly problematic. For example, if instructors are unable to hold a class, they fall behind in the presentation of the scheduled material, which forces them to either eliminate the missed content altogether or fit the missed material into one presentation. However, each option has negative effects on students' exposure to the material and their understanding (Rhema & Miliszewska, 2010). Investing in educational technology, such as computers and Internet access, would improve Libyan education by providing alternative opportunities for students and educators to gain access to educational materials, supplying opportunities for collaboration and communication with colleagues throughout the world, and enabling educators and students to stay abreast of new advancements and improvements.

Educators are blamed for the weak education in Libya because they are reluctant to change their traditional ways of teaching (Elzawi & Underwood, 2010). This

explanation, however, is based on research indicating Libya does not specifically focus on educators and their different skills and needs (Elzawi & Underwood, 2010). Because of the lack of focus on educators' needs, Libyan research should involve educators in every step of educational reform, especially in planning the integration of technology into Libyan classrooms. The involvement of educators could ensure institutions adopt technologies tailored to their competencies within each educational context (Elzawi & Underwood, 2010). Therefore, exploring Libyan educators' competency in the use of computer technology was the main focus of this study.

Many Libyan educators have shown their willingness to use technology and are eager to improve higher education in Libyan institutions (Rhema et al., 2013).

Computers and Internet access are nominally available in large universities in Eastern Libya, mainly Benghazi and Omer Al-Moktar, but they are not available in university classrooms and not used for education. Furthermore, throughout Libya and even with infrastructure in place, Internet access can be erratic and unreliable. Libyan users (students and educators) have found it easy and enjoyable to use technology for entertainment and for professional purposes in work but become anxious and worried when it comes to learning (Rhema & Miliszewska, 2010). Kenan, Pislaru, and Elzawi (2011) conducted a study that presented possible ways to successfully implement technology in a Western Libyan institution. Based on the strengths of the United Kingdom's use of technology in education, their study proposed the notion of using technology, mainly the Internet, in Libya. Kenan et al. also asserted that although the infrastructure of technology had been improving in some Libyan universities, there was still a need to establish appropriate training at different levels of Libyan education to

develop expertise in the use of technology for learning purposes, carry out more research to obtain data, and initiate useful reports for future development toward using technology in Libyan higher education. Consequently, this study investigated certain factors (competency and discipline of educators) to determine the current skill levels of Libyan educators and reasons for the rare use of technology in their classrooms.

Rhema et al. (2013) conducted a quantitative study with engineering educators in Western Libya. The purpose of their study was to specifically investigate students' and educators' attitudes toward technology and incorporate it at two different Western Libyan universities--the Universities of Tripoli and Al-Jabal Al-Gharbi. Rhema et al. found Libyan students and educators showed positive attitudes and willingness to use technology in their courses even with the difficulties related to consistently accessing the Internet in Libya. Because their study was conducted in a specific region of Libya and with technically oriented participants, it called attention to the need to gather more data confirming the future of technological implementation in Libyan higher education using research that focused on those who did not possess a technical background as well as those who did. Therefore, this study included both technically oriented and nontechnically oriented participants.

So far, the number of studies conducted by Libyan researchers to investigate the future implementation of education technology in Libya has been limited. This might be explained by the fact that Libyan education has been isolated from the rest of the world due to political issues and instability and, concurrently, from technological advancements. Furthermore, most of these studies did not differentiate between the types of users (students or educators) and used both educators and students in obtaining their

data (Elkaseh, Wong, & Fung, 2015; Elmarzugi et al., 2014; Rhema et al., 2013). In addition, almost all of the studies that investigated or explored the future of implementing technology in Libyan higher education were conducted in Western Libya (Elkaseh et al., 2015; Elmarzugi et al., 2014; Rhema & Miliszewska, 2010; Rhema et al., 2013) and excluded East Libyan universities and institutions. This exclusion was a result of the country's centralized decision system, which is located in Western Libya, leading to delayed responses to the needs of the universities and institutions in Benghazi and surrounding cities (Eastern side) from the Ministry of Education located in Tripoli (Western side). Therefore, to the best of the researcher's knowledge, no study has focused specifically on Libyan educators' competency in the use of technologies in Eastern Libyan higher education.

Although Rogers (2003) claimed individuals shape their attitudes about using technology after they know how and why to use it, many of the studies (Emhamed & Krishnan, 2011; Othman, Pislaru, Kenan, & Impes, 2013; Rhema & Miliszewska, 2014; Rhema et al., 2013) focused on the attitudes of Libyan educators and students regarding the use of technology without confirming what participants knew about computer technologies before proceeding. Also, no study has been conducted either in Western or Eastern Libya that included participants from both technical and nontechnical disciplines. This study did not focus on the attitudes toward technology of educators. Rather, it focused only on the competencies of Eastern Libyan educators in the use of technology in the classroom. The study included Libyan educators from both technical and nontechnical disciplines to determine if these educators differed in technological

competencies and gathered information that could help guide the process of integrating technology into Libyan higher education.

Purpose of the Study

The primary purpose of this quantitative survey research with limited qualitative data was to evaluate the implementation of technology into Libyan higher education from the educators' perspective using both a survey and some open-ended questions. The first research objective was to evaluate educators' competencies in using computer technology in four areas: basic computer operation, the use of application software, the use of internet, and the use of peripheral technologies. The justification for selecting these four areas was these areas formed the basis for the development and validation of an established competency survey developed by Yusuf and Balogun (2011). These four skill domains are the most common and essential operations that involve the use of computer software and hardware, Internet, and external devices that can be connected to computers (Yusuf & Balogun, 2011). This instrument was adapted slightly to reflect Libyan culture for use in this study. Participants' levels of knowledge in these four areas of competency were evaluated to formulate future workshops Libyan educators might provide.

Second, the researcher tested a Libyan stereotype that implied Libyan educator disciplines would influence the future integration of technology into Libyan higher education. Hence, this research determined if a difference existed in levels of competency between educators who majored in technical areas and those who majored in nontechnical disciplines. This comparison provided rudimentary data, indicating a relative need for special efforts in particular educational areas or standardized efforts

across all disciplines with regard to integrating educational technology. All participants were Libyan educators who worked at the main universities in Eastern Libya (Benghazi and Omer Al-Moktar). The purview of this study of technology integration included computer hardware and software, Internet usage, and other peripheral equipment that could be connected to computers, e.g., printers and cameras.

Research Questions

The following research questions guided this study:

- Q1 Does the skill level of Libyan educators differ across the four competency areas of basic computer operation and issues, use of application software, use of the internet, and use of peripheral technologies as measured by a self-report instrument?
- Q2 Do the competency levels of Libyan educators who specialize in a technical discipline differ from competency levels of those who specialize in a nontechnical discipline in the areas of basic computer operation and issues, use of application software, use of the internet, and use of peripheral technologies as measured by a self-report survey?

Rationale of the Study

Technology plays an important role in our daily lives and has changed the manner in which we receive and react to information. The use of technology has increasingly and exponentially affected worldwide interaction and communication. Its role in education has challenged traditional learning where teachers control the learning process and students merely receive information. Technology enhances learning through engagement, collaboration, feedback and interaction; it bridges the context to real experiences. Technology also expands what students learn (Roschelle, Pea, Hoadley, Gordin, & Means, 2000).

Although technology has become commonly used in classrooms around the world, Libya is still technologically far behind other countries because it continues to use a traditional classroom model--a teacher-focused lecture style where students listen and take notes (Rhema et al., 2013). Therefore, this study sought to persuade educators, administrators, and policy makers in Libya to integrate technology into higher education. This task was not an insurmountable undertaking as this study was guided by Creswell (2012) through a logical sequence of manageable pieces of research providing educators, administrators, and policy makers with a rigorous plan.

Significance of the Study

To the best of this researcher's knowledge, no published research has investigated the integration of technology in Libya at Benghazi and Omer Al-Moktar Universities. The current study is the first to be conducted in the Eastern Libya geographic area. Assessing current educators' competencies in using computer technologies could provide needed information for creating professional development workshops to train educators and prepare them to use classroom technologies.

In addition, the findings of this study provide Libyan policy makers and administrators with initial data that might influence their decisions regarding the integration of technology into Libyan higher education. Specifically, the results might assist administrators in constructing a preliminary vision for integrating technology into Libyan higher education classrooms based on current educators' relative levels of competency in using classroom technology. Data also indicated whether or not technical and nontechnical academic areas required the same or different amounts of effort and focus in training and implementation efforts. Finally, this study promotes and increases

the awareness of participants about the importance of technology use in their classrooms. Participants were provided with an opportunity to evaluate their own competency in the use of computer technology and to participate in rebuilding their country's educational system.

Due to the lack of research in Libyan higher education in general and integrating technology into Libyan higher education in particular, this research provided a method that guided Libyan researchers in other topics. Studies using the same instrument add to the comparative value of studies in the presented topic.

Theoretical Foundation

The theoretical framework that formed the foundation of this research came from Rogers's (2003) diffusion of innovations theory, which investigated the processes and decisions around the adoption of innovations, particularly in higher education environments (Sahin, 2006). Rogers (2003) used the terms *innovation* and *technology* as synonyms and many studies have been conducted that involve technological innovations (Sahin, 2006). As Rogers (2003) stated, "A technology is a design for instrumental action that reduces the uncertainty in the cause-effect relationships involved in achieving a desired outcome" (p. 13). Technology consists of two parts: hardware and software. Whereas hardware is "the tool that embodies the technology in the form of a material or physical object," software is "the information base for the tool" (Rogers, 2003, p. 259). In the case of integrating technology into Libyan higher education when these two parts are newly presented in classrooms in creating a transfer from the traditional approach of teaching and learning to a technological one, the adaptation process will be quite slow (Sahin, 2006) for both students and educators.

Rogers (2003) defined the innovation-diffusion process as an “uncertainty reduction process,” which basically means this process will assist in predicting whether individuals adopt or reject an innovation (p. 232). He described the process typically as proceeding in five ordered stages: knowledge, persuasion, decision, implementation, and conformation. Rogers’s framework established a foundation for this research and helped create a comprehensive framework for future researchers to use as they advance the diffusion of technology into Libyan higher education. This research particularly focused on the first phase—knowledge—in order to establish a baseline of technical skill levels among Libyan educators, thus providing a foundation of knowledge for future research directed at the integration of technology into Libyan higher education.

Various conditions prior to the knowledge phase include previous practices, needs or problems, and norms of the social system where the innovation is to be integrated. In the knowledge phase, an individual learns about the innovation and seeks information about it. The knowledge phase is considered as a primary, critical phase in the innovation-decision-process (Rogers, 2003) because when integrating technology into classrooms, the biggest barrier to educators’ use of technology in teaching is their lack of knowledge of how and why to integrate technology in the classroom (Sprague, Kopfman, & Levante Dorsey, 1998). Hence, to facilitate the adoption of an innovation, an individual should have a sufficient level of how to use the innovation prior to the trial of the innovation (Sahin, 2006). The current objective of this study focused on the knowledge stage of the innovation-diffusion process, providing a useful base of information for the future work of this researcher and other Libyan researchers interested in integrating technology into Libyan higher education.

In the second phase (persuasion), individuals form an attitude after they know about the innovation. In the third phase (the decision), an individual decides whether to adopt or reject the innovation. In the fourth stage (implementation), the innovation is put into practice and in the last stage (confirmation), the individual looks for support for his or her decision. Before the implementation and conformation stages of the diffusion of technology into Libyan higher education classrooms take place, the knowledge stage that answers the questions about “what the innovation is and why and how it works” (Rogers, 2003 p. 12) needs to be accomplished through investigating educators’ current skill status, learning needs, and problems. This research investigated the knowledge phase of Rogers’s (2003) model by evaluating educators’ current competencies in the use of computer technology for educational purposes.

Definition of Terms

Numerous technical terms are commonly used in the field of educational technology and are defined as follows:

Competency. A cluster of skills and knowledge that enables an individual to perform a task that “can be measured against well-accepted standards, and that can be improved via training and development” (Parry, 1996, p. 50).

Computer technology. For the purposes of this study, computer technology refers to advanced and peripheral technologies such as the Internet and common software applications that can be used for the purpose of education in classrooms to ease the communication between educators and their students and provide various resources and material.

Educator. A person who provides instruction or education. In this study, an educator is defined as a teacher who teaches students in higher education.

Non-technically oriented discipline in Libya. Any discipline not related to vocational or technical curriculum. In the context of this study, nontechnical disciplines include arts, law, and education (called social sciences in the United States).

Technically oriented discipline in Libya. Any discipline related to vocational or technical curriculum. In the context of this study, technical disciplines included engineering, science, and economics with the exclusion of information technology disciplines such as computer science, computer engineering, and computer information systems.

Technology. “A distinctive phenomenon referring to the use of knowledge, materials, tools, techniques, systems, and sources of power to make life easier and better and to work more productively and efficiently” (Cemalettin, 2006, p. 15).

Technology integration. Full implementation of computers, applications, Internet, and other technologies (e.g., projectors, printers, and so on) for education within and beyond classrooms.

Traditional instruction. An instructional environment where classroom furniture is arranged into rows of desks or chairs facing a chalkboard and teacher talk overrides student talk (Cuban, 1993).

Summary

Compared to worldwide institutions of higher education, Libya primarily relies on traditional instructional methods of lecture by instructors and a more passive reception of knowledge by students. Libya desperately needs to improve its educational system,

incorporate technology to overcome drawbacks to the traditional education model, and compete successfully in today's world. Therefore, this study attempted to understand how the integration of classroom technology could best be undertaken to support improvements in higher education in Libya.

Chapter II provides detailed information about Libya and its education system. The theoretical foundation for this work is also discussed in detail. Chapter III describes the methodology as it relates to the survey design, participants, sampling methods, instruments used, research procedures, and steps in data analysis. Chapter IV presents the data analysis and results and Chapter V provides a discussion of the study's findings, implications for administrators and policy makers, limitations of the study, and recommendations for future research.

CHAPTER II

LITERATURE REVIEW

Today, technology plays an important role in our daily living and has changed the manner in which we receive and use information. For example, digital, audio, and visual media have replaced many traditional teaching methods such as lecturing. The role of technology in instructional methods is to simplify complex content, provide resources other than printed text via the Internet, reduce teachers' efforts, and provide more learning options for students.

Even though computer applications and Web content are more user-friendly, users still need to be skilled to utilize these resources to gain information from local and global communities efficiently. Particularly, today's educators are required to be skilled in using computer applications and in navigating through the Internet. Furthermore, they are required to learn the use of computer skills quickly as instructional technologies grow and change rapidly. Competency in using technology is important for educators across all basic disciplines; thus, technological competence should be widely established among elementary, secondary, and high school teachers coming from different backgrounds including biology, mathematics, English, and social science studies (Rogers, 2000).

Educators in developing countries where traditional instruction is the most common approach used for instruction have greater difficulty than educators in advanced

countries in changing the way they teach. Traditional educators need to learn new skills to effectively integrate advanced technologies such as computers and the Internet into teaching instead of using outdated chalk and blackboards. Libya is a developing country that faces this specific difficulty because technology use in universities for education is limited. Therefore, the purpose of this study was to explore existing competencies of Libyan educators in the use of current technology as these competencies relate to long-term efforts directed at integrating technology into Libyan higher education.

This chapter discusses literature related to the problem this study addressed—Libya is still using traditional instruction processes (Cuban, 1993) in today's technological world. The first section discusses the need to use advanced computer technology for education. The second section defines competencies in the use of computer technology for the purposes of this study. The third section explains Rogers's (2003) diffusion of innovation model, which served as the theoretical foundation for investigating the issue of integrating technology into Libyan higher education. The fourth section discusses technology-related research based on Rogers's model. The fifth section provides information pertaining to Libya, its education system, and the challenges related to integrating technology into Libyan higher education. The last section presents information regarding the implementation of technology in technical and nontechnical disciplines.

The Need to Use Technology in Teaching and Learning

Most of us have experienced classroom-based traditional instruction where teachers conduct direct instruction consisting of a sequence of lectures. Teachers are the

decision makers regarding curricula and learning outcomes; they control the entire learning environment. In such an environment, students play the role of knowledge buckets into which information is poured. In other words, in a traditional instruction environment, teachers are the main influence in learning, the individual needs of students are ignored, and the development of problem solving and other higher order intellectual skills is neglected. Also, the traditional instruction approach requires long class periods to cover material adequately and for learners to digest extensive information. Since classroom time is limited and students have different skills and abilities within the same classroom, teachers might have difficulty delivering lesson content tailored to different students' needs (Cuban, 1993; Hannum & Briggs, 1982).

Technology has begun to overcome obstacles that emerged with the traditional approach to education. Many debates recently emerged considering whether or not technology (media) influenced learning. From the perspective of some researchers, media modalities are mere vehicles for delivering instructions to students and do not affect their learning (Clark, 1994). On the other hand, if we merely consider technology as a vehicle, we will never understand its relationship with learning. One argument is there is no reason to invent educational technology if there is no relationship between technology and learning (Kozma, 1994). If so, why are technologies integrated and accessed by people in offices, classrooms, and living rooms all over the world (Kozma, 1994)? As such, the learning influences of modern technology are infinite.

Recently, universities and schools have had many opportunities to ensure their faculty members and students are fully equipped in the use of technology. These demands emerged after research indicated computer technology could be a motivational

tool to help students become armed with high levels of analytical skill, critical thinking ability, and creativity (Roschelle et al., 2000). Interestingly, cognitive research shows effective learning can be achieved through participation among groups, active engagement, interaction and feedback, and real-world communication (Roschelle et al., 2000). Cognitive research also illustrated that expanding what students learn could occur by varying options of educational resources available (Roschelle et al., 2000). These goals could be reached through the use of technology. The following subsections discuss how technology could be used to improve learning outcomes.

Enhancing Learning through Engagement

Roschelle et al. (2000) asserted the traditional method of learning of using lectures and texts compels students to be passive; it fails to connect their understanding to thinking outside of the classroom. Numerous learning studies have been conducted, indicating that to enhance learning, more attention should be focused on actively engaging students in learning activities. The role of technology is to fill this learning gap as it offers many ways to guide students' learning. Applications such as PowerPoint and videos assist students in creating presentations that reflect their understanding of a specific topic. For example, in a project for American high school students, two groups of students were asked to participate in a "multimedia designers" competition and create an electronic yearbook to share with their children's museum. The results of the study indicated students from classes who used computer applications were more motivated, demonstrated more task engagement, and were more confident in their designs than

students who learned in more traditional noncomputer classrooms (Roschelle et al., 2000).

When technology is integrated, educators establish and present content that is relevant and interesting to students. Students become more engaged and active learners when the learning content is relevant to them. How is this going to happen? With the increased intensity of accessing learning resources, tools, and information, students are pulled deeper into the discussion topic and become able to direct their own learning. Through the power of technology, variations in lessons and practices can be accomplished easier, resulting in increased student engagement. Some examples of instructional methods that use technology to increase students engagement can be (a) using visual displays, particularly for constructing, comparing, demonstrating and analyzing; (b) creating opportunities where students have options about how they interact with content; (c) allowing for opportunities to work jointly on an activity both within the classroom and across classrooms, institutions, or the world; (d) connecting students with experts from across the globe; and (e) using up-to-date real-world problems, information, and news in teaching and learning (Peterson-DeLuca, 2014).

Enhancing Learning through Collaboration

Collaboration is a well-known practice at all levels of education (Strijbos, 2016). It can be defined as “a learning phenomenon where individuals in a social constellation (e.g., group, team, or community) within a physical or virtual environment interact on the same or different aspects” in order to accomplish explicit or implicit individual or group learning goals (Strijbos, 2016, p. 302). Technology has proven its power for use as a

social instrument for learning. It has been studied intensively in both recent research (because of the spread of technology use and availability) and in numerous studies conducted many years ago to determine its role in learning (Strijbos, 2016).

For instance, Roschelle et al. (2000) stated learning in a social context provides students with an opportunity to solve complex problems more effectively than when they relied on solving these problems individually. The conversations among learners and the use of gestures allow a deeper and more accurate understanding of subjects. For instance, networking technologies such as videos, online and offline discussion rooms, and other Internet resources permit learners to share their knowledge from different regions around the world (Roschelle et al., 2000).

A study examining such networking technologies was conducted in the United States to investigate students' collaborative production of writing (Roschelle et al., 2000). During this study, many classrooms in different countries were merged using the Internet. The results revealed students were more motivated to discuss and share their opinions through online communication than when they enrolled in an actual face-to-face classroom. The authors suggested this type of communication was successful because classroom time was not restricted by physical walls. In addition, the project incorporated students from many different nationalities, which allowed them to share knowledge from the perspectives of different cultures (Roschelle et al., 2000).

Enhancing Learning through Feedback and Interaction

In traditional classrooms, students have minimal time to interact with the required material and must wait to receive feedback from their teachers. Research provides

consistent evidence that learning happens through receiving direct feedback (Skinner, 1984). If feedback is immediate, it shows students how well they are performing tasks; thus, they can either be encouraged to proceed if they are doing well or notified they are performing incorrectly. Hence, they can obtain a clearer understanding of subject matter and determine how to correct misunderstandings in real time.

Technology is an effective tool for providing immediate feedback, especially in large classrooms where it becomes difficult for teachers to track every student's performance. Moreover, in specific majors such as math and science that require students to practice many and various problems, Zhang, Trussell, Gallegos, and Asam (2015) found student learning from the Splash Math app allowed them to make more than one attempt to practice problem sets and receive corrections, "which was unlikely to occur in a paper and pencil condition" (p. 38).

Another example illustrating how students could be provided with immediate feedback is using software whereby students can create interactive graphs and receive immediate feedback when they change the parameters in a mathematical model. This immediate feedback enhances student learning because it would take a long time to recognize the variations between the graphs if the same students had to graph each parameter by hand. Moreover, teachers could use software applications to track and analyze students' performance over time and receive an immediate report of student evaluations and assessments (Roschelle et al., 2000).

Enhancing Learning through Bridging Context to the Real World

Roschelle et al. (2000) stated the most common problem in learning in the 20th century, and it still exists currently (21st century), is transferring what students learn from their textbooks to solving real-world problems. In fact, problem-solving assignments used in traditional learning provide students with a vast number of real problems but do not help in transference because most of them can be solved immediately using class materials. Injecting technology into the transference process—acquiring the skill to extend what has been learned in one context to other contexts—assists learners to understand the main concepts of a problem instead of memorizing solutions and facts (Byrnes, 2001). Technology provides an invaluable repository of data and a vast quantity of real problems students might encounter in their real lives and students can use technologically generated problems to practice applying the knowledge they have acquired through instructions (Harasim, 2012). Technology also provides students with tangible results, affirming for them that learning occurs by doing (Kolb, 1984).

A good example of connecting students' knowledge to the real world is the Global Learning and Observation to Benefit the Environment (GLOBE) program (cited in Roschelle et al., 2000). This program was begun in 1992 by Vice President Al Gore as an aid to help students learn science. The notion of GLOBE is to assist students in learning about the environment while they monitor it. Students are motivated to be engaged in learning because they deal with real research, and they use technology for the purpose of organizing and analyzing their data. In addition, they feel their data are valuable for the entire community (Roschelle et al., 2000).

Expanding What Students Learn

Besides being a tool to assist in motivating students to learn, technology can also expand what students learn within the walls of the classroom. By using computers and the Internet, students have an opportunity to access multiple resources such as links, simulations, web definitions and translators, articles, blogs, and the like. These resources can compensate for what students could not grasp and what teachers could not cover during class time (Roschelle et al., 2000). In addition, with the rapid growth of technology and with its affordable prices for many students around the world, students can use their iPads, cellphones, and other smart technologies during class time to expand their understanding.

It is essential to recognize that using the Internet “is an add-on that complements the existing curriculum” (Harasim, 2012, p. 28). Internet access provides students with online activities that do not replace traditional methods or provide a significant part of the course grade. Online activities are used to enhance or expand activities inside classrooms, providing opportunities such as reading more examples, taking more quizzes, discussing with peers, and watching videos related to the discussed topic (Harasim, 2012).

Competency in the Use of Computer Technology

Currently, competence in the use of technology plays a significant role in higher education because the rapid growth of technology worldwide requires educators to be skilled in the use of computer technology in order to teach successfully in the 21st century. Faculty members are role models for prospective teachers; their attitudes toward

and use of technology for education might influence how future teachers integrate technology into instruction in their profession (Rogers, 2000).

In our technological world, educators need to be knowledgeable about advanced technologies such as the use of computers and the Internet. This knowledge includes being skillful or competent in operating digital technologies that ease communication, assist in student grading, maintain class attendance, and keep students' records. In general, these competencies or skills include the ability to operate computer hardware and to use software tools such as spreadsheets, word processors, e-mail, Internet browsers, and authoring software, meaning "toolkits, systems, or shells that can be used by nonprogramming authors to develop an educational Adaptive Hypermedia Software" (Brusilovsky, 2003, p. 392). Important competencies also include creating and archiving documents, installing and removing peripheral devices, and installing and uninstalling software programs (Mishra & Koehler, 2006).

In addition to computer competencies, educators need to be competent in the use of advanced digital technologies that assist in improving the delivery of the subject matter they teach including being able to differentiate the tools used for specific tasks and the ability to apply educational strategies with available technologies. For instance, educators need to be able to use tools for running discussion boards and chatting (Mishra & Koehler, 2006) where students are given a task and access to online resources to accomplish their task via online discussion.

Despite numerous advantages offered by advanced software tools, a key issue related to most of the software tools currently available was they were not produced specifically for classroom needs; rather, they were initially created to solve problems in

the business sector (Zhao, 2003). Therefore, transforming these tools for classroom use will not be effortless (Mishra & Koehler, 2006). The process of transformation requires educators to be aware of the available technologies, be skilled in their use, and be creative enough to tailor a specific tool to a specific educational goal within a specific content area (Mishra & Koehler, 2006).

As stated by Rogers (2000), competency in the use of technology across all disciplines and worldwide universities should not rely solely on how much the integrated technology costs in terms of dollars and the availability of contemporary computers at educators' desks. Integrating technology into higher education requires universities to develop cohesive training programs or workshops that assist faculty members' learning about advanced digital technology. Moreover, universities will be required to provide educators with knowledge on how to obtain the most effective "mix of the best of the old and the best of the new" teaching methods in parallel with "just in time" technical support (Rogers, 2000, p. 19). Training should not be focused only on technical matters; it must also give priority to explaining learning theories and to the learning styles of individual students. The combination of applying learning theories and technical skills will help the paradigm shift to sail from the teaching to learning harbor with less difficulty (Rogers, 2000).

Theoretical Foundation

This research is based on Rogers's (2003) diffusion of innovation model (see Figure 1). Rogers's model is a theoretical framework widely used in the area of technology diffusion and has been adapted for use mainly in the higher education sector in different disciplines including economics and education (Dooley, 1999).

“Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 1983, p. 5). Rogers (2003) considered innovation, communication channels, time, and social systems as the four main elements of the model. Furthermore, the model included the innovation-decision process consisting of the knowledge, persuasion, decision, implementation, and confirmation stages. The attributes of innovations, rate of adoption, and adopter categories are also included in Rogers’s (2003) model. All of the components of the model are described in detail in the following sections.

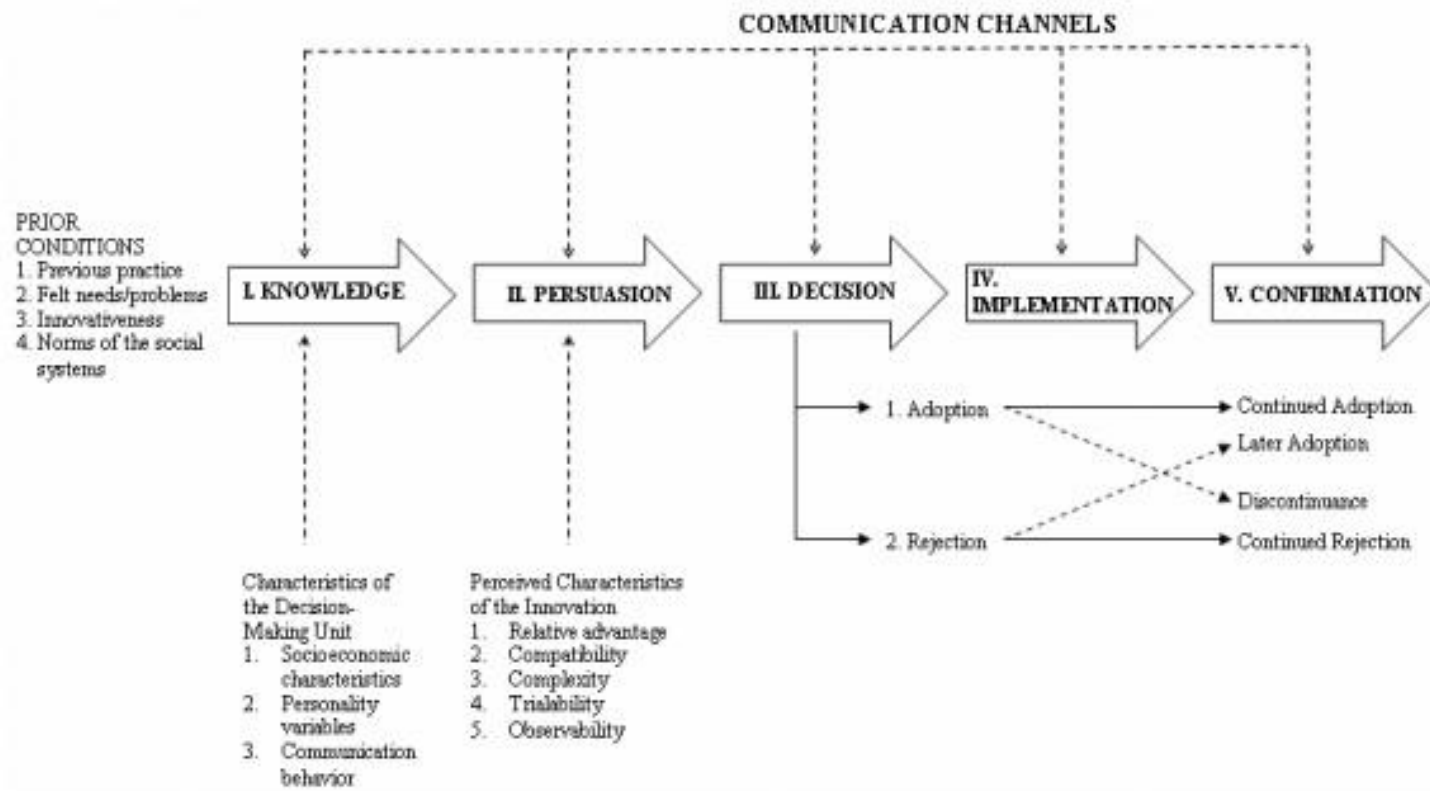


Figure 1. Diffusion of innovation model (Source: Diffusion of Innovation, Fifth edition by Everett M. Rogers. Copyright © 2003 by the Free Press. Printed with permission pending of the Free Press: A Division of Simon & Schuster.

Main Elements in the Diffusion of Innovation Model

Innovation. “An innovation is an idea, a practice or project that is perceived as new by an individual or other units of adoption” (Rogers, 2003, p. 12). Rogers (2003) used the term *innovation* and the term *technology* as synonyms. An innovation might have been invented a long time ago but if it is presented to individuals as a new tool, it is still an innovation for them. It should not be anticipated that the diffusion and adoption of all innovations is desirable. The same innovation might be desirable for one individual in a specific situation but undesirable for another individual in a different situation. For instance, “mechanical tomato pickers have been adopted rapidly by large commercial farmers in California, but these machines were too expensive for small-sized tomato growers, and thousands have thus been forced out of tomato production” (Rogers, 1983, p. 12). Consequently, a technological innovation could produce uncertainty for individuals or users in either adapting or rejecting the new technology when it is presented. Hence, to reduce the uncertainty of technology adoption, individuals need to be informed about the advantages and disadvantages of the innovation (Rogers, 2003).

Moreover, innovations have consequences that are the “changes that occur to an individual or to a social system as a result of the adoption or rejection of an innovation” (Rogers, 2003, p. 436). The consequences of innovations are classified into three types: (a) desirable versus undesirable consequences, depending on whether the effects of an innovation in a social system are functional (practical) or dysfunctional; (b) direct versus indirect consequences, depending on whether the changes to a social system or an individual happen as an immediate result of the innovation or as an intermediate result;

and (c) anticipated versus unanticipated consequences, depending on whether the changes are recognized by the members of the social system or not (Rogers, 2003).

Communication channels. “Communication is a process in which participants create and share information with one another in order to reach a mutual understanding” (Rogers, 2003, p. 5). This basically means a message conveyed from one individual to another. Rogers (2003) considered mass media as the most effective channel for establishing knowledge of innovations; whereas interpersonal channels are more powerful channels in shaping and changing attitudes about a new innovation, influencing the decision to adopt or reject the new innovation.

Most individuals evaluate innovations based on the opinion of a “near-peer” who has adopted the innovation. Therefore, distinctive aspects are presented in the diffusion of innovation called heterophily and homophily. Heterophily “is the degree to which pairs of individuals who interact are different in certain attributes, such as beliefs, education, social status, and the like,” whereas homophily “is the degree pairs of individuals who interact are similar in certain attributes” (Rogers, 2003, p. 19). Since most of human communication happens when individuals are homophilous, securing effective communication is often reachable through homophily in the diffusion of innovation.

Time. Rogers (2003) claimed the time aspect has been given less attention in most behavioral science research than other issues. He mentioned time does not exist independently of events; it is an element of every activity. The time dimension is involved in the innovation-decision process by which an individual passes into the adoption or rejection of an innovation from the initial knowledge of the innovation. The

time element is also involved in categorizing the members of the social system into innovators, early adopters, early majority, late majority, and laggards. Moreover, time plays an important role in rating the adoption of an innovation in a system. Adoption rate is usually measured by the number of members in a given system that adopt the innovation in a specific period. These aspects of Rogers's model are discussed later in detail.

Social system. "A social system is a set of interrelated units that are engaged in joint problem solving to accomplish a common goal" (Rogers, 2003, p. 23). As Rogers (2003) mentioned, the members or units of a social system can be individuals, organizations, informal groups, or subsystems. The social system shapes a boundary in which the innovation is diffused. Because individuals are influenced by their characteristics and by the nature of the social system, Rogers claimed members of a given social system need to be categorized into different types of adopters. Adopter categorization by Rogers is discussed later.

Innovation-Decision Process

The knowledge phase. The innovation-decision process starts with the knowledge phase. In this phase, an individual learns about an innovation and information regarding its existence; they seek to answer the questions of "what the innovation is and why and how it works" (Rogers, 2003, p. 21). As stated by Rogers (2003), these questions shape three types of knowledge: awareness-knowledge, how-to-knowledge, and principles-knowledge.

Through awareness-knowledge, an individual learns more about an innovation. Through how-to-knowledge, an individual learns how to use an innovation correctly.

Educators who have a technical background may not use technology in their teaching if they do not know how to use it correctly (Sahin, 2006). Therefore, educators need assistance in how to effectively use technology in the teaching process (Johnson, Adams Becker, Estrada, & Freeman, 2015). Rogers (2003) considered how-to-knowledge as a primary factor in the innovation-decision-process. “To increase the adoption chance of an innovation, an individual should have a sufficient level of how-to-knowledge prior to the trial of the innovation” (Sahin, 2006, p. 16). Principle-knowledge encompasses functioning principles that describe why an innovation operates. If an innovation is adopted without knowledge or skill in using it, the misuse results in discontinuance of the innovation (Sahin, 2006).

The persuasion phase. Individuals might possess all of the knowledge in the how and why of using a specific innovation but they might not adopt this innovation because their attitudes influence their decision to either adopt or reject it (Sahin, 2006). This phase follows the knowledge stage because individuals cannot shape their attitudes toward an innovation if they do not know about the innovation and how to use it (Rogers, 2003). Furthermore, Rogers (2003) asserted individual opinions and beliefs about a specific innovation or technology are more likely to be influenced by colleagues or peers. For example, in education, “while information about a new innovation is usually available from outside experts and specific evaluations, teachers usually seek it from trusted friends and colleagues whose subjective opinions of a new innovation are most convincing” (Sherry, 1997, p. 70).

The decision phase. Individuals continue the innovation evaluation process in order to select whether to adopt or reject the new innovation. In simple words, this stage

leads to “adoption, a decision to make full use of an innovation as the best course of action available” or to “rejection, a decision not to adopt an innovation” (Rogers, 2003, p. 177). If individuals have an opportunity to try an innovation on their own, they come to the adoption decision, which, in turn, speeds up the innovation-decision process (Sahin, 2006). Rejection, on the other hand, can be an active or passive process (Rogers, 2003). In an active rejection, individuals try an innovation and think about adopting it, but later they decide not to adopt it. In a passive rejection, individuals do not consider adopting the innovation at all (Rogers, 2003).

The implementation phase. During this phase, an innovation is used by individuals who need technical assistance from experts to reduce uncertainty about the consequences. The innovation-decision process ends in this phase because “the innovation loses its distinctive quality as the separate identity of the new idea disappears” (Rogers, 2003, p. 180).

The confirmation stage. During this stage, the innovation-decision is already made and individuals look for information that supports their decision. Depending on the amount of support individuals obtain for adopting an innovation and their attitudes toward the new innovation, discontinuing the adoption of an innovation might occur in this stage. Discontinues can be “replacement discontinues,” where an individual discontinues adopting the innovation and replaces it with a better one, or it can be “disenchantment discontinues,” where an individual rejects an innovation because of its poor performance or because it does not meet desired needs (Rogers, 2003).

Attributes of Innovation and Rate of Adoption

Rogers (2003) defined the innovation-decision process as “an uncertainty reduction process” (p. 232) and he considered the following attributes of an innovation to be the tools used to decrease the uncertainty of innovation: relative advantage, compatibility, complexity, trialability, and observability. “Individuals’ perceptions of these characteristics predict the rate of adoption of an innovation” (Rogers, 2003, p. 219). The rate of adoption is measured by the length of time needed for a specific percentage of the members of a system to adopt an innovation (Rogers, 2003). Communication channels and social systems, in addition to the attributes of an innovation, might assist in predicting the adoption rate of an innovation (Rogers, 2003). The attributes of an innovation are described in detail as follows:

Relative advantage. Relative advantage refers to the extent to which individuals think the innovation is preferable to the traditional approach it supersedes (Rogers, 2003).

Compatibility. Compatibility means the extent to which individuals find the innovation is compatible with the traditional approach it supersedes (Rogers, 2003). If an innovation is compatible with individuals’ needs, the uncertainty will be decreased and the rate of adoption of the innovation will increase (Rogers, 2003).

Complexity. Complexity refers to the extent to which individuals find the innovation difficult to use and understand. If an innovation (computer technology including its hardware and software) is user friendly, uncertainty will decrease and the rate of adoption of innovation will increase (Rogers, 2003).

Trialability. Trialability refers to the extent to which individuals think there are opportunities for the innovation to be experienced before deciding whether or not to adopt it. The more an innovation is tried, the quicker individuals adopt it (Rogers, 2003).

Observability. Observability refers to the extent to which the outcomes of an innovation are visible to others. The more the change made by an innovation is visible to individuals, the quicker individuals adopt it (Rogers, 2003).

Adopter Category

Adopter category is “the classification of members of a social system on the basis of innovativeness” (Rogers, 2003, p. 22). This classification includes innovators, early adopters, early majority, late majority, and laggards. Innovators are gatekeepers who bring the innovation in from outside of the social system. Furthermore, innovators are willing to take the risk and experience the consequences of the innovation. Early adopters are more likely to be leaders within the social system than innovators and provide the information to other members about the innovation. Therefore, early adopters’ attitudes toward the new innovation are essential and play an important role in decreasing uncertainty about the innovation in the diffusion process.

Early majority members do not have as much leadership as early adopters but are still able to influence the other members in the social system. They take a longer time to adapt to the new innovation than innovators and early adopters. The late majority includes one-third of all members of a given social system; they are doubtful about the innovation and its value in terms of outcomes. Hence, pressure and persuasion from other members assist them in adopting the innovation. Finally, laggards do not have a leadership role in the social system. They do not adopt the innovation until they see the

successful adoption of the innovation by the other members. Therefore, their decision-making process about adopting the innovation is relatively long (Rogers, 2003).

Technology-Related Research Based on Rogers' Model

Rogers's (cited in Aharony & Shonfeld, 2015) diffusion of innovations model has been used as a theoretical framework to analyze the adoption of technology in education. Numerous researchers have advocated Rogers's theory as being the most appropriate for investigating the adoption of technology in higher education (Aharony & Shonfeld, 2015; Blankenship, 1998; Bowers, Ragas, & Neely, 2009; Buabeng-Andoh, 2012; Carter, 1998; Less, 2003; Medlin, 2001; Ntemana & Olatokun, 2012). The innovation diffusion framework is used to describe the rate at which people adopt an innovation to focus on the reasons that lead people to adopt or reject an innovation or to guide the process of integration of technological innovation related to basic computer applications or advanced computer technologies such as simulations or virtual worlds in higher education.

Libya has not used basic computer applications in its educational system and is still too far behind to use advanced technologies related to Information Communication Technology (ICT; Rhema et al., 2013). Therefore, this study focused specifically on the knowledge stage of the innovation-decision process of Rogers's (2003) framework in examining prior knowledge by evaluating Libyan educators' knowledge or skills of basic computer use in classrooms. Information gathered from this stage could be used to create appropriate workshops that ensure all educators have the necessary computer technology skills for use in their classrooms. The remainder of this section presents several studies illustrating the use of Rogers's diffusion of innovation theory.

Carter (1998) explored the status of the diffusion and adoption of computer-based technologies in 33 Appalachian College Association universities and schools using Rogers's (1995) diffusion of innovation theory--an earlier version of the framework. The researcher used computer surveys and in-depth interviews to identify computer-based technologies being used by the educators. Furthermore, the study defined factors that influence educators' use of these technologies. Educators' attitudes toward using computer-based technology, available support and resources, and training or professional development workshops were named as factors needed to use these technologies effectively. Carter also found word processing software, e-mail, and Internet resources were the most frequently used computer-based technologies.

Rogers's (1995) diffusion theory has been used to investigate factors influencing the use of computers in teaching. For instance, Blankenship (1998) conducted both qualitative and quantitative research in Carroll County (Virginia) public schools and used Rogers's diffusion theory to explore factors related to computer use by teachers in classroom instruction. In this study, 233 teachers were surveyed for the quantitative part as well as five focus groups with four to six teachers. Factors including teachers' attitude toward computers, teachers' access to computers, training provided to teachers in computer use, available support for teachers' computer use, age of the teacher, grade level a teacher taught, curriculum area in which a teacher taught, gender of the teacher, and teaching expertise were used to predict computer use by teachers in classroom instruction. The main outcomes of the study indicated that attitude, support, access, and age were statistically significant predictors of computer use in classroom instruction. Grade level and curriculum area must be considered for successful and effective training,

and teachers need to be knowledgeable and skillful in the use of technology in their teaching. Blankenship (1998) recommended computer training, technical support, and the availability of computer labs in every building of an organization or university as essential strategies that influenced teachers' use of computer technology in the classroom.

In addition to Blankenship's (1998) study, Medlin (2001) used Rogers's (1995) diffusion of innovations theory as a framework to examine particular factors that might influence an educator's motivation and decision to adopt new electronic technologies in classroom instruction. The study was conducted in North Carolina via a mail survey of 45 educators who taught an introductory accounting class at 12 public institutions of higher education. The researcher classified the findings into three groups: social, organizational, and personal motivational factors. Social factors included friends, mentors, peer support, and students; these factors were found to be significant predictors affecting educators' decisions to adopt electronic technologies in the classroom. Organizational variables such as physical resource support and authorization from the university were statistically significant predictors of the educators' use of electronic technologies in the classroom. "Personal interest in instructional technology," "personal interest in improvement in my teaching," and "personal interest in enhancing student learning" were stated as the personal motivational factors that affected an educator's decision to adopt instructional technologies. Medlin concluded social, organizational, and personal motivational factors needed to be considered when developing an appropriate environment in which to incorporate technology into higher education.

The classification of technology users in Rogers's (1995) framework has also been applied to investigate factors that affected the use of technology in teaching. For

example, Less (2003) conducted a causal-comparative research design and used Rogers's classification of users on a continuum from Innovators to Laggards. Less investigated full-time educators' adoption of computer technology for instruction at 58 institutions for a total of 4,203 educators throughout the North Carolina Community College system. Less categorized the educators based on Rogers's five categories of innovation adoption and compared them based on the demographic variables of age, gender, race/ethnicity, teaching experience, and highest degree attained. Less concluded that while a significant relationship was obtained among Rogers's adopter categories and years of teaching experience and highest degree attained, the findings did not result in a significant difference among educator adopter categories and age, gender, and race/ethnicity. Furthermore, no significant differences were found in any of the five categories between faculty who used computer technology in instruction and those who did not across the demographic variables of age, gender, race/ethnicity, teaching experience, and highest degree attained. Educators who expressed using technology for instruction often used multiple techniques such as e-mail to make contact with students, "posting assignments and other information on course websites, and using course management software for recordkeeping functions" (Less, 2003, p. 2).

In addition to Less's (2003) study, Bowers et al. (2009) used Rogers's theory (2003) to investigate the value of Second Life as an educational tool among post-secondary educators. Using Rogers's diffusion of innovations as the theoretical framework, participants who answered a questionnaire were classified into three adopter categories: innovators, early adopters, and the early majority based on the time they had spent using Second Life as an educational tool. The study included 160 educators who

were assessed on their satisfaction level with the new innovation across their category as well as on the factors influencing the adoption of Second Life as an educational tool. Participants were from 15 countries and 25 academic disciplines. The wide variety of nationalities and disciplines among the participants indicated the substantial potential this innovation had to be adopted across many different countries and in many disciplines. Personal interest factors such as “personal interest in improving my students’ learning,” “personal interest in instructional technology,” and “personal interest in improving my own teaching” were followed by “access to computer hardware and software” (p. 1427), rather than interpersonal communication factors “such as peer support, shared departmental values, or friends and students” (p. 1427), as most influential in the respondents’ decision to adopt Second Life as an educational tool.

Furthermore, Buabeng-Andoh (2012) conducted a review of the literature to identify factors influencing teachers’ adoption and integration of ICT. Buabeng-Andoh used Rogers’s (2003) definition of adoption. Personal, institutional, and technological factors were elements that encouraged teachers’ use of computer technology for education. On the personal level, teachers’ feelings, knowledge, and attitudes influenced their use of ICT in teaching. On the institutional level, support, funding, training, and facilities affected teachers’ adoption and integration of technology into their classrooms. On the technological level, teachers needed to believe the new technology was superior to past technology and new practices were “consistent with teachers’ existing values, past experiences and needs” (Buabeng-Andoh, 2012, p. 147). Ease of use could be investigated on “a limited basis before making a decision to adopt, and finally the results of the innovation are visible to others” (Buabeng-Andoh, 2012, p. 147). Factors found to

prevent teachers from using computer technology for teaching and learning purposes were “lack of teacher ICT skills; lack of teacher confidence; lack of pedagogical teacher training; lack of suitable educational software; limited access to ICT; rigid structure of traditional education systems; restrictive curricula, etc.” (Buabeng-Andoh, 2012, p. 136). Buabeng-Andoh suggested identifying the extent to which these obstacles influenced individuals and institutions in making a decision on how to defeat them.

The attributes of an innovation from Rogers’s (2003) theory have been used to investigate how they influenced educators’ use of technology. For example, a study conducted by Ntemana and Olatokun (2012) explored the influence of the five attributes of the diffusion of innovation theory (relative advantage, complexity, compatibility, trialability, and observability) on educators’ use of information and communication technologies. A structured questionnaire was used to collect data from 213 educators across seven faculties at the National University of Lesotho (NUL). The attributes of relative advantage, complexity, and observability were found to have a positive influence on the attitudes of educators toward using ICTs; observability had the highest influence. Ntemana and Olatokun recommended administrations need to establish appropriate training for educators and deploy user-friendly ICTs in order to promote diffusing the use of ICTs.

Additional research was conducted by Aharony and Shonfeld (2015) to explore what factors influenced student ICT use and web technology competence. One of the intentions of this study was to determine the extent to which certain elements of Rogers’s (2003) diffusion of innovations theory explained students’ ICT use. The survey study was conducted in Israel during the second semester of the 2013–2014 academic year with

110 participants from two groups: a group of Educational Technology students and a group of Library and Information Science students. Findings confirmed the importance of relative advantage and complexity as traits that affected students' ICT use. The more the users used ICT, "the more they believe it can enhance their ability and improve their efficiency"; whereas the more they "perceive ICT use as complex, difficult, or complicated, the less they use it" (Aharony & Shonfeld, 2015, p. 199).

In summary, Rogers's (2003) diffusion of innovation theory has been widely used in the higher education sector to elucidate how, why, and at what rate new ideas and technology spread. This framework is composed of different elements that influence the diffusion of technology: process, users, and the characteristics of innovation per se. With regard to integrating technology into Libyan higher education, the process explained in this theory was the theoretical framework for this research.

Libya

The Education System in Libya

Libya is an Arabic country located in the north of Africa. The country is bordered by the Mediterranean Sea and by Algeria and Tunisia on the West, Niger and Chad on the South, Egypt on the East, and Sudan on the Southeast. Different dialects of the Arabic language are spoken throughout different regions in Libya. In terms of area (658,000 square miles; El-Mehdawi, 1975), Libya is the fourth largest country in Africa and the 17th largest country in the world (Al-Hadad, 2015). Furthermore, it is the 11th largest oil producer in the world (Mashat, Ritchie, Lovatt, & Pratten, as cited in Al-Hadad, 2015). As stated by Al-Hadad (2015), its population was approximately six and a half million in 2010 and is approximately in the same range (6,273,203) based on figures from the

United Nations Department of Economic and Social Affairs: Population Division (2016). The observed religion in Libya is Islam whereby Libyans follow the five pillars of Islam that provide rules on how to live, pray, give of alms to the poor people, fast during Ramadan, and perform Hajj rules. Formal Arabic is the only language used in schools, business organizations, and by the government.

The educational system in Libya is free at all levels--from elementary to post-graduate levels either at home or abroad. This is accomplished by providing Libyan students with full scholarships to pursue their education (El Zoghbi et al., 2010). The Libyan Ministry of Education, located in the capital city of Tripoli (centralized system), has ultimate responsibility for all educational decisions in Libya. It shares its responsibility with the educational committees and higher education departments at all Libyan universities (El Zoghbi et al., 2010). Figure 2 is adapted from *No Niger Fighters in Libya* (2018) and modified to depict the map of Libya with the main universities included in the study--Benghazi and Omer Al-Moktar.

Bukhatowa et al. (2010) analyzed the education system in Libya using qualitative methodology as well as experimental and documentary analysis. These authors stated the education system in Libya has several educational stages (see Figure 3) and each stage has two semesters per year. The first level is the primary stage, which starts at the age of six. It is mandatory for the next six years. Children might have their education in public schools, private schools, or at home. Home schooling is administrated by the Ministry of Education, which provides free textbooks, required material, and financial support for parents. The second stage is preparatory school or middle school. It is mandatory, lasts for three years, and ends with the national exam; students at this stage cannot be home

schooled. At the third stage, students have various options: to attend high schools (general or specialized high schools), attend intermediate vocational centers, or attend a teacher training institution.



Figure 2. Map of the main universities in Eastern Libya. Adapted from *No Niger Fighters in Libya* (2018).

General high school has three optional areas of study for its students including arts, science, or technology. Specialized high school includes various areas: basic sciences, engineering and industrial sciences, medical sciences, agricultural sciences, social sciences, economics, fine arts, and media. General high schools and vocational centers last for three years, specialized high schools last for four years, and teacher

training institutions last for five years. The third stage is finalized with a national exam for all institutions. Depending on the type of institution students attend, successful graduates receive a general high school certificate or a diploma (Clark, 2004). Students who receive a high school certificate with satisfactorily high marks are able to advance to higher education (Bukhatowa et al., 2010). Libyan higher education is composed of various institutions that consist of public and private universities including an Open University, vocational institutions, qualifying institutes, petroleum training, and advanced technical institutions (Arabsheibani & Manfor, 2001). The undergraduate higher education system is financially supported by the government; however, students who attend private universities and the Open University need to pay the tuition and fees for their education (Bukhatowa et al., 2010).

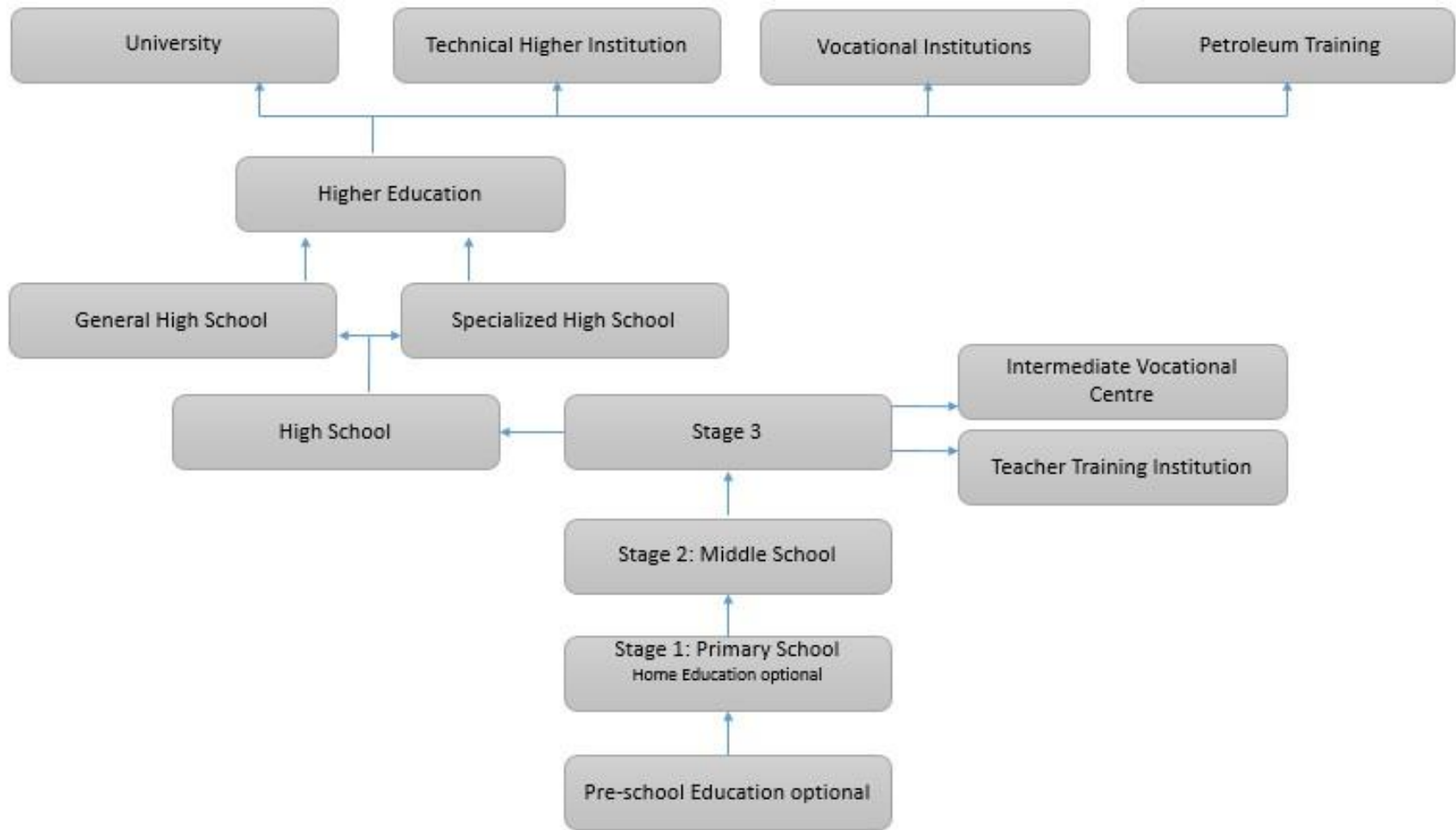


Figure 3. The structure of Libyan education system.

Benghazi University as the oldest university in Libya was established in Benghazi in 1951 (Bukhatowa et al., 2010). Omer-Almoktar University is also one of the main universities in Libya. Both universities have numerous campuses. Undergraduate courses require four to five years of full time attendance. Post-graduate studies are not free but they are subsidized by the government; these programs require two to three years attendance to earn a master's degree. Libyan universities provide a doctorate in three specific fields: Arabic, Islamic studies, and humanities. Doctoral programs have not yet been started in Libyan universities in the fields of science, engineering, and technology (Bukhatowa et al., 2010). Most Libyans earn their master's and doctoral degrees from international universities (Clark, 2004).

According to Clark (2004), the Open University was founded in 1990 in Tripoli, the capital city of Libya, and has 16 campuses throughout Libya that provide bachelor's degrees. Petroleum training students, employees, and qualifying institute trainees within the oil and gas segment take courses from the London Institute. Vocational and higher institutions were founded in Libya in 1980 and include specialized higher institutes for agricultural, technical, and industrial sciences; higher vocational centers; and higher teacher training institutes. These institutions provide programs in the fields of social work, medical technology, industrial technology, computer studies, civil aviation, finance, and mechanical engineering. Furthermore, these institutions provide a Higher Technician Diploma after three years or a bachelor's degree after four or five years of study. After completion, students are allowed to start working on development projects throughout the country (Rhema & Miliszewska, 2010).

International educational organizations that have evaluated Libyan education have determined one of the critical weaknesses in Libyan higher education is instruction is restricted to meeting in physical classrooms at a fixed time (Elferjani, Ruddock, Khashkhush, & Elmsallati, 2011). For instance, the Global Competitiveness Report (World Economic Forum, 2010) ranked Libyan education as 128th out of 133 countries that provide qualified higher education (Elferjani et al., 2011). Moreover, the United Nations Development Program (2002) pointed out Libya is one of the countries wherein scientific research and technology development is considered weak throughout all of its educational settings. The technological lag experienced in Libya could be related to the long period of the United Nation's embargo (1993–2003) and an ongoing revolution since 2011 (Khashkhush, Eaton, Elmsallati, & Elferjani, 2011).

To compensate for what Libyan higher education has lacked thus far, universities need to establish a road map or blueprint that provides a clear plan for change and improvements which integrate technology into the educational systems. Ideally, this plan should focus on a top-down approach, an essential feature of which is to start with a policy decision by governmental officials (Sabatier, 1986). One major project was sponsored by the Libyan government and the United Nations Educational, Scientific, and Cultural Organization (UNESCO) to ensure the appropriate and timely implementation of technology in Libyan higher education (El Zoghbi et al., 2010). The project targets included training for faculty to establish digital literacy, basic computer skills, and competence in using technology in teaching (El Zoghbi et al., 2010). Because of the political upheaval that has been ongoing since 2011 (Khashkhush et al., 2011), the project did not proceed.

Integrating technology into Libyan higher education classrooms would enhance Libyan education as a whole. The top-down approach is suitable for the Libyan educational situation because all prospective Libyan teachers are from universities and those prospective teachers view their educators as technology users. University-educated teachers are likely to follow the methods they learned at school when engaging in their future profession (Bolick, Berson, Coutts, & Heinecke, 2003). Hence, choice of a higher education sector as a starting point for implementing technology would be an effective way to incorporate the advantages of technology at every level of education: elementary, secondary, and high school.

In addition, a technology integration plan should focus on the vision of all educational members. Hutchings and Quinney (2015) concentrated on the necessity of having a shared vision between stakeholders to implement any successful change in an organization. Based on this perspective, the plan for improving Libyan higher education should ensure all personnel agree and support the goals and objectives presented when integrating technology into this setting. Since 2000, there has been a growing interest in implementing urgent changes in Libyan higher education and using technology as a way to better prepare a new technological generation for working life (Porter & Yergin, 2006). In keeping with this initiative, the Ministry of Education has started to provide a technological infrastructure for Libyan higher education institutions (Porter & Yergin, 2006; Rhema & Miliszewska, 2010). This is considered to be a sign of support and willingness from administrators and policy makers toward assisting Libya to be one of the educational leaders in African countries; this could be achieved through integrating technology into its higher education.

The Ministry of Education's invaluable educational support is not exclusively for Libyan citizens; it also offers potential for change in some neighboring African countries including Chad, Nigeria, and Rwanda (Rhema & Miliszewska, 2010). Furthermore, successful initiatives in some neighboring countries, such as Tunisia, imply technology integration into Libyan classrooms would not create unmanageable upheaval in the Libyan education system. Tunisia has designed and implemented the first educational platform in its education history--Waheeb. Waheeb "provides a fully integrated student environment, learning management system, and a range of custom content creation and publication tools" (Rhema & Miliszewska, 2010, p. 434). Fortunately for Libya, Waheeb can be used in the future as it functions fully in the Arabic language as well as in English and French (Chorfi & Jemini, 2002).

Educator attitudes are a significant factor that needs to be explored in order to use the Libyan technological infrastructure effectively (Sadik, 2006). Abouchedid and Eid (2004) found positive attitudes regarding technology integration from Libyan educators are needed to move forward with educational reform efforts. Technology could be perceived as an effective aid for education only if users, students, and educators believe it will assist and improve the effectiveness and the efficiency of their teaching and learning (Wagner, Hassanein, & Head, 2008).

Since research findings indicated attitudes toward using technology are an essential factor when making plans to integrate technology into education, most of the initial Libyan studies related to integrating technology into Libyan education were focused on the attitudes of either students or educators toward using technology in the educational system (Elkaseh et al., 2015; Elzawi & Underwood, 2010; Emhamed &

Krishnan, 2011; Othman et al., 2013; Rhema & Miliszewska, 2014; Rhema et al., 2013). These studies are discussed in the following sections.

Elkaseh et al. (2015) conducted a study in two private and two public universities in Western Libya. The study surveyed 291 students and 175 educators. The main purpose of the study was to explore factors that affected technology implementation into Libyan higher education by extending the technology acceptance model to include social influence and perceived enjoyment. The findings revealed perceived enjoyment had a significant direct effect on educator perceived ease of use and perceived usefulness of technology. On the other hand, perceived enjoyment had a significant direct effect on students' perceived ease of use only. The findings also revealed social influence had a direct effect on students' perceived ease of use and perceived usefulness of technology but no significant direct effect on educators' perceived ease of use and perceived usefulness of technology.

Rhema and Miliszewska (2014) conducted research at two different universities located in Western Libya (University of Tripoli and University of Al-Jabal Al-Gharbi) using a survey instrument to collect data. The 348 participants in the study were undergraduate engineering students from the department of Electrical Engineering and Petroleum Engineering at each of the universities. The purpose of the study was to investigate student attitudes toward technology in Libya. The findings indicated participants were positively disposed toward technology and believed in its advantages. Furthermore, it found a statistically significant correlation between student attitude and the level of access to various technology--students who had better access to technology and the Internet had stronger positive attitudes.

Rhema et al. (2013) conducted research at two different universities located in Western Libya (University of Tripoli and University of Al-Jabal Al-Gharbi) using a survey instrument to collect data. There were 149 participants in the study--125 students and 24 educators from the Department of Electrical Engineering and Petroleum Engineering at each of the universities. The purpose of the study was to investigate student and educator attitudes toward technology in Libya and their satisfaction level with technology, e.g., the quality of Internet access at the institution and ease of use of technology. The findings indicated the participants had positive attitudes toward technology but the satisfaction level was low because the devastation caused by the 2011 war in Libya resulted in significant damage to the education infrastructure and services.

With the purpose of investigating the integration of technology into Libyan higher education from the perspective of Libyan educators who pursue their education abroad, Othman et al. (2013) conducted a qualitative as well as quantitative study. They collected data by providing open and closed questions to Libyan educators who were pursuing their master's or Ph.D. degrees in different areas of the United Kingdom. A survey was e-mailed to the participants. Although the researchers distributed 200 questionnaires, they received only 30 responses. The researchers intended to analyze Libyan educator responses in order to evaluate the technology as an effective support to face-to-face learning in Libya. The researchers concluded Libyan educators had positive attitudes toward using technology in Libyan higher education and accepted technology as a tool to obtain a better standard of education. However, from the study participants' perspectives, the following challenges face integration of technology into Libyan higher education: a language barrier where most of e-resources are in English and people in

Libya speak only Arabic, no proper technological infrastructure, and lack of support from a skilled management crew in the education system.

In addition, Emhamed and Krishnan (2011) conducted a study in a Libyan city. Their objective was to investigate Libyan English language teachers' attitudes toward integrating technology into teaching English as a foreign language (EFL) to Libyan students and the barriers encountered in using technology in secondary schools in the Libyan city. The researchers adopted a mixed-method design and administered a survey to 40 purposefully selected Libyan teachers in the city to elicit information on their attitudes toward integrating technology into teaching EFL students, their readiness to integrate technology, the types of technology used, and the difficulties they encountered in their efforts to integrate technology into teaching processes. A semi-structured interview was also conducted with eight respondents selected randomly from the sample to collect in-depth data on their attitudes toward integrating technology and issues they faced. The findings suggested most of the teachers had positive attitudes toward integrating technology in teaching EFL students. On the other hand, they faced barriers related to having a short period for class time and a lack of administrative support.

To investigate factors that affected Libyan engineering faculty members' use of the Internet to improve their teaching, Elzawi and Underwood (2010) conducted a study at a Western university (Alfatheh University) using survey research with 32 educators in three academic engineering disciplines (civil engineering, construction engineering, and build and environmental management). They found educators' attitudes and technology availability were the most important factors that affected educators' use of Internet functions in their teaching.

Almost all of these studies used surveys to obtain data and the researchers generally concluded Libyan users, students, and educators expressed positive attitudes and willingness to use technology in education. This implied tremendous potential for future use of technology in Libyan classrooms. However, despite high comfort levels with using technology for personal and professional purposes, Libyan users expressed apprehension about using technology for educational purposes (Rhema & Miliszewska, 2010). Therefore, factors specific to Libyan users' decisions to use technology in education bear investigation, i.e., competency.

This dissertation focused primarily on Libyan educators' competencies in the use of computer technologies. Berge, Muilenburg, and Haneghan (2002) suggested competencies and use of technology might serve to form and modify educator attitudes toward technology use. Educators with skill in using technology inside the classroom had a greater disposition to use advanced technology outside the physical walls of a classroom, i.e., distance education--one branch of education around the world steeped in technology (Berge et al., 2002).

Challenges of Integrating Technology into Libyan Higher Education

Some of the challenges Libya has encountered in terms of integrating computer technology into higher education have been educators' readiness to use computer technology, a lack of related research in Libya, and insufficient technological infrastructure. Research related to these challenges is discussed in the following sections.

Educator readiness in using computer technology. Educators are the core element in reforming the Libyan educational system so opportunities need to be provided

that enhance their teaching skills, especially when using technology in education becomes fundamental (Danwa & Wenbin, 2010). In developing countries, especially in Libya, educators are used to teaching with the method of “chalk and talk.” The curriculum they teach has been established based on this method (Bukhatowa et al., 2010). Furthermore, although most Libyan educators are provided with personal computers to use in their offices, the basic computer skills they possess are considered low (Rhema & Miliszewska, 2010). Since changing and adapting to teaching with technology is potentially one of the challenges of integrating technology into any higher education system, adopting and implementing technology into Libyan education requires educators to acquire skills and confidence in computer technologies through training or workshops (Mapuva, 2009). These workshops need to focus on improving computer use skills but they should also play an important role in encouraging and reminding educators about the importance of using current technology both in their classrooms and as a tool for communication with their students.

Research development. “Research is a process of steps used to collect and analyze information to increase our understanding of a topic or issue” (Creswell, 2012, p. 3). Research is vital because it adds to our existing knowledge. Researchers use systematic methods to maximize the veracity and objectivity of the information they collect. Systematic research methods create a body of knowledge based on consistent principles of objectivity, providing a comprehensive collection of empirically-founded information about a given phenomenon, topic, or issue. This process allows other researchers to discover and address gaps in the body of knowledge about specific topics or to replicate a previous research study with different participants and settings. Research

replications help to “establish the reliability and validity of existing theories and conclusions within a body of knowledge” (D. Parker, personal communication, December 30, 2017).

Research improves practices by providing educators with new ideas experienced in other settings; therefore, they can evaluate and choose what they are able to apply to their current setting (Creswell, 2012). Research informs policy makers. In addition to assisting educators in becoming better practitioners, research helps policy makers, specifically administrators, by providing them with data-based evidence for rigorous decision making (Creswell, 2012).

Although research is essential to improving education, health, and other development systems in any country, Libya is still struggling with a low scientific research contribution within regional and international research organizations, mainly in the education sector (Tashani, 2009). This is caused by the lack of a strategic plan and support for staff that is needed in universities in order to make research a viable component of the system; solid research is needed to enhance the overall education system (Tashani, 2009). Furthermore, Libya is an Arabic-speaking country but most e-sources and web content, such as journal articles and software, are in English.

The level of university support for staff members and educators has been shown to influence their work and teaching productivity (Andersson & Grönlund, 2009). Weakness of research in Libyan universities might be one of the challenges of integrating technology into Libyan higher education. Also, the lack of original Libyan research might be a challenge to students since Libyan students who pursue their education either inside or outside the country might struggle to find authentic Libyan references they can

use in their research. However, this weakness should be an incentive to explore educator and researcher needs in order to improve their work and, in turn, the education system as a whole. This research contributed to the solution by exploring educator competencies in the use of computer technologies in order to design appropriate workshops that support educators' needs and efforts should incorporate ways to adjust to the current instability of the country. This research provided a baseline of information about Eastern Libyan educators' current skill levels in the use of computers and educational technology. The findings might guide Libyan researchers who are investigating other topics related to integrating technology into Libyan higher education or Libyan education in general. Studies using the same instrument would add to the comparative value of studies in the presented topic.

Insufficient technological infrastructure. “The technological infrastructure in Libya is not currently at the same level of provision as the developed countries” (Bukhatowa et al., 2010, p. 6). Even though Internet access and computer labs are available at most of the main universities, insufficient networking facilities for Internet access and inconsistent access to the Internet pose barriers not only for the education sector in integrating technology (Rhema & Miliszewska, 2010) but also for all Libyan citizens to meet the needs of their daily lives. Consequently, Libya needs to communicate with international and regional organizations to obtain up-to-date hardware and software tools that increase the speed and ease of accessing the Internet (Bukhatowa et al., 2010).

Implementing Technology in Technical and Nontechnical Disciplines in Advanced and Developing Countries

With the intention of identifying obstacles related to the effective integration of technology in the education system, some research has focused on users, their needs and skills, and also on the context in which technology needed to be integrated. For instance, in some disciplines, subject content is largely infused with technologies, i.e., technical disciplines such as engineering. Therefore, in developing countries such as Libya, it is reasonable to consider the idea that integrating technology into the education system might be easier for people in technical disciplines than it would be for those in disciplines that do not incorporate much technology such as social studies (nontechnical discipline).

The general discipline of social studies is still struggling from the ineffective use of technology in classrooms even in advanced countries with high levels of available technology (Higgins & Spitulnik, 2008). As a result, educators use technology mainly to support existing content rather than being able to develop methodologies suited for a specific content (Higgins & Spitulnik, 2008). Higgins and Spitulnik mentioned this result emerged from conducting several studies that investigated educator practices using this medium without focusing on a specific content area.

A content area that does not necessarily incorporate technology does not prevent students, educators, and other staff members in the social studies sector from obtaining advantages of using technology in education. Technology plays an important role in moving from teacher-centered learning to student-centered learning (Palak & Walls, 2009). Regardless of student area of study, technology strives to equip students with

valuable critical thinking skills and collaboration opportunities rather than focusing them on memorizing and receiving information solely from their educators.

With the purpose of investigating how technology is perceived in the social studies sector, numerous studies have been conducted around the world, focusing mainly on educator traits. One of the findings from these studies was social studies educators have been anxious about modifying their instruction and materials through the use of technology, which led some researchers to conclude that social studies have not been visibly modified or improved as a consequence of integrating technology (Bolick et al., 2003). As a result, many studies have been conducted that focus mainly on the attitudes and beliefs of social studies users toward implementing technology in the education system.

For example, Yusuf and Balogun (2011) conducted a study empirically examining 382 student-teachers' competencies and attitudes toward technology. These prospective teachers were from the Faculty of Education at a Nigerian university. The researchers used a questionnaire to collect the data. Their findings revealed the majority of the student-teachers had a positive attitude toward the use of technology and were competent in the use of a few of the basics of advanced technology such as searching for files on computer systems and running computer applications (e.g., Microsoft Word application). Furthermore, the implication of their study was student-teachers lacked necessary competencies for the full integration of technology in the social studies curriculum.

In addition to Yusuf and Balogun's (2011) study, Beck and Eno (2012) completed a literature review of social studies and integrating technology that included 121 peer reviewed journals, books, and conferences. The results indicated some social studies

educators had positive attitudes toward technology and had the ability to use the Internet and computer applications to present their material. The remaining problem was educators were not fully skilled in the development of tailored content using computer technology.

Bolick et al. (2003) researched integrating technology into social studies teacher education in the western region of the country. Specifically, these researchers investigated the reasons teachers were not willing to use technology in their classrooms. For this purpose, Bolick et al. used a longitudinal survey design with cohort and panel members of the College and University Faculty Assembly. They targeted teacher educators because they are role models for future teachers. The same instrument was administered annually for five consecutive years. The results of this study indicated teacher educators in social studies had not been “convinced” in using technology to “conceptualize” course content. They used it primarily to assist pre-service teachers to present information, model some course content, and analyze teaching and learning. The researchers suggested the lack of time might have been a reason for failing to convince educators to use technology. They suggested once educators became comfortable with using technology, they would infuse it into their course content. In addition, the researchers predicted if technology completely controlled Libyan society, educators would not be able to teach without technology.

In the Libyan social studies sector, there has been a lack of research related to integrating technology in education and the studies conducted focused primarily on exploring the types of technologies that assisted educators and students in teaching and learning. For example, a study conducted by Emhamed and Krishnan (2011) in Western

Libya listed the most appropriate computer applications for teaching English. However, their study focused on various technologies rather than exploring the characteristics of users who were going to apply these applications in this sector.

With respect to integrating technology into the technical disciplines around the world, there is a lack of research investigating educator attitudes and competencies in using technology. A study conducted by Atai and Dashtestani (2013) focused on the use of computer technologies in the engineering sector. At an Iranian university, the researchers investigated their participants' attitudes toward technology, mainly the Internet. Participants were 723 undergraduate students from civil engineering, 67 subject-specific instructors (English for Academic Purposes, EAP), and 105 civil engineering (CE) instructors. A questionnaire, semi-structured interviews, and participant observations were used to collect the data. The data analysis revealed the majority of EAP instructors, CE instructors, and undergraduate students had positive attitudes toward using technology, mainly the Internet. However, the results also indicated EAP instructors did not use any type of Internet-based activities in their classes. This lack of use indicated reasons that might include inadequate Internet skills, inability to filter appropriate CE sites, and low credibility of free CE websites. The results also showed CE undergraduate students lacked various Internet-based skills.

On the other hand, a review of literature related to integrating technologies into Libyan higher education revealed the small numbers of Libyan researchers who conduct their research in Western Libya had focused on the engineering sector and paid less attention to the social studies sector's use of computer technologies. This focus did not necessarily indicate stronger support for technical disciplines in Libyan education but it

did suggest a small segment of individuals with technical proficiency were focused on networking facilities including their infrastructure, installation, maintenance, security, and administration systems (Sife, Lwoga, & Sanga, 2009; Wright, Dhanarajan, & Reju, 2009). These studies showed Libyan engineering educators had positive attitudes toward technology even with constant barriers related to Internet access and that most educational applications were not supported in Arabic.

In summary, advanced countries' technology integration studies focused more on the social studies sector than on technical disciplines relative to the use of computer technology in education. Libya had the opposite focus. Most of the limited number of Libyan studies focused on technical disciplines, such as engineering, more than on the social studies sector. This study included participants from both technical and nontechnical disciplines in order to provide comprehensive information from both sectors that might facilitate implementing a unified technological education system in Libya.

Summary

This chapter reviewed literature related to the problem under investigation. The Libyan education system is still using traditional teaching and learning methods in today's technological world. The first section discussed the necessity of using technology for education. The second section defined competency in the use of computer technology as it relates to using technology for educational purposes. The third section explained Rogers's (2003) diffusion of innovation model, which served as the theoretical foundation for this research. The fourth section discussed technology-related research based on Rogers's model. The fifth section provided information about Libya, its educational system, and the challenges related to integrating technology into Libyan

higher education. The last section presented information regarding implementing technology in technical and nontechnical disciplines. Chapter III describes the methodology used for this study including survey design, participants, sampling methods, instruments, research procedures, and data analysis. Chapter IV presents the results of the data analysis and Chapter V includes a discussion and suggestions for future work.

CHAPTER III

METHODOLOGY

The research questions, research design, participants, pilot survey findings, procedures, data analysis, and summary of the chapter are presented in the following sections. The purpose of this quantitative survey study with limited qualitative data was to explore the implementation of technologies into Libyan higher education from the perspectives of current Libyan educators. In particular, the researcher evaluated the existing competency levels of Libyan educators in using computer technologies in four core skill areas: basic computer operations, use of application software, use of the internet, and use of peripheral technologies. These data provided an initial indication (or baseline measure) of the presence of the technological skills required of Libyan educators to successfully integrate technology into Libyan higher education.

In addition, this study sought to test a Libyan stereotype that implied Libyan educators' specific academic disciplines might influence the process of integrating technology into Libyan higher education. Furthermore, other key elements the researcher explored were barriers that could be a challenge to this objective and the advantages of using technology in Libyan classrooms from educators' perspectives. The following research questions were addressed:

- Q1 Does the skill level of Libyan educators differ across the four competency areas of basic computer operation and issues, use of application software,

use of the internet, and use of peripheral technologies as measured by a self-report instrument?

- Q2 Do the competency levels of Libyan educators who specialize in a technical discipline differ from the competency levels of those who specialize in a nontechnical discipline in the areas of basic computer operation and issues, use of application software, use of the internet, and use of peripheral technologies as measured by a self-report survey?

Research Design

When a researcher attempts to “establish the overall tendency of responses from individuals and to note how this tendency varies among people,” a quantitative approach is the best match (Creswell, 2012, p. 13). This study used quantitative methodology because the researcher sought to assess educators’ evaluations of their competencies with skills critical for integrating technology into Libyan higher education and how these evaluations differed among educators. Creswell (2012) stated quantitative research problems are required to explain either the relationship among variables or to compare similarities and differences between groups. This study focused on exploring if there was a difference in educators’ competencies relative to the four areas of computer skills. It also included a competency comparison between technical and nontechnical educators relative to the target of implementing technology into their classrooms.

This study used a cross-sectional survey design to identify “trends in attitudes, opinions, behaviors, or characteristics of a large group of people (called the population)” (Creswell, 2012, p. 21). This researcher sought to identify the trends among educators in acquiring competencies related to the use of classroom technologies in Libyan higher education. Furthermore, the nature of this study was broadly exploratory as the amount of research related to integrating technology into Libyan higher education was considered

minimal. To the best of this researcher's knowledge as of the date of this study, no existing research focused specifically on Libyan educators' competencies in the use of computer technologies as related to the overall integration of technology into Libyan higher education. Furthermore, no Libyan research compared the two primary discipline domains within the Libyan education system (technical and nontechnical).

Numerous published studies highlighted the advantages and disadvantages of using surveys (Creswell, 2012, 2013; Kelley, Clark, Brown, & Sitzia, 2003). Using a survey design allows the collection of information in a short period and researchers can reach a large representative sample from a specific population economically (Creswell, 2012). Furthermore, collecting data via a survey allows anonymity in canvassing the participants and in avoiding biasing their responses (Creswell, 2012). However, survey information is self-reported information that reflects what individuals think instead of what they can do (Creswell, 2012). Occasionally, the response rate obtained from surveys is low and "the researcher cannot make claims about the representativeness of the results to the population" (Creswell, 2012, p. 403). Because surveys do not supply participants with an opportunity to respond flexibly to the questions (Creswell, 2012), the survey included a few open-ended questions to gain a better understanding of other aspects that might be considered in developing a rigorous plan for integrating technology into Libyan higher education.

Participants

The target population for this study was Libyan educators in Libyan higher education and the accessible population was Libyan educators from Benghazi University and Omer Al-Moktar University in Eastern Libya. All participants ($N = 161$) were

educators, none came from a population that was vulnerable to physical or emotional attack or harm, and all were Libyan citizens who resided in Eastern Libya and speak Arabic as their native language. None of the participants had an information technology background including computer science, computer engineering, or computer information systems majors to avoid including educators from other disciplines who were hired to substitute for the lack of faculty caused by war in the country. Educators who received the survey package were contacted by their departments, which is described later in the data collection section.

The participants were 117 males and 44 females. The majority of the participants' ages ranged from the 30s to 40s. Specifically, seven participants fell within the age range of 20–29, 53 participants were ages 30–39, 69 participants were ages 40–49, 19 participants were ages 50–59, eight participants' ages ranged from 60–96, and five participants left the request for their age blank. Each participant was a current educator at one of the main universities of the Eastern region (108 educators from Benghazi University and 53 from Omer Al-Moktar University). Each had a higher education degree at the master's or doctoral level (71 educators with master's degrees and 90 with doctoral degrees). There were 89 educators who earned their degrees from Arabic universities and 71 had earned their degrees from Western universities; one participant left this question blank.

Each participant was either from a nontechnical discipline (40 educators from the College of Arts, 15 educators from the College of Law, and 13 educators from the College of Education) or from a technical discipline (eight educators from the College of Engineering, 59 educators from the College of Science, and 26 educators from the

College of Economics). None of the participants had an information technology background. This restriction was controlled via a question in the survey that asked participants about their departments. The list of the educators' departments was checked manually by the researcher during the preliminary data checking process. There were 144 educators whose current work required the use of computers and 17 whose current work did not. The number of years participating educators had been teaching in the higher education sector ranged from 1 to 42 years. The year educators obtained their last degree ranged from 1988–2017. Table 1 contains a summary of the sample demographics.

Table 1

Demographic Characteristics of Participants

Demographics	N	%
Gender		
Male	117	72.7
Female	44	27.3
Discipline		
Technical		
Engineering	8	5.0
Science	59	36.6
Economic	26	16.1
Non-Technical		
Law	15	9.3
Art	40	24.8
Education	13	8.1
Current Degree		
Master's	71	44.1
Ph.D.	90	55.9
Source of Last Degree		
Arabic university	89	55.6
Western university	71	44.4
Current Job Requires Use of Computers		
Yes	144	89.4
No	17	10.6
Age		
20-29	7	4.5
30-39	53	34.0
40-49	69	44.2
50-59	19	12.2
60-69	8	5.1

Note. N = 161

Sampling Method

A non-probabilistic sampling approach was appropriate for this study (Kumar, 2014) because the number of educators in each college in Libya was unknown due to the war, which caused difficulty in accessing educators' records at the two targeted universities. Specifically, the researcher decided to use convenience sampling, which allowed data collection within time, place, and safety constraints. The careful, comprehensive description and selection of the sample for this study demonstrated what Gall, Borg, and Gall (1996) recommended for quantitative research: "If the sample is carefully conceptualized to represent a particular population...the sample is equivalent to a sample randomly drawn from the population; therefore, the use of inferential statistics is justified" (p. 229).

Results from a G*Power analysis (a statistical tool used to estimate needed sample sizes based on the selected statistical test) indicated the estimated sample sizes required to answer this study's research questions were as follows:

- The first research question required a sample size at least of 36 (Effect size = 0.5, α err prob = 0.05, power (1 - β err prob) = 0.90). One hundred sixty-one (161) responses were used to answer the first research question; therefore, the sample size was appropriate.
- The second research question required a total sample size of 140, 70 for each group (Effect size = 0.5, α err prob = 0.05, power (1 - β err prob) = 0.90). There were 68 participants from one group and 93 participants from the other group; therefore, the sample size was appropriate. The specific test

used to answer the second research question considered the inequality of the two groups' size (refer to Results chapter).

Instrumentation

Survey questions used to evaluate educators' competence in the use of computer technologies were adapted from Yusuf and Balogun (2011) and were approved for use (see Appendix B). These survey items were modified to include common applications and computer peripherals that could be affordable in Libya to make the instrument suitable for realistically identifying the levels of technological competency of Libyan educators in the near future. The English version of the survey instrument (see Appendix B) contains three sections: (A) Personal Information, (B) Competency in Using Computer Technology Scale (CUCTS), and (C) General Information.

Section A included demographic information and situational data about Libyan educators and included the following: educators' discipline (technical: College of Engineering, College of Science, and College of Economic or nontechnical: College of Law, College of Arts, and College of Education), gender (male or female), source of highest degree (an Arabic university or a Western university), whether or not they had had experience with work that required using computers, the specific academic degree (master's or Ph.D.), age, number of years of experience in the higher education sector, the year they completed their degrees, and departments where they taught. Areas indicating age, number of years of experience in the higher education sector, the year they completed their degrees, and departments where they taught were left blank for the participants to answer.

Section B, the Competency in Using Computer Technology Scale (CUCTS), was designed to determine the competence levels of Libyan educators in basic computer operation, use of application software, use of the Internet, and use of peripheral technologies. This section contained 32 items and used a 4-point Likert-type scale ranging from 1 (*Incompetent*) through 4 (*Fully competent*) with 4 being the highest score and 1 being the lowest score. The original survey items scale was modified slightly for use in the current study by reducing the scale from a 5-point Likert-type scale to a 4-point Likert-type scale. This modification was needed for clarity and applicability; it was also made in an effort to maximize the completion rate by reducing the cognitive load required to complete the survey (Driscoll, 2005), thus making the scale less time consuming for participants. The four sections of the CUCTS are described as follows:

- Basic Computer Operation. This subscale consisted of eight items where educators rated their competence in the basic computer operations on a 4-point Likert-type scale ranging from a 1 (*Incompetent*) through 4 (*Fully competent*) with 4 being the highest score and 1 being the lowest score. The following is an example item from this subscale: “I can locate an application program (e.g., Microsoft Word).” The sum of these items yielded the overall basic computer operation scores with a possible score range of 8–32.
- Use of Application Software. This subscale consisted of eight items where educators rated their competence in the use of application software on a 4-point Likert-type scale ranging from 1 (*Incompetent*) through 4 (*Fully competent*) with 4 being the highest score and 1 being the lowest score. The following is an example item from this subscale: “I can open a new

document in Microsoft Word).” The sum of these items yielded the overall use of application software scores with a possible score range of 8–32.

- **The Use of Internet Resources.** This subscale consisted of eight items where educators rated their competence in the use of Internet resources on a 4-point Likert-type scale ranging from 1 (*Incompetent*) through 4 (*Fully competent*) with 4 being the highest score and 1 being the lowest score. The following is an example item from this subscale: “I can access an Internet site via its website address.” The sum of these items yielded the overall use of Internet resources scores with a possible score range of 8–32.
- **The Use of Peripheral Technologies.** This subscale consisted of eight items where educators rated their competence in the use of peripheral technologies on a 4-point Likert-type scale ranging from 1 (*Incompetent*) through 4 (*Fully competent*) with 4 being the highest score and 1 being the lowest score. The following is an example item from this subscale: “I can use a scanner to scan images.” The sum of these items yielded the overall use of peripheral technologies scores with a possible score range of 8–32.

Section C included three multiple choice questions and two open-ended questions.

For the multiple-choice questions, participants were encouraged to choose from one or more options for the first question and only one option for the other two questions. The first multiple choice question asked what Libyan educators considered positive influences in the integration of technology into their classrooms. The other two questions were used to determine what Libyan educators considered as the main barriers that would influence the integration of technology into their classrooms and to evaluate ways Libyan educators

thought were most effective to improve their technological competency. These questions were used with open-ended questions included in the survey in order to gain a deeper understanding of educators' perspectives toward the future of integrating technology into Libyan higher education, thereby providing more information to policy makers and administrators.

Validity and Reliability

Yusuf and Balogun (2011), who developed the CUCTS, administered the initial draft to 50 student-teachers from a university in Southwest Nigeria to test the instrument's validity and reliability. Feedback obtained from this first administration was used to revise the final instrument. The final instrument was tested for reliability using a test-retest method at three-week intervals. Reliability coefficients obtained for the four sections of the instruments were 0.86 (Basic Computer Operation and Issues), 0.81 (Use of Application Software), 0.80 (Use of the Internet Resources), and 0.76 (Use of Peripheral Information and Communication Technology, ICT, Equipment).

To establish the validity of the survey for the purpose of this dissertation, some changes to the initial survey were made based on peer-review recommendations including feedback from the research advisor, suggestions from other research experts in the applied statistical and research methods lab, and recommendations from Libyan educators who participated in the pilot survey (content validity). Furthermore, in order to confirm information technology (computer science, computer engineering, and computer information systems) disciplines were excluded, the survey included one question in the Personal Information Section that stated, "I teach in the department of _____." If one of

the returned surveys had one of the information technology disciplines indicated, it was not included in the data analysis.

The method of forward and backwards translation was used to translate the survey and the consent form into Arabic and the results back into English (McGorry, 2000). This method ensured the translation process focused on cross-cultural concepts rather than providing linguistic equivalence (McGorry, 2000). Furthermore, this method was used to confirm the participants fully understood the survey questions and provided accurate responses. The survey and the unsigned consent form were translated from English to Arabic in an authorized office in the mid-western region of the United States (see Appendices C, D, and E). Then, a bilingual expert in the area accomplished the translation from Arabic to English. These two copies were then compared by the researcher. Additional changes were made by the researcher after consultation and discussion with the bilingual expert.

The factor structure (construct validity) of the CUCTS was analyzed via exploratory factor analysis (EFA). In general, “factor analysis assembles common variables into descriptive categories” or factors (Yong & Pearce, 2013, p. 80). Exploratory factor analysis is a factor analysis technique typically used to establish construct validity of an instrument in situations where relationships amongst variables are unknown or ambiguous (Brown, 2014). Exploratory factor analysis attempts to uncover complex patterns by exploring dataset and testing predictions (Child, 2006). Researchers also use it to discover the number of factors influencing variables or items and analyze which items go together. Exploratory factor analysis is normally the first step in creating a scale or new metrics (Yong & Pearce, 2013). The reliability (internal consistency) of

the survey items score was tested using Cronbach's alpha. The output of EFA and Cronbach's alpha is presented in Chapter IV.

Pilot Survey

According to Gall et al. (1996), "a pilot study involves small-scale testing of the procedures you plan to use in the main study, and revising the procedures based on what the testing reveals" (p. 65). In many cases, a pilot study is conducted for the purpose of developing or revising an instrument based on suggestions or recommendations from participants who should be from a population similar to the future target population (Borg & Gall, 1989; Gall et al., 1996). Adhering to these recommendations, the current instrument was field tested and the content validity of the survey was established with a group of 10 Libyan educators from Eastern Libya. These educators had teaching experience at either Benghazi University or Omer Al-Moktar University. Each was living in the United States at that time of this study and pursuing advanced degrees (master's and doctoral levels). Each was majoring in either a technical or nontechnical discipline. Participants' suggestions and recommendations were made to verify the instrument measured technological competency and the questions were understandable, comprehensible, and clear.

In addition to the suggestions, participants were asked to write in the time they needed to finish the survey in order to establish the content validity of the survey items. The time they needed ranged from approximately 5 to 20 minutes. The construct validity of the items' scores was not tested in this stage using factor analysis due to the very small sample size. Although the sample size was very small, the researcher tried to test the data from the survey to get initial information about the reliability (internal consistency) of the

instrument. The researcher ran Cronbach's alpha for all areas of competency. The values of Cronbach's alpha were 0.77 for Basic Computer Operation, 0.78 for Use of Application Software, 0.76 for Use of the Internet, and 0.78 for Use of Peripheral Technologies. These values were acceptable in the area of educational studies (Bland & Altman, 1997; DeVellis, 2003 as cited in Tavakol & Dennick, 2011; Nunnally & Bernstein, 1994).

Data Collection and Confidentiality

The first phase of implementing this research study was to obtain human subject participation approvals from different sites: The Benghazi University Directorate in Libya (see Appendix F), Omer Al-Moktar University Directorate in Libya (see Appendix G), and the University of Northern Colorado's Institutional Review Board (see Appendix H). Then, in the summer of 2017, the researcher sent a copy of the research package to Libya that included the Arabic version of the survey as well as the Arabic version of the participants' unsigned consent form. The research package was e-mailed to professionals in Libya who volunteered to assist with the research during this phase. These professionals were four educators. Two of them were currently teaching at Benghazi University and one was currently teaching in another Arabic country but volunteered to visit Libya and distribute the survey. The fourth one was teaching at Omer Al-Moktar University.

These individuals were responsible for printing approximately 240 copies of the survey and the consent form--120 copies for each University. The materials were distributed to the designated colleges within each university: College of Arts, College of Law, College of Education, College of Engineering, College of Science, and College of

Economics. Each college received a packet of 20 copies of the Arabic versions of the survey and consent form. Before distributing the survey, the researcher contacted the professionals via telephone to provide some suggestions toward obtaining a high response rate and to confirm the information technology disciplines such as computer science, computer engineering, and computer information systems would be excluded. Furthermore, the researcher kept in touch with those professionals for follow-up purposes.

Unfortunately, the response rate was very low using the printed copy of the survey package. This led the researcher to create an electronic copy of the survey package using Qualtrics--a simple to use web-based survey tool for conducting survey research, evaluations, and other data collection activities. Anyone can use this research suite to build surveys, send surveys, and analyze responses from any online location and any time that was needed. The researcher requested that each department chair distribute the electronic survey via Facebook pages for each department. By doing this, the response rate increased enormously and provided a chance for all educators to participate in case they did not have a chance to meet with their departments' chairs face-to-face. The survey was designed to remove all identifiers from the submitted form, eliminating the possibility of the researcher tracing information back to original sources. Coding of respondents was accomplished by automatic and blind numerical identification.

Data obtained from conducting this study were strictly confidential and retained by this researcher. Participants' names were not obtained, survey answers on the printed copies were returned electronically via scanning from Libya to the United States, and at all times reports are kept in locked files on the researcher's secure, password-protected

laptop. Findings of this research will be shared with both universities. Data from this study will be stored for three years after which time they will be destroyed.

Data Analysis Procedures

The researcher used Excel spreadsheets for data entry from both printed and electronic surveys and assigned a unique identification number to each participant. The researcher completed data validation on a total of 171 surveys to confirm the survey questionnaires were completed and represented consistent data. This validation step reduced the number of the surveys; a total of 161 completed surveys were used for the analysis step. The researcher ensured all survey option items were coded correctly using the values of 0 and 1 or by creating dummy and new variables when needed. In terms of coding missing data, analysis was conducted only with cases that had no missing data.

The first research question was tested with a Friedman's analysis of variance (ANOVA) test. The independent variable for this question was type of computer competency, which was a categorical variable with four types (basic computer operation, the use of internet resources, the use of peripheral technologies, and the use of software applications). The dependent variables were responses on the Likert-type scale for the item, which ranged from 1--*Incompetent* to 4--*Fully competent*.

For the second research question, one-way multivariate analysis of covariance (MANCOVA), an extension of one-way multivariate analysis (MANOVA) that incorporates a covariate, was used. The independent variable for this question was the educator group--either technical (College of Engineering, College of Science, and College of Economics) or nontechnical (College of Engineering, College of Science, and College of Economics). The dependent variables for the MANCOVA consisted of the

scores on the four computer competency subscales (basic computer operation, the use of Internet resources, the use of peripheral technologies, and the use of software applications).

Some extraneous variables, such as gender or source of highest academic degree (Arabic university or Western university) might have threatened the validity of the study findings even though the researcher was not interested in analyzing them. Consequently, the researcher included questions in the survey to obtain information about these extraneous variables in order to control them statistically using the inclusion technique (considering them while analyzing). Assumptions for using these types of statistical tools were tested to confirm these tools were appropriate to answer the research questions.

To analyze the general information gathered via Part C of the survey, response frequencies for forced-choice questions were supported by listing educators' statements related to open-ended segments of the general questions to add more information regarding the topic investigated.

Summary

A survey method design was used to explore future needs for implementing technologies into Libyan higher education. Specifically, the research objective was to evaluate current Libyan educators' competency levels in the use of computer technologies in four key areas: basic computer operation and issues, use of application software, use of the internet, and use of peripheral technologies. Furthermore, the researcher sought to test a stereotype that implied Libyan educators' major disciplines would influence the process of integrating technology into Libyan higher education. As such, this research attempted to determine if a difference in technological competency

existed between educators who had technical versus nontechnical majors. This comparison might assist in providing primary data that could guide efforts to integrate technologies into Libyan higher education classrooms, indicating whether to pay more attention to any specific educational area or if all majors needed equal attention. By using a survey that went through specific procedures of translation, reliability testing, and validation, this research provided opportunities for other Libyan researchers to use this survey or modify it for different purposes to more easily conduct ongoing research related to implementing technology into Libyan higher education classrooms.

CHAPTER IV

RESULTS

This investigation focused on Libyan educators' current competency in the use of computer technology as measured by a self-report survey in the following four areas: basic computer operation, use of Internet resources, use of peripheral technologies, and use of software applications. Moreover, this investigation compared the competency levels of educators who specialized in a technical discipline as well as those who specialized in a nontechnical discipline in the aforementioned four areas.

Results of the data analysis for the two research questions are presented in this chapter. The content includes factor analysis, reliability values, Friedman's ANOVA test, and MANCOVA results for the Likert-type survey items. Frequencies of responses to the forced-choice questions and lists of the participants' responses to the open-ended segments captured the nature of trends in these data.

Construct Validity (Factor Analysis)

The researcher used an EFA to establish the construct validity for the Likert-type survey items of the CUCTS. Initial run output included the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) and Bartlett's sphericity test on the overall CUCTS (across 32 items). The KMO value (ranged from 0 to 1) was .902, indicating the data set was superb—perfectly appropriate for factor analysis—and should yield distinct and reliable

factors (Field, 2009). Bartlett's test yielded $\chi^2(496) = 5520.746, p < .001$, indicating patterned relationships between the items, so it was appropriate to use factor analysis.

Moreover, in the initial step, the principal axis factoring method for extraction was used because the purpose of running the EFA was to identify factors. Then the factor loadings (the relationship of each variable/item to the underlying factor) were examined using the Promax rotation method (oblique rotation). The oblique rotation method was chosen under the assumption the factors produced would be correlated. After a careful examination of the pattern matrix, 24 items of 32 were retained because they had load values over .30 (Kline, 1994). Eight items (2, 7, 8, 22, 23, 24, 30, and 31) of 32 that were eliminated from the scale loaded in two or three factors with less than a 0.1 difference between the loads (Büyüköztürk, 2002). As a result, all 24 items that were retained had a primary loading over .30. Only one item had a cross-loading above .30 ("I can attach files to outgoing e-mails"). However, this item was not eliminated because it had a strong primary loading of .63 and the difference between the loads was over 0.1 (Büyüköztürk, 2002).

After deleting the eight weak items, EFA was applied to the remaining 24 items. The results showed the remaining 24 items were gathered under four factors. The KMO test value for the final 24-item scale was .873, indicating the data set was suitable for factor analysis and for further data analysis. Bartlett's test of sphericity yielded $\chi^2(276) = 3892.284, p < .001$, showing there were patterned relationships between the items so factor analysis was appropriate for further analysis of data. The four factors explained a cumulative variance of 68.37%.

To confirm the number of the factors obtained, a scree plot (see Figure 4) and eigenvalues were examined. Decisions were based on two criteria: Eigenvalues (retain all factors with $EV > 1$) and scree plot (retain all factors "before the elbow"). Factor loadings and eigenvalues based on a principal axis factoring with oblique rotation for 24 Likert-type survey items of the Competency in Using Computer Technology Scale ($N = 161$) are presented in Table 2.

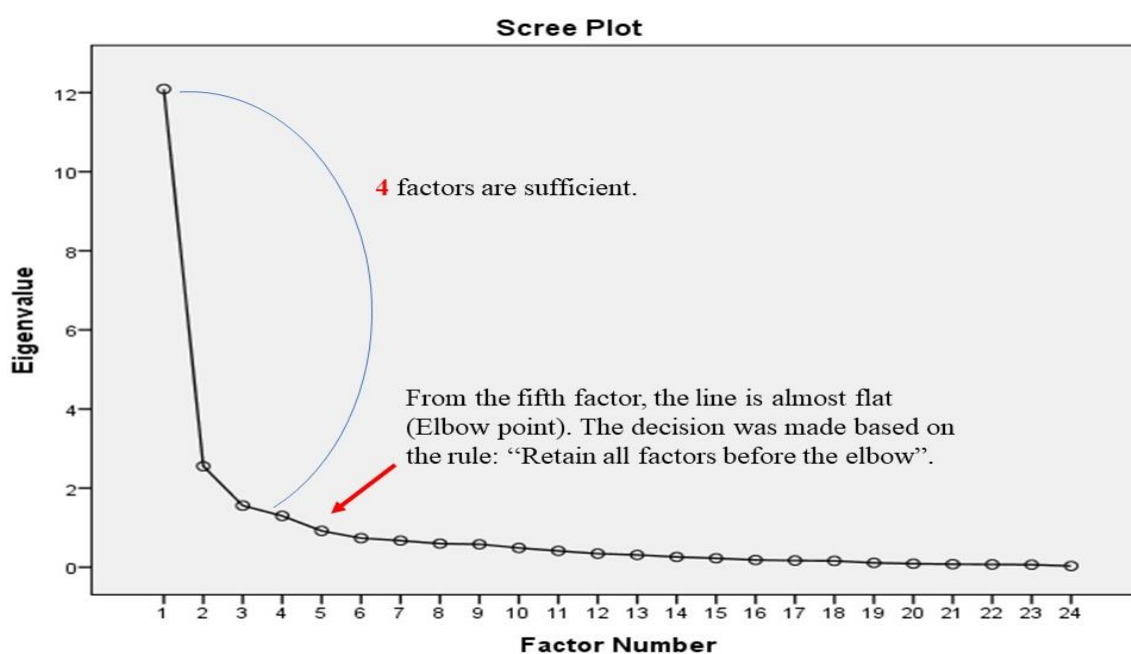


Figure 4. Output for scree plot indicating the data had four factors.

As a result, the four factors of the CUCTS were labeled: (a) basic computer operation, (b) the use of internet resources, (c) the use of peripheral technologies, and (d) the use of software applications. Furthermore, this analysis indicated the EFA provided support for the construct validity of scores on the Arabic version of the Competency in Using Computer Technology Scale in the population of the educators from Libyan universities who participated in this study.

Table 2

Factor Loadings and Eigenvalues Based on a Principal Axis Factoring with Oblique Rotation for the Likert-Type Survey Items of the Competency in Using Computer Technology Scale

	Basic Computer Operation	Use of Internet Resources	Use of Peripheral Technologies	Use of Software Applications
I can locate an application program (e.g. Word).	.881			
I can search for files on a computer system.	.767			
I can access information on a CD/DVD	.780			
I can organize electronic files into folders.	.891			
I can move files between folders.	.754			
I can open a new document in Microsoft Word.	.973			
I can use simple editing tools (e.g. bold, italics, centering, font size, etc.).	.614			
I can use a spreadsheet package to filter data.				.863
I can use a spreadsheet package to make reports.				1.040
I can use a spreadsheet package to sort data.				.890
I can create a basic presentation package.	.360			
I can modify a slide (e.g., change colors of text, lines, and spaces, etc.).	.508			
I can include animations into slides.				.370
I can access an Internet site via its website address.		.753		
I can download files from the Internet.		.820		
I can send e-mail messages.		.903		
I can access received e-mail messages.		.844		
I can attach files to outgoing e-mails.	.358	.637		
I can use a digital camera to capture images.			.675	
I can transfer pictures from camera to computers.			.706	
I can use a web camera to communicate with others on the Internet.			.875	
I can incorporate a Multimedia Projector into my teaching.			.842	
I can perform connections to set up a Multimedia Projector.			.815	
I can connect speakers to computers.			.509	
Eigenvalues	10.16	8.45	9.00	5.60
% of variance	49.07	58.86	64.09	68.37

Note. If the factors are correlated (oblique), the factor loadings are regression coefficients and not correlations and as such they can be larger than one in magnitude (Jöreskog, 1999).

As illustrated in Table 2, the number of factors of computer competency skills remained the same as the original survey (four factors) but the number of items and the items themselves in each factor changed after the validation step; therefore, the structure of Part B of the survey (Competency in Using Computer Technology) changed as follows:

- **Basic Computer Operation.** This subscale consisted of nine items where educators rated their competence in basic computer operations on a 4-point Likert-type scale ranging from a 1 (*Incompetent*) through 4 (*Fully competent*) with 4 being the highest score and 1 being the lowest score. The sum of these items yielded overall basic computer operation scores with a possible score range of 9–36.
- **Use of Internet Resources.** This subscale consisted of five items where educators rated their competence in the use of Internet resources on a 4-point Likert-type scale ranging from 1 (*Incompetent*) through 4 (*Fully competent*) with 4 being the highest score and 1 being the lowest score. The sum of these items yielded overall use of Internet resources scores with a possible score range of 5–20.
- **Use of Peripheral Technologies.** This subscale consisted of six items where educators rated their competence in the use of peripheral technologies on a 4-point Likert-type scale ranging from 1 (*Incompetent*) through 4 (*Fully competent*) with 4 being the highest score and 1 being the lowest score. The sum of these items yielded overall use of peripheral technologies scores with a possible score range of 6–24.

- Use of Application Software. This subscale consisted of four items where educators rated their competence in the use of application software on a 4-point Likert-type scale ranging from 1 (*Incompetent*) through 4 (*Fully competent*) with 4 being the highest score and 1 being the lowest score. The sum of these items yielded overall use of application software scores with a possible score range of 4–16.

Reliability Test (Cronbach's Alpha)

Regarding the reliability of the survey and the four subscales (internal consistency), Cronbach's alpha for the remaining 24 Likert-type survey items of the CUCTS (across 161 participants) was .94. Individually, the reliability of basic computer operations scores was similarly high (nine items, $\alpha = .92$). For the use of Internet resources, the reliability of scores was the same (five items, $\alpha = .92$). The reliability of use of peripheral technologies scores was slightly lower but still strong (six items, $\alpha = .91$). Finally, the reliability for use of software applications scores had the lowest score; however, it was still high (four items, $\alpha = .89$). Table 3 summarizes the reliability results.

Table 3

Reliability of the Twenty-Four Items and Subscale Scores

Factor	# of Participants	# of Items	α value
Basic Computer Operations	161	9	.92
Use of Internet Resources	161	5	.92
Peripheral Technologies	161	6	.91
Use of Software Applications	161	4	.89

Note. Cronbach's alpha of 24 items scores was .94.

Quantitative Analysis of Competency in Using Computer Technology Scale Survey: Parts A and B

Quantitative data obtained from Parts A and B of the CUCTS were used to answer the first and second research questions via running inferential statistics. The required assumptions to run inferential statistics tests were checked to confirm the data were appropriate for each test. The following sections present the details of analyzing the quantitative data from the survey.

- Q1 Does the skill level of Libyan educators differ across the four competency areas of basic computer operation and issues, use of application software, use of the internet, and use of peripheral technologies as measured by a self-report instrument?

Before conducting the statistical test to answer this research question, a test for data normality was completed using the Shapiro-Wilk Test of Normality. The probability of error for the Shapiro-Wilk Test for all four factors was .000, indicating the data significantly deviated from a normal distribution. In addition, a Q-Q plot and histograms output confirmed what the Shapiro-Wilk Test of Normality provided. Therefore, a data transformation was performed to correct the problem. However, when the Shapiro-Wilk Test of Normality was performed again, the transformed data also violated the normality assumption. When a large deviation from the assumption of a normal distribution is presented, parametric tests should not be used; equivalent non-parametric tests should be used instead (Gall et al., 1996). Non-parametric tests are tests of statistical significance, distribution free tests, and yield the same level of statistical significance as parametric tests when the sample size is large, i.e., 30+ (Gall et al., 1996; Pallant, 2007). Moreover, when using non-parametric tests, the most appropriate measure of central tendency would probably be the median (Field, 2009). In the case of an adequate sample size, a

Friedman's ANOVA test (non-parametric test) is equivalent to a repeated measures ANOVA (parametric test) so the Friedman's ANOVA test was used to answer the first research question.

The independent variable for this question was type of computer competency (basic computer operation, the use of internet resources, the use of peripheral technologies, and the use of software applications) and the dependent variables were item response scores on the Likert-type scales, which ranged from 1 = *Incompetent*, to 4 = *Fully competent*. The data met the following assumptions for the use of a Friedman's ANOVA test: one group was measured on three or more different occasions, which in the case of this study, participants' skills were measured in the four types of computer competency; the group was representative of the population; the dependent variable should be measured at the ordinal level (Likert scale); and the data did not need to be normally distributed.

The Friedman's ANOVA test first ranked the values in each matched set of the raw data (each row or each participant) from low to high and each row was ranked separately. Then it summed the ranks in each column (each competency) to be used for Friedman's ANOVA calculation to explore the significance difference (Field, 2009). When these processes were applied to the raw data of this research, the mean rank for basic computer operations was 3.99, the mean rank for the peripheral technologies was 2.83, the mean rank for the use of Internet resources was 2.17, and the mean rank of the use of software applications was 1.01. In simple words, this initial step indicated Libyan educators thought they were most competent in basic computer operations with the

highest mean rank and they were least comfortable using software applications, which ranked lowest.

The output of the Friedman's ANOVA test showed a statistically significant difference (at $\alpha = .05$) in educators' competency of using computers depending on the competency type: use of basic computer operation, use of Internet resources, use of peripheral technologies, and use of software applications, $\chi^2(3) = 451.269, p = 0.000$. A post hoc analysis using Wilcoxon signed-rank tests was conducted, applying a Bonferroni correction, resulting in a significance level set at $p < 0.008$. Medians for the use of basic computer operation, use of Internet resources, use of peripheral technologies, and use of software applications were 36 (9-36), 20 (5-20), 23 (6-24), and 12 (4-16), respectively. A statistically significant difference was found between educators' competency in the basic operation of using computers and the use of the internet resources, ($Z = -11.198, p = 0.000$). A statistically significant difference was also found between educators' competency in the basic operation of using computers and the use of peripheral technologies, ($Z = -11.135, p = 0.000$). A statistically significant difference existed between educators' competency in the basic operation of using computers and the use of software applications, ($Z = -11.048, p = 0.000$). There was a statistically significant difference between educators' competency in the use of the internet resources with peripheral technologies and the use of software applications, ($Z = -8.117, p = 0.000$), ($Z = -11.001, p = 0.000$), respectively. Finally, a statistically significant difference was found between educators' competency in using peripheral technologies and the use of software applications, ($Z = -11.004, p = 0.000$). In simple words, educators' skills in each area of using computer technologies differed significantly from the other ones. Educators'

competency in basic computer operation was different from competency levels in the use of Internet resources, use of peripheral technologies, and use of software applications.

Educators' competency in the use of the Internet resources was different from the use of peripheral technologies and the use of software applications. Educators' competency in using peripheral technologies was different from the use of software applications.

Q2 Do the competency levels of Libyan educators who specialize in a technical discipline differ from the competency levels of those who specialize in a nontechnical discipline in the areas of basic computer operation, use of application software, use of the Internet, and use of peripheral technologies as measured by a self-report survey?

The independent variable for this question was the educator group--either technical (College of Engineering, College of Science, and College of Economics) or nontechnical (College of Engineering, College of Science, and College of Economics). The dependent variables for the MANCOVA consisted of scores on the four computer competency subscales (basic computer operation, use of Internet resources, use of peripheral technologies, and use of software applications). Additional demographic variables were statistically controlled in this analysis to reduce potential error introduced by extraneous sources.

To answer the second research question, the researcher ran a one-way MANCOVA using IBM SPSS Statistics 20. The output of this analysis included tests to ensure the data met the necessary assumptions for multivariate analyses. It is not unusual when working with real-world data to have one or more of the test assumptions violated. However, even when data fail to meet certain assumptions, there is often a solution to overcome the issue (Field, 2013). After running the MANCOVA, the output included Box's test of the assumption of equality of covariance matrices. This statistic tested the

null hypothesis that the variance–covariance matrices were the same in the two groups. Therefore, if the matrices were equal (the assumption of homogeneity was met), this statistic should be non-significant. The obtained data violated the assumption of equality of the covariance matrices ($p = .000$). In addition, the data violated the test of normality as noted in the discussion of research question one and indicated by the Shapiro-Wilk Test of Normality.

However, when using MANOVA to protect against “nonnormality and heterogeneity of covariance matrices, the largest-root test should be avoided while the Pillai-Bartlett trace test might be recommended as the most robust of the MANOVA tests with adequate power to detect true differences in a variety of situations” (Olson, 1974, p. 894). Based on that statement, the researcher used Pillai’s Trace of MANCOVA to determine a statistically significant difference between the groups. Pillai’s Trace test is considered to be the most powerful and robust statistic for interpreting the output of MANOVA or MANCOVA when group sizes are unequal (Seber, 2004), which was the case in this data where there were 93 participants in the technical group and 68 in the nontechnical group. The MANCOVA output indicated a statistically significant difference between the discipline groups (technical and nontechnical) on the overall competence (combined dependent variable scores across the four types of competency) after controlling for gender and educator source of degree, $F(4, 154) = 4.121, p = .003$; Pillai’s $T = 0.097$, partial $\eta^2 = .097$ (partial eta squared-effect size). In simple words, the MANCOVA output showed the members of the technical group were more competent than those of the nontechnical group in using computer technologies. At present, there

are no agreed definitions of what constitutes a strong (or otherwise) effect size (Huberty & Olejnik, 2006).

In addition, the output of MANCOVA, after applying a Bonferroni correction, resulted in a significance level set at $p < 0.0125$, showing the difference between educator groups in basic computer operation skills was significant, $F(1, 157) = 8.65$; $p = .004$. The difference between educator groups in competency in the use of software skills was also significant, $F(1, 157) = 14.08$; $p = .000$. In the areas of use of Internet resources and the use of peripheral technologies, no significant differences were found between technical and nontechnical educators: ($F(1, 157) = 4.32$; $p = .039$; $F(1, 157) = 5.05$; $p = .026$), respectively. The output of MANCOVA is presented in Table 4.

Table 4

Output of the Multivariate Analysis of Covariance Test

Source	Dependent Variable	SS	Df	MS	F	Sig
Educators Group	Basic Operation	143.99	1	143.99	8.65	.004
	Error	2611.96	157	16.63		
	Total	186561.0	161			
	Internet Resources	21.20	1	21.20	4.32	.039
	Error	770.65	157	4.90		
	Total	58778.00	161			
	Peripheral Technologies	68.39	1	68.39	5.05	.026
	Error	2125.47	157	13.53		
	Total	75921.00	161			
	Software Applications	165.52	1	165.52	14.08	.000
	Error	1844.52	157	11.74		
	Total	24389.00	161			

Since the differences between educator groups in basic computer operation skills and in the use of software applications skills were significant, a follow up analysis was conducted using a Mann-Whitney U test. A Mann-Whitney U test is used to compare differences between two independent groups when the dependent variable is either ordinal or continuous but not normally distributed (Field, 2009). It is a non-parametric test, it converts the data into ranks, and it is used as an equivalent to the independent sampled *t*-test (Field, 2009).

The output of Mann-Whitney U test indicated the competence in basic computer operation skills was significantly higher for technical educators (median = 36.00) than for the nontechnical educators (median = 34.50), $U = 2096.50$, $p = 0.00$ (two tailed). Similarly, the Mann-Whitney U test showed the competence in the use of software applications was significantly higher for technical educators (median=13.00) than for the nontechnical educators (median = 11.00), $U = 1994.00$, $p = 0.00$ (two tailed). As a summary, educators in technical disciplines expressed more competence in basic computer skills and software applications than educators in the nontechnical group.

Competency in Using Computer Technology Scale Survey, Part C: General Information

Part C of the CUCTS survey contained five questions. The first three were multiple choice questions regarding (a) positive aspects of integrating technology into Libyan classrooms, (b) the main barriers to integrating technology into Libyan classrooms, and (c) the most effective ways to improve educators' competency in using computers in their classrooms. Frequencies and lists of what participants stated are presented below, providing comprehensive summaries of responses to this group of

questions. The other two questions in Part C of the survey were open-ended questions related to the types of support and resources Libyan educators needed to improve their skills in teaching with computer technology and recommendations and suggestions for Libyan researchers toward improving Libyan education by using computer technology. The researcher used frequencies of the statements provided by the participants and listed the recommendations educators offered to confirm every input for this research for future research.

Regarding the first multiple choice question, “What do you consider as positive(s) that will influence the integration of technology into your classroom?”, participants were allowed to choose one or more responses from the provided options. Frequencies of responses showed 134 participants (88%) thought computer technology allowed educators and students access to various educational resources, 108 participants (67%) expressed computer technology would enhance communication between students and educators, and 87 participants (54%) indicated computer technology would provide time for feedback and discussion in the classroom by reducing the amount of lecturing. Some participants tried to add other positives that would influence the integration of technology into their classroom. Educators provided the following list of added positives that would influence the integration of technology into their classrooms.

- Creating more time for explanations.
- Using visualization for clarification and making instructions easier or simpler for students to understand. This, in turn, helps students to keep the information in their long-term memory so they keep the knowledge they learned in their classroom even after their exams and graduation.

- Make lecturing more active and provide access to advanced resources.
- Assist students to acquire skills that help them to communicate with other students and researchers in other universities.
- Using software provides students with a chance to evaluate educators rather than using traditional ways of evaluation.
- Deliver instructions to students in accurate and faster ways.
- It helps with being close to what universities around the world have.
- Serve students with applications that are suitable for their subjects, such as software for drawing maps.
- The technology itself helps students to be trained to use it. It encourages students for collaboration even with people they have not met before. If educational websites are parts from their study, they might help to not waste more time in non-educational websites.
- It assists in data analysis, expands students' and educators' knowledge, and assists students to pay more attention to the value of using technology in their lives.
- It assists with summarizing data and delivering it as simple information in more exciting ways.
- It assists in saving time and effort, breaking the daily traditional ways of teaching, and making teaching more active.
- Connecting students with information while teaching.

- It assists students to grasp information faster, and it makes topics more interesting to students.
- Deliver simple and comprehensive information.
- It assists students with their assignments.
- Communicate with students at any time.
- It is the best way to change knowledge.
- It assists students with conducting research.
- It assists educators to publish their research.
- It is the best way to keep students active while teaching.
- It assists in keeping with global development.
- It is the best way to display information such as data tables and pictures.

Regarding the second multiple choice question, “What do you consider as the main barrier that will influence the integration of technology into your classroom?”, participants were allowed to choose only one option from the provided answers. Of the options provided, 94 participants (58%) believed the main barrier that would influence the integration of technology into their classrooms was the limited access to technology in classrooms, mostly computers and Internet. Only 23 participants (14%) considered the main barrier that would influence the integration of technology into their classrooms was educators’ competencies in using computer technologies in the classroom and 20 participants (12%) thought the main barrier that would influence the integration of technology into their classrooms was the long development and delivery time needed to integrate technology into Libyan classrooms. Numerous participants tried to add other

main barriers that would influence the integration of technology into their classrooms. Educators provided the following list of main barriers that would influence the integration of technology into their classrooms.

- Facilities.
- Weak electricity discontinues Internet access and prevents making active classrooms, and lack of software systems to connect classrooms with the departments and the administration offices in a unified manner.
- The current safety situation and difficulty to obtain the primary needs to live in the country such as food, money, and shelters.
- Bad infrastructure in Libyan universities.
- Some educators are incompetent in using technology in their classrooms because most of them earned their degrees from other developing countries, similar to Libya. In terms of students, they are skillful in using social media but not for education purposes.
- Benghazi University is damaged. Educators currently teach in elementary and middle school classrooms, so there is a completely uncomfortable environment for teaching using technologies.
- Educators lack of motivation to improve their teaching via using computers that should be aligned with the today's technological world.
- Some educators used to deliver their instructions using the traditional ways (blackboard and chalk); it is going to be very difficult for them to construct their lesson in a format of slides.

- All valuable scientific resources are available online with the English language. The problem is a big number of educators in the university do not speak English or have a low level of English.
- Universities are fully dependent on using traditional resources to teach, so educators and students do not have an electronic database to access the World Wide Web.
- Students are not motivated so, in turn, educators become careless about improving their teaching.
- The old generation of educators is not prepared to use technology in their classrooms.
- Bad administration and management systems.
- Lack of financial support to buy and use advanced technologies in Libyan universities.

Participants were also allowed to choose only one option from the provided answers for the third multiple choice question: “What do you consider as the most effective way to improve educators’ competency in using computer technology in classrooms?” A total of 103 participants (64%) considered the most effective way to improve educators’ competency in using computer technology in classrooms was to provide workshops. Fewer participants (33, 20%) believed the most effective way to improve educators’ competency in using computer technology in classrooms was through self-training with books, records, etc. without direct supervision or attendance in a class. Some participants tried to add other effective ways to improve educators’ competency in

using computer technology in classrooms. The following added suggestions were provided by one or more participants:

- After preparing educators and training them on how to use computer technologies in their classrooms (the training should be intensive), teaching with technology must be mandatory for all educators to teach, and [the use of educational technology] must be a required skill in accepting new faculty at the universities.
- By providing continued training or continuing professional development on technologies, which need to be transferred from advanced countries. This transformation step needs time and money for sure.
- By improving the administration and management systems in Benghazi and Omer Al-Moktar university using technology first, so the change can be visible to both students and educators.
- By participation in international and national conferences on how to use technologies in classrooms.
- By motivating educators, for example, providing presentations and demonstrations from guest speakers from advanced countries. Also, by providing educators with a safe environment that will help them to focus on teaching rather than their daily expenses, salaries, etc.
- When educators find the e-learning embedded in their universities, such as Learning Management Systems, BlackBoard, and web Citi, they will use it intently.

The CUCTS survey also contained two open-ended questions regarding what types of support educators needed to improve their skills in teaching with technology and asked for suggestions for Libyan researchers so they could contribute to improving the Libyan higher education system, specifically at Benghazi University and Omer Al-Moktar University.

Frequencies for statements made by participants about types of support and resources Libyan educators need to improve their skills in teaching with technology are listed in Table 5. All responses are listed. The total number of responses did not match the number of participants (161) because some participants chose to leave the open-ended questions blank.

Table 5

Participant Responses Regarding Needed Support and Resources

Resource	Total Number of Participants	%
Computers in classrooms	81	50
Internet access in classrooms	76	47
Projectors in all classrooms	50	31
Workshops provided by a unified center in each university after preparing classrooms with technology	33	20
Individual financial support	18	11
Computer labs in each department that provide up-to date contextual software (based on each major need), printing, free access for e-libraries, and Arabic software and applications	8	4
Highly secured website for each university for communication between university members	6	3
24/7 technical support	3	1

Participating educators in this study suggested the following recommendations to Libyan researchers regarding the integration of technology into Libyan higher education.

- Libyan researchers should conduct more research so technology for both teaching and learning can be supported and implemented through the minister of education.
- Libyan researchers should be supported financially.
- Libyan researchers should be supported in ways that allow them to actively participate in international educational conferences.
- Continued participation in workshops related to improving teaching using technology.
- Libyan researchers should conduct valuable studies in ways that these studies findings can provide recommendations for the policy makers in the Libyan universities to apply them.
- Libyan researchers should be required to be knowledgeable about the up-to-date technologies used in other advanced countries' education. This knowledge can assist them in making decisions about which technology can be used in Libyan classrooms that could be suitable for the current instability in Libya.
- Libyan researchers should be responsible for conducting workshops that encourage both students and educators and teaching them how to improve their work using technology.

- Libyan researchers should be responsible for providing both students and educators with appropriate, authentic, and free resources that assist the population in improving their work using technology.
- Libyan researchers should be provided with educational resources in both languages Arabic and English.
- Libyan researchers should be required to improve their knowledge in using statistical research methods in order to obtain accurate findings from their studies.
- Libyan universities should support researchers by offering an authorized translation center at each university. This will encourage researchers to use studies used in advanced universities with the English language. Also, this will reduce the cost that researchers need to pay for private offices for translation matters.
- Libyan researchers should summarize some studies and present these them in local university conferences. These studies should be related to integrating technologies in teaching and assisting educators' understanding of how to defuse technology in their teaching step-by-step.
- Researchers must be responsible for encouraging the administrators and policy makers to make the attendance of technology workshops required, and workshops should be held within the work hours of each educator.
- Researchers need to conduct more research that is related to distance learning since Libya is a wide country. Distance learning resources would

help solve the problem for students and educators who live in rural or small villages.

- Researchers should disseminate the information that they obtain to facilitate sharing the experiences of educators who have been successful in their own teaching with technology with other educators and stakeholders. This in turn will build a competitive environment among educators and students as well.
- Libyan researchers should be responsible for providing a rigorous plan that aligns with the limited-facility setting in Libya to facilitate the integration technology into Libyan higher education.

Summary

This chapter presented a report of the results of both descriptive and statistical analyses of the obtained quantitative and qualitative data to address the two research questions. The output of the Friedman's ANOVA test showed a statistically significant difference in educators' competency in using computers depending on the competency type: the use of basic computer operations, use of Internet resources, use of peripheral technologies, and the use of software applications. Furthermore, the Friedman's ANOVA test showed the following rank order for the types of computer competency: (a) basic computer operations, (b) use of peripheral technologies, (c) use of Internet resources, and (d) the use of software application. Based on a follow-up analysis to determine which competency was different from the other one, the results of the post hoc analysis, Wilcoxon signed-rank tests, showed a statistically significant difference among all types of computer-use competency. Furthermore, the output of MANCOVA analysis indicated a statistically significant difference between the discipline groups (technical and

nontechnical) on the overall competence of using computer technologies after controlling for gender and educator source of degree. A follow-up test for MANCOVA was conducted (Mann-Whitney U test), which showed educators in technical disciplines expressed more competence in basic computer skills and software applications than educators in the nontechnical group. Finally, to provide more information from the participants regarding their thoughts about integrating technology into Libyan higher education, this chapter provided frequencies and lists of participant responses from the forced-choice questions and the open-ended segments of the survey.

CHAPTER V

DISCUSSION

This chapter provides a discussion of the procedures followed to support the validity and the reliability aspects of the study. The interpretations of results from the quantitative data analyses addressing each research question are also presented in this chapter. Contents of this chapter include interpretations of the forced-choice and open-ended survey questions, implications for administrators and policy makers, limitations of the study, recommendations for future research, and a general summary.

Procedures

Although the researcher planned to use only a printed form to distribute the survey to the sample of Libyan educators, a very low response rate opened the door to using both printed and web-based surveys to maximize participation (Evans & Mathur, 2005). The response rate increased tremendously when the web-based copy of the survey was offered, which might be an indicator that Libyan educators are moving forward and becoming more willing to use computer technologies even with erratic Internet access that currently creates a challenge for users in almost all Libyan cities. On the other hand, the high comfort level of participants with the web-based survey might confirm Rhema and Miliszewska's (2010) conclusion that Libyan educators found it easy and enjoyable to use technology for entertainment. They used computer technology for work but they

expressed discomfort with the idea of using these technologies to teach. This dissertation was directed at supporting the needs of Libyan educators by evaluating their skills in using computer technologies they would need to use in their classrooms. An added benefit of this study was the results provided information for those involved in educational development and teaching in Libya that could be broadly disseminated. This study was also intended to encourage the overall understanding of the importance of integrating computer technology into the education process.

The change in responsiveness on the part of participants after the web-based survey was offered bears discussion. Using only a print survey might have conveyed a message to potential participants that the survey was directed at individuals who did not have any computer and Internet background so those who were more comfortable using computers did not take the survey. Using both methods might have reduced this potential bias by providing opportunities for all educators to choose their preferred form of the survey. The web-based copy of the survey served to increase the response rate and the automated process made it easy to track the number of the participants. The electronic survey also helped the researcher save time and reduce cost because graphic and numerical data were simple to access and easy to import to the data analysis programs (Evans & Mathur, 2005). This alone supports a call to encourage the use of technology to improve the research and the education system as a whole in Libya.

In the present study, the CUCTS was adapted for the Libyan culture after the basic translation process from English to Arabic was completed. The purpose of the survey was to evaluate Libyan educators' overall competence in using four different categories of computer technologies: basic computer operation, use of application

software, use of the Internet, and use of peripheral technologies. The scale consists of 24 items that measured these four dimensions (or skill domains), providing an indication of participants' perceived levels of competency in the four different areas and in general (as indicated by their total score across the four skill categories). Perceived competency was measured by participants' responses to each item on a 4-point Likert scale ranging from 1 (*Incompetent*) through 4 (*Fully competent*) with 4 being the highest score and 1 being the lowest score. Exploratory factor analysis described in Chapter IV confirmed that each item of the scale served to describe the traits intended to be measured by the complete CUCTS. Moreover, Cronbach's alpha coefficients indicated high levels of internal consistency for the scale so it is reasonable to conclude the CUCTS is a valid and reliable scale that could be employed in ongoing research and intervention to evaluate computer technology competency among Libyan educators who teach at Libyan universities.

The results of factor analysis agreed with factors identified for the original instrument, showing overall competence consisted of four factors: basic computer operation, use of application software, use of the Internet, and use of peripheral technologies. This similarity suggested workshops for Libyan educators need to address four distinct skill areas; separate workshops for each skill area are likely to accommodate the varying needs of educators. For example, educators with established basic computer operation skills could choose to skip a basic class and move into other areas where they are less competent. This study focused on two primary research questions and their results are discussed as follows.

Research Question One

The first research question addressed whether the skill levels of Libyan educators differed across the four competency areas investigated in this study: basic computer operation and issues, use of application software, use of the Internet, and use of peripheral technologies. A quantitative analysis of responses to the CUCTS scale--Parts A and B using the Friedman's ANOVA test indicated a statistically significant difference in Libyan educators' perceived levels of competency across these four areas. Perceived levels of competency in the different skill areas ranked in the following order: basic computer operations, use of peripheral technologies, use of Internet resources, and use of software applications. In addition, a follow-up analysis using Wilcoxon signed-rank tests showed educators' perceived levels of skill in each area differed statistically from each other. Educators' perceived levels of competency in basic computer operation differed from perceived levels of competency in the use of the internet resources, use of peripheral technologies, and use of software applications. Educators' perceived levels of competency in the use of Internet resources differed from those related to the use of peripheral technologies and the use of software applications. Educators' perceived levels of competency in using peripheral technologies differed from those about the use of software applications.

These results confirmed the veracity of the ranking results. In other words, skill level differences in the four areas were far from minor. These results showed noticeably large gaps and indicated that although many Libyan educators had basic computer operation skills, many lacked the ability to use software and applications for teaching.

Libyan educators' skill levels in the use of Internet resources and software applications lagged far behind basic computer operation skills.

In connection with stage one of Rogers's (2003) diffusion of innovation theory-knowledge phase, these results supported the conclusion that overall competence (the prior knowledge) of Libyan educators was not high. All in all, Libyan educators are not fully competent in the use of computer technologies in classrooms. This finding was expected given that Libya is located in a large region of developing countries. Also, the results of this study aligned with those of Agbatogun (2013) who found university educators in Nigeria, a developing country in Africa, demonstrated low levels of technical skills and a lack of competence in the use of technology. This suggested Libyan educators need workshops that focus on providing intensive information that teaches new skills or reinforces what educators already know. Such workshops would allow Libyan educators to answer the question of "what the innovation is and how it works," a required step for the first phase (knowledge) of the diffusion of innovation theory (Rogers, 2003, p. 21).

Taking an appropriate approach to designing workshops for Libyan educators is critical according to Al Mulhim (2014). The results of this dissertation supported Al Mulhim's statement that workshops for Libyan educators at this stage of integrating technology into Libyan higher education should be designed to focus on the technical aspects of computer technologies. This does not mean pedagogical skills are unimportant components of educator workshops but practically speaking, educators who have limited experience with using technologies in classrooms are likely to prefer to learn basic

computer technologies first and then be involved in pedagogical training later (Al Mulhim, 2014).

The ideal way to construct effective training for Libyan educators is to consider solutions Al Mulhim (2014) suggested based on convergent research findings (Snoeyink & Ertmer, 2001; Veen, 1993). These researchers advocated dividing any training in computer technology into two phases that teach technical skills and pedagogical skills, respectively. Furthermore, the solutions or training packages should be tailored to meet trainees' specific needs and provide real-time experiences in using computers and related technologies rather than generalized (i.e., a "one-size-fits-all" approach). The findings of this research strongly supported this perspective, indicating Libyan educators (both technical and nontechnical) need to be trained sequentially in the technical and then in the pedagogical aspects of using computers in classrooms. To avoid the "one-size-fits-all" approach, workshops for technical and nontechnical educators should be designed differently to accommodate the nature of different curricula.

In addition to providing critical technical and pedagogical training, workshop designers must consider the discipline and content focus required for Libyan educators to improve their teaching via technology. Educators' workloads should be adjusted and aligned with workshop schedules to ensure educators have time to attend. As stated by Elzawi and Underwood (2010), the teaching load at Libyan universities is considered large. For instance, the average number of teaching hours for academic staff is 24 hours per week and some educators undertake extra activities such as writing and publishing research papers to increase their income. Balancing educators' teaching time with research and training activities would assist in establishing an academic research tradition

that has not yet been constructed in Libyan higher education (Elzawi & Underwood, 2010). Therefore, the administration and management system in Libyan universities needs to be fully involved in reconstructing policies that allow educators to participate in professional development workshops as a mandatory part of their profession as well as encouraging them via premiums for conducting research and improving their educational technology skills. Making the workshops a mandatory part of an educator's profession confirms all educators are prepared to use technology in their classrooms; hence, no educator technologically left behind. Moreover, continuity in providing mandatory workshops assists in not only keeping educators current with the latest practices in using classroom technologies but also helps them become more diverse professionals.

Research Question Two

Research question two focused on finding whether competency levels of Libyan educators who specialized in a technical discipline differed from the competency levels of those who specialized in a nontechnical discipline across the four skill areas: basic computer operation and issues, use of application software, use of the Internet, and use of peripheral technologies. Through this question, the researcher sought to test a Libyan stereotype that implied Libyan educators from different disciplines would have different needs related to integrating technology into their teaching. Therefore, this research assessed and evaluated potential differences in educators' competencies based on their major discipline area--technical or nontechnical. In agreement with Al Mulhim's (2014) suggestions, this comparison provided fundamental data, indicating the need to make special efforts in specific educational areas rather than standardizing efforts across all disciplines. A statistically significant difference was found between the discipline groups

(technical and nontechnical) on the combined dependent variables (competency levels) after controlling for gender and educator source of degree, indicating the technical group was more competent in the overall use of computer technology than the nontechnical group. This result corroborated findings of Atai and Dashtestani (2013) who found social studies educators had inadequate skills in using the Internet and other computer technologies. The results of the present study also supported conclusions of Rhema et al. (2013) who found Libyan educators in engineering departments were technically-minded and accepted using technology in their classrooms more than educators in other disciplines.

The statistically significant difference in overall computer skills between technical and nontechnical educators in this study implied the stereotype disseminated in Libyan educational society regarding the influence of different academic disciplines on integrating technology into Libyan higher education might not be a stereotype. Given these results, it is likely more support in acquiring technological skills is needed among nontechnical groups of educators during efforts to integrate computer technologies into higher education classrooms in Libya.

In addition to the difference between educator groups in overall competence, the MANCOVA output also confirmed significant differences between the two groups in basic computer operating skills and in competency using software. However, no significant differences were found between educator groups in their ability to use Internet resources and peripheral technologies. The significant difference between groups in competence with basic computer operations and software use is logical and reasonable based on the statistical results for research question one where Libyan educators ranked

competence with basic computer operations highest among the four skill areas and competence with software applications as the lowest.

Absence of a significant difference between educator groups in their competence in using Internet resources was practical. This result might be explained by the fact that all participating educators had encountered the same circumstances caused by the armed conflict that had been ongoing since 2011. Under those circumstances, navigating the erratic access to the Internet was often the only way for educators to communicate either inside or outside the country.

Similarly, the MANCOVA output showed no significant difference between educator groups in their competence with using peripheral technologies. This finding could be related to the survey questions that focused on using camera equipment and printers. All participating educators indicated they were comfortable with these types of external technologies, likely because many used them in daily life. Although these technologies are basic, they are fundamental to teaching with technology. Future research should investigate Libyan educators' comfort levels with additional peripheral technologies to obtain more detailed information about this skill area.

Competency in Using Computer Technology Scale Survey, Part C: General Information

The forced-choice and open-ended survey questions directed at obtaining information about participants' perspectives on positives of using computer technologies in classrooms and issues related to technology integration into Libyan higher education systems added insightful information to this study. Specifically, the high percentages of responses to the question related to educators' perspectives regarding the positives of

using computer technology in their classroom implied Libyan educators knew the only way to improve their educational development and research activities was via computer technologies. These positives were not new as they were confirmed by Kenan et al. (2014) in an overview of the current trends and policy issues for e-learning implementation in Libyan universities.

However, knowing about or valuing the use of computer technologies in classrooms does not mean or guarantee educators are fully competent and ready to embed technology into their teaching. This statement agrees with Rogers's (2003) viewpoint on certainty in making decisions when a new innovation is presented. Rogers argued attitudes toward an innovation could not be shaped until those involved actually used the innovation. Therefore, Libyan educators' perceptions about the value of using technology in their classrooms cannot be completely formed until they have a chance to use computers in their classrooms--the implementation stage of Rogers's model.

This study also obtained data regarding what Libyan educators considered to be the main barrier to integration of technology into their classrooms. Of the options provided, 94 participants (58%) thought the main barrier to technology integration was limited access to technology in classrooms (mostly computers and Internet) and 20 participants (12%) considered the main barrier to the integration of technology to be the long development and delivery time needed to complete the process. Taken together, these responses indicated a high percentage of Libyan educators believed administration and management systems needed to be enhanced so these systems could respond to their needs and provide funding for building the needed infrastructure changes in Libyan universities.

Notably of the options provided, only 23 participants (14%) thought the main barrier that influenced the integration of technology into their classrooms was educators' competencies in using classroom computer technologies. This was a small percentage compared to the other two responses taken together. This result was unexpected and contradicted the results of the quantitative analysis for research question one, which showed Libyan educators were not fully competent in using computer technologies into their classrooms. This inconsistency could be explained by differences in educators' perceived levels of computer competence and their willingness to learn and grow in this area. They might not feel completely competent but this was not considered the main barrier because they were willing to attend training and engage in using educational technology. Libyan educators' willingness to improve their teaching using technology was also confirmed by Rhema et al. (2013).

An additional interpretation of why Libyan educators thought their competence was not a main barrier to integrating technology into Libyan universities that is reasonable and realistic related to the current physical situation in Libya. Educators expressed in their comments the massive damage to Benghazi University, the very limited infrastructure at Omer-AL Moktar University, and the difficulty of obtaining living needs led them to believe physical and political factors were the main barriers to enhancing their abilities to teach using computers rather than their existing computer technology skills.

When educators were asked about the most effective way to improve their competency in using computer technology in classrooms, 103 participants (64%) expressed the most effective way to improve educators' competency in using computer

technology in classrooms was to provide workshops. Fewer participants (33, 20%) thought the most effective way to improve educators' competency in using computer technology in classrooms was through self-training with books, records, etc., without direct supervision or attendance in a class. The high percentage of positive responses to the idea of workshops indicated Libyan educators who participated in this study were motivated to improve their skills in teaching with technology by attending the types of workshops this study proposed. Participants who favored self-training might have different learning styles, have better access to the Internet and computers, or have the financial resources needed to travel outside of the country and access different resources than others might have.

Statements made by participants in the last open-ended questions of the survey about types of support and resources Libyan educators needed to improve their skills in teaching with technology and the recommendations they suggested for Libyan researchers confirmed what other Libyan researchers found (Bukhatowa et al., 2010; Kenan et al., 2011, 2014; Rhema & Miliszewska, 2010). Similarities in these statements and recommendations indicated numerous efforts were directed at improving Libyan higher education but these efforts were neglected. Indeed, there was a need to eliminate corruption throughout the administrative systems in Libyan higher education as suggested by Kenan et al. (2014).

“One hand cannot clap.” Libya desperately needs to have all educators, students, staff members, and society as a whole reach a consensus about the importance of educational reform in supporting the future well-being of the country. Educators, students, and staff members need a unified goal, the ability, and the motivation to

transform this goal into action. Libyan universities need to move from traditional instructional practices to technology-based teaching. The massive amount of effort and time needed to support students through this change and to assure transferability among all members of the education system is daunting (Hutchings & Quinney, 2015).

Drawing attention to this demand of time and energy, Hutchings and Quinney (2015) proposed strategies “for ensuring reliability and sustainability of resources and tools, changing people and cultures” (p. 114) that included “creating a shared vision through a holistic model for education innovation” (p. 115). This strategy helped increase the degree to which all personnel were in agreement with needed changes and supported the goals and objectives presented by the proposed plan. The strategies also included “building a robust and dedicated core team for managing change” (Hutchings & Quinney, 2015, p. 116). A team should be created to plan and manage the integration process, anticipate and address the risks followed by changing the culture, and establish solutions for problems. This team must also be responsible for “capitalizing on networking opportunities and forming alliances for horizon scanning” (Hutchings & Quinney, 2015, p. 117). Alliances are essential to providing opportunities for educators to network and exchange expertise with different higher education institutions in neighboring countries such as Tunisia and Egypt to specify the challenges, advantages, and ways to make the integration process go faster (Hutchings & Quinney, 2015).

Libya is just one of several countries currently in crisis. It seems redesigning the educational system, especially the system of higher education, would be easier now than if Libya had planned to build the technology before the onset of war because during this period, people have become more skilled in the use of the Web to follow news and

connect with the outside world. People in Libya have become familiar with technology through the use of texting, emailing, and Skyping. Therefore, institutions should take advantage of this improvement in digital skills and incorporate them into learning processes. However, one of the most important challenges to integrating technology into Libyan higher education has been that Libyan administrators and policy makers need to assist in making educators' call for obtaining living needs heard. In addition, Libyan administrators and policy makers technically are challenged to provide consistent Internet access for the universities. These authorities are also responsible for facilitating the availability of the Internet in homes, neither of which is a simple task (Guessoum, 2006). Due to this restriction, the first stage of integrating technology in Libyan education should be rudimentary such as providing affordable Internet access and computers with appropriate basic software to classrooms. When these fundamental needs have been met, institutions could gradually add more resources for blended or distance learning systems for the universities and efforts to offer organized access to the Internet in homes could increase.

Implications and Recommendations

Findings of this study are of value to Libyan administrators, policy makers at the Libyan Ministry of Education, and Libyan educators. The results of this study have numerous implications and recommendations for consideration by administrators and policy makers in Libyan higher education as they make efforts to support educators throughout the process of learning to enhance their teaching via computer technologies.

First, the country's centralized decision system, including the Libyan Ministry of Education, is located in Western Libya, which leads to delayed responses to the needs of

universities and institutions in Benghazi and surrounding cities in Eastern Libya. Indeed, it is the responsibility of administrators and policy makers in the Libyan Ministry of Education to ease the procedures and closely attend to the needs of universities and educators in Eastern Libya. The administrators and policy makers in the Libyan Ministry of Education should be aware of the critical role university educators play in Libyan society. Libyan educators are not only a significant resource to influence Libyan education system by teaching prospective teachers but also by teaching future employees. They are also an invaluable resource to influence other systems in the country such as economy, agriculture, and law.

Second, the Libyan Ministry of Education is also expected to respond promptly with necessary financial support for universities in Eastern Libya. Financial and logistic support would contribute to reducing the migration of Libyan educators and staff members who have strong technological skills to other countries and universities. Furthermore, those who know their country's needs and culture might serve their country better than experts hired from outside of the country.

Maslow's (1943) hierarchy of needs could provide Libyan administrators and policy makers with a reminder and framework that Libyan educators are less likely to perform at their full potential if their basic needs are unmet. Specifically, the first two stages of Maslow's theory, physiological and safety stages, highlight the importance of providing Libyan educators' life needs first and then work to meet their teaching with technology needs in the remaining stages of the theory. Physiological needs include food, water, sleep, and shelter. If all Libyan educators have these needs met, the next

stage is safety. How safe and secure do those educators feel in their country? What about their safety at university campuses? These questions need to be addressed.

Last but not least, Libyan educators need technical workshops that establish basic competencies before the actual implementation of computer technologies in their classrooms takes place. Therefore, infrastructure issues in Libyan universities must be addressed to support effective skill training including specifying a suitable center for conducting the workshops, establishing consistent Internet access, providing up-to-date computer equipment required for educators' professional development, and providing competent instructors.

The structure of the workshops should be comprised of four different workshops, each focused on a specific area. Workshops about basic operations would provide a solid foundation of using computers in classrooms. Once educators understand the basics, they will have a clear understanding on which to build their future knowledge of and skill with computer technologies and the Internet. Table 6 summarizes activities for these workshops.

Table 6

Activities Suggested for Computer Technologies Workshops

Basic Computer Operations	Use of Application Software	Use of Internet Resources	Use of Peripheral Technologies
Locate an application program (e.g. Word).	Open a new document in Microsoft Word.	Access an Internet site via its website address.	Use a digital camera to capture images.
Run an application program (e.g. Word).	Use simple editing tools (e.g. bold, italics, centering, font size, etc.).	Download files from the Internet.	Transfer pictures from camera to computers.
Search for files on a computer system.	Use a spreadsheet package to filter data.	Attach files to outgoing email messages.	Use a web camera to communicate with others on the Internet.
Access information on a CD/DVD.	Use a spreadsheet package to make reports.	Send e-mail messages.	Perform connections to set up a multimedia projector.
Organize electronic files into folders.	Use a spreadsheet package to sort data.	Access to received e-mail messages.	Incorporate a Multimedia Projector in actual teaching.
Move files between folders.	Create a basic presentation package.	Save text and images from web pages.	Use a scanner to scan images.
Link to various networked printers.	Modify a slide (e.g., change colors of text, lines, and spaces, etc.).	Use web search engines (e.g., Google, etc.).	How physically connect computers to printers.
Access information on a flash drive.	Include animations into slides.	Chat on the Internet using instant messaging tools (e.g., Skype, etc.)	Connect speakers to computers.

Note. Application software workshops might also include a specific software each department needs. For instance, the geography department might add the basics of using over shelves applications (free) such as QGIS mapping software.

Limitations

Although this study achieved its targets, several limitations were unavoidable. First, a substantial challenge to this research was the difficulty in finding current scientific research related to integrating technology into higher education in Libya. Current research evaluated the use of technologies far in advance of those available in Libya; thus, much of the current research had limited relevance to this study. Libya has not used the Internet and other computer technologies in higher education, resulting in a low scientific research contribution in regional and international research organizations.

Secondly, a questionnaire with limited qualitative information was used to obtain data--a self-report method. Therefore, the findings could have been influenced by educators' social willingness to provide desirable information rather than a truthful response that reflected their actual skills in using computer technologies. It was difficult to make a final decision about educators' competency using a survey (Palak & Walls, 2009) but the survey information could be enriched by conducting classroom observations. Using observations would assist in gathering more data related to educators' competencies in using classroom technologies. However, the current safety situation in Libya prevented any attempt to implementing local classroom observations.

Third, the convenience sampling method used restricted the findings to the sample of Libyan educators who participated in the study. Therefore, the findings could not be generalized to all Libyan educators who had technical and nontechnical backgrounds. However, the generalizability of the results of this study could be supported by replicating this study at other Libyan universities. "Repeated replication of the findings is much stronger evidence of their validity and generalizability than is a statistically

significant result in one study” (Gall et al., 1996, p. 229). Lastly, the response rate was not high as a consequence of current safety issues in Libya, which have resulted in many educators temporarily residing outside of the country. Some recommendations that might assist in overcoming some of these limitations are discussed in the following section.

Recommendations for Future Research

The instability and changes in all Libyan organizations make Libya a fruitful environment for obtaining rich research data. Ironically, this difficult context might facilitate major educational reform in Libya by improving the education system from scratch as opposed to making efforts to accommodate an outdated traditional system. This study evaluated faculty members’ competence in using computer technologies because current levels of computer competence strongly influence efforts to integrate technology into Libyan university classrooms. Nevertheless, the study did not assess educators’ attitudes toward this effort. Therefore, future studies that focus on assessing educator attitudes about using technology might serve to identify additional barriers that might impede the process of integrating technology into Libyan instructional practices. An investigation of attitudinal factors is needed as it applies to the second phase of Rogers’s (2003) model--the persuasion phase--where individuals shape their attitudes after they know how to use classroom technologies because they have attended the workshops provided in the first phase--the knowledge phase. Policy makers and administrators in Libya might benefit from such studies because they are likely to provide further suggestions about how to improve efforts.

Through ongoing research efforts, policy makers in the Libyan Ministry of Higher Education will become more informed about factors that hinder or facilitate the

integration of technology into the instructional practices of faculty members at the university level throughout the postsecondary educational system in Libya. This study contributed findings from two postsecondary education institutions; consequently, studies targeting several institutions at once might help policy makers and administrators become more informed about success or failure of their efforts.

The instrument and design used for this study could guide future investigations of educators' competence in using basic computer technologies in classrooms in different educational settings in Libya, in different parts of Libya, and in other Arabic countries in Africa or in the Middle East. This study provided information for comparative research about educational systems within Libyan and in similar countries. Since the instrument was translated into Arabic, future studies might use the same instrument in North Africa or in the Middle East to establish a firm foundation of validity and reliability for the instrument.

The study was a quantitative study using a survey design. Consequently, it is suggested that other studies use qualitative designs with the same population or other target populations, e.g., students and other staff members in Libyan universities, and incorporate observation or interviews as well. Variety in designs and sample characteristics across different studies would provide information that could not be accessed using a survey instrument.

Summary

This study contributed to the growing body of knowledge in the area of integrating technology into Libyan higher education as well as in African countries and Arabic countries in general. This chapter provided interpretations of the study findings as

they related to the weak infrastructure at Libyan universities and to the current situation in the whole country. The chapter also provided limitations of the study and recommendations for future work. Focusing on the limitations of this study might strengthen the results of future studies related to the integration of technology into Libyan education system.

Overall results of this study showed the majority of Libyan educators currently working in universities lacked computer-related skills necessary for integrating computer technology into the Libyan higher education system. Although many participants had basic computer operation, they lacked access to computer hardware and the Internet. They also had very limited experience with use of Internet resources, additional software, and peripheral technologies associated with modern instructional practices. Furthermore, damaged and limited infrastructures and inconsistent commitment on the part of administrative authorities have hindered progress in providing the equipment, internet access, and software applications educators need to have to accomplish a successful transition to using computer technology in the classroom. Study participants generally believed integrating educational technology into the Libyan higher education is needed to accomplish educational reform and increase Libyan worldwide research contributions. Findings of this study suggested fundamental education infrastructure issues must be addressed before effective skill training for educators in Libya can proceed, e.g., establishing consistent Internet access and providing up-to-date computer equipment. Therefore, qualitative information contributed to this study by participants needs to be reported to administrators and policy makers in Libya at Benghazi University and Omer Al-Moktar University along with a summary of the statistical results of this research.

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APPENDIX A
PERMISSION TO USE INSTRUMENT

● Asking for Permission (3)

People ★

● **lereyusuf** <lereyusuf@yahoo.com>

10/08/15 at 5:52 AM ★

To Ilham Hbaci

Thanks for the message.

I wish to express my acceptance of your request.

You are free to make use of the instrument as desired.

M. O. Yusuf
University of Ilorin

Ilham Hbaci <ilhamhbaci@yahoo.com> wrote:

Dear Prof.Yusuf,

I am Ilham, a PhD student at University of Northern Colorado, United States. I am conducting a study that aims to investigate the future of implementing technology in Libyan higher education. I would like to have your permission to use a survey that you use in your paper titled " student-teachers' competence and attitudes towards information and communication technology: A case study in a Nigerian University" (2011).

I am looking forward to have your permission as soon as possible.

Thanks and Regards,
Ilham Hbaci

APPENDIX B
ENGLISH VERSION OF THE SURVEY

Competencies Using Computer Technology Survey

Part A: Personal Information

Please provide the following information for data analysis purposes. All responses are kept confidential (please do not write your name).

Please mark one answer from the provided choices.

1. My discipline is:	Technical disciplines from <input type="radio"/> College of Engineering, <input type="radio"/> College of Science, <input type="radio"/> College of Economics	Non-Technical disciplines from <input type="radio"/> College of Law, <input type="radio"/> College of Arts, <input type="radio"/> College of Education
2. My gender is:	<input type="checkbox"/> Female	<input type="checkbox"/> Male
3. I earned my last graduate degree from:	<input type="checkbox"/> An Arabic university	<input type="checkbox"/> A Western university
4. My current job requires me to use computers:	<input type="checkbox"/> Yes	<input type="checkbox"/> No
5. My academic degree is :	<input type="checkbox"/> Master	<input type="checkbox"/> Ph.D.

Please write your answer for the following questions.

6. My age is:	
7. Number of years of experience in higher education is:	
8. I teach in the department of:	
9. I got my last graduate degree in:	

Part B: Competency in Using Computer Technology

Below is a set of skills dealing with the use of technology. Please mark your answer for each question from the provided choices.

1. Basic Computer Operation

Statement	Incompetent	Somewhat Incompetent	Somewhat Competent	Fully Competent
1. I can locate an application program (e.g. Word).				
2. I can run an application program (e.g. Word).				
3. I can search for files on a computer system.				
4. I can access information on a CD/DVD.				
5. I can organize electronic files into folders.				
6. I can move files between folders.				
7. I can link to various networked printers.				
8. I can access information on a flash drive.				

2. *Use of Application Software*

Statement	Incompetent	Somewhat Incompetent	Somewhat Competent	Fully Competent
9. I can open a new document in Microsoft Word.				
10. I can use simple editing tools (e.g. bold, italics, centering, font size, etc.).				
11. I can use a spreadsheet package to filter data.				
12. I can use a spreadsheet package to make reports.				
13. I can use a spreadsheet package to sort data.				
14. I can create a basic presentation package.				
15. I can modify a slide (e.g., change colors of text, lines, and spaces, etc.).				
16. I can include animations into slides.				

3. The Use of Internet Resources

Statement	Incompetent	Somewhat Incompetent	Somewhat Competent	Fully Competent
17. I can access an Internet site via its website address.				
18. I can download files from the Internet.				
19. I can send e-mail messages.				
20. I can access received e-mail messages.				
21. I can attach files to outgoing e-mails.				
22. I can save text and images from web pages.				
23. I can use web search engines (e.g., Google, etc.).				
24. I can chat on the Internet using instant messaging tools (e.g., Skype, etc.)				

4. *The Use of Peripheral technologies*

Statement	Not competent	Somewhat Incompetent	Somewhat Competent	Fully Competent
25. I can use a digital camera to capture images.				
26. I can transfer pictures from camera to computers.				
27. I can use a web camera to communicate with others on the Internet.				
28. I can incorporate a Multimedia Projector into my teaching.				
29. I can perform connections to set up a Multimedia Projector.				
30. I can use a scanner to scan images.				
31. I can physically connect computers to printers.				
32. I can connect speakers to computers.				

Part C: General Information

Please mark one or more option to answer the following question.

1. What do you consider as positive(s) that will influence the integration of technology into your classroom?

- Allow educators and students access various educational resources.
- Enhance the communication between students and educators.
- Provide time for feedback and discussion in the classroom by reducing the amount of lecturing.
- Others (Please list here-----).

Please mark one answer for each question from the provided choices.

2. What do you consider as the main barrier that will influence the integration of technology into Libyan higher education?

- Limited access to technology in classrooms, mainly computers and Internet.
- Educators' competencies in using computer technologies in the classroom.
- The long development and delivery time needed to integrate technology into Libyan classrooms.
- Others (Please list here-----).

3. What do you consider as the most effective way to improve educators' competency in using computer technology in classrooms:

- Workshops.
- Self-training through books, records, etc., without direct supervision or attendance in a class.
- Others (Please list here-----).

Please write your answer for the following question:

4. What kind of support do you think will help you to improve your teaching using technology?

(-----).

5. Do you have any recommendations for Libyan researchers towards improving Libyan education by using technology?

(-----).

APPENDIX C
ARABIC VERSION OF THE SURVEY

إستبيان حول كفاءة إستخدام التكنولوجيا فى التعليم العالى فى ليبيا

الجزء الأول: معلومات شخصيه

يرجى اختيار إجابته واحده من الأختيارات المعطاه. كل الإجابات سوف تحفظ بسريه تامه. يرجى عدم كتابه اسمك على الأستبيان.

1. التخصص:	فى المجال العلمى	فى المجال الأديبى
	<input type="radio"/> كلية الهندسه <input type="radio"/> كلية العلوم <input type="radio"/> كلية الأقتصاد	<input type="radio"/> كلية القاتون <input type="radio"/> كلية الأداب <input type="radio"/> كلية التعليم
2. الجنس:	<input type="radio"/> ذكر	<input type="radio"/> أنثى
3. حصلت على آخر درجة علمية:	<input type="radio"/> من جامعه عربيه	<input type="radio"/> من جامعه غير عربيه
4. عملى الحالى يتطلب إستخدام الكمبيوتر:	<input type="radio"/> نعم	<input type="radio"/> لا
5. الدرجة العلميه الحاليه:	<input type="radio"/> ماجستير	<input type="radio"/> دكتوراه

الرجاء كتابه إجابتهك لأ سئله التاليه:

6. العمر
7. عدد سنوات العمل فى مجال التعليم العالى:
8. أقوم بالتدريس فى قسم:
9. تحصلت على آخر درجة علميه (ماجستير أو دكتوراه) فى سنه:

الجزء الثاني: الكفاءة في استخدام تكنولوجيا الكمبيوتر

ادناه يوجد قائمه تتعلق بمهارات استخدام التكنولوجيا يرجى اختيار إجابتك من الخيارات المعطاه.

1. المهارات الأساسية لإستخدام الكمبيوتر

كفئ	كفئ بعض الشيء	غير كفئ بعض الشيء	غير كفئ	المهاره
				1. أستطيع تحديد مكان تواجد التطبيقات في جهاز الكمبيوتر على سبيل المثال تطبيق Word Document
				2. أستطيع تفعيل التطبيقات على سبيل المثال تفعيل Word Document
				3. أستطيع البحث عن الملفات في جهاز الكمبيوتر
				4. أستطيع الوصول الى المعلومات المخزنه في ذاكره اليباتات CD/DVD
				5. أستطيع تنظيم الملفات إلى مجلدات
				6. أستطيع نقل الملفات بين المجلدات
				7. أستطيع تعريف الطابعات في جهاز الكمبيوتر
				8. أستطيع الوصول الى المعلومات المخزنه في ذاكره اليباتات flash Drive

2. المهارات في إستخدام التطبيقات

كفئ	كفئ بعض الشيء	غير كفئ بعض الشيء	غير كفئ	المهاره
				9. أستطيع أن افتح ملف جديد بإستخدام Word Document
				10. أستطيع إستخدام أدوات التحرير المتواجده في التطبيقات على سبيل المثال التحكم في حجم الخط، موقع الكتابه في الصفحه، مدى وضوح الخط، اختيار الخط المائل.
				11. أستطيع تتقيح اليباتات بإستخدام Spreadsheet Package
				12. أستطيع عمل تقارير بإستخدام spreadsheet Package

				13. أستطيع تنظيم البيانات باستخدام Spreadsheet Package
				14. أستطيع عمل عرض للبيانات Presentation Slides
				15. أستطيع التحكم في البيانات الموجوده في أداة عرض البيانات على سبيل المثال التحكم في لون الخط , ترتيب الأسطر, و التحكم في الفراغات
				16. أستطيع إستخدام الرسوم و الكلمات المتحركه في أداة عرض البيانات Animation

3.المهارات في إستخدام الأنترنت و مصادر ها

المهارة	غير كفن	غير كفن بعض الشيء	كفن بعض الشيء	كفن
17. أستطيع الوصول إلى أي موقع الكتروني باستخدام عنوانه الإلكتروني				
18. أستطيع تحميل ملفات من المواقع الإلكترونيه أو الأنترنت				
19. أستطيع إرسال رسائل إلكترونيه				
20. أستطيع إستقبال الرسائل الإلكترونيه				
21. أستطيع إرفاق ملفات مع الرسائل الإلكترونيه				
22. أستطيع تخزين صور و نصوص خطيه من الصفحات الإلكترونيه				
23. أستطيع إستخدام أدوات البحث في الإنترنت على سبيل المثال Google				
24. أستطيع إستخدام برامج التواصل على سبيل المثال Skype				

4.المهارات في إستخدام المعدات التي يتم إيصالها بالكمبيوتر

المهارة	غير كفن	غير كفن بعض الشيء	كفن بعض الشيء	كفن
25. أستطيع إستخدام آلة التصوير لإلتقاط الصور				
26. أستطيع نقل الصور الفوتوغرافيه من آلة التصوير إلى جهاز الكمبيوتر				

الجزء الثالث: معلومات عامه

الرجاء اختيار إجابيه أو أكثر من الخيارات المعطاه

1. من وجه نظرك , ما هي إجابيات إستخدام التكنولوجيا في تدريسك ؟

- السماح للطلاب و المعلم للوصول الى مراجع علميه متعدده
- تحسين التواصل بين الطلبة و المعلمين
- إعطاء وقت كافي للحوار بين المعلم و الطلبة و اعطاء النتائج من خلال تقليص وقت المحاضره
- إجابيات أخرى (الرجاء كتابها هنا) _____

الرجاء اختيار إجابيه من الخيارات المعطاه

2. ما هو العائق الأساسي من استخدام التكنولوجيا في التعليم العالي في ليبيا؟

- نقص في توفر أجهزة الكمبيوتر و الإنترنت في القصول الدراسيه
- قلة كفاءة أعضاء هيئة التدريس اللازمه لإستخدام الكمبيوتر و الإنترنت في تدريسهم
- التأخير في توفير الإحتياجات و الطلبات التي يقدمها أعضاء هيئة التدريس لكي يتمكنوا من إستخدام التكنولوجيا في تدريسهم
- أسباب أخرى (الرجاء كتابها هنا) _____

3. ما هي الوسيله الأفضل لتطوير كفاءه أعضاء هيئة التدريس لكي يتمكنوا من إستخدام التكنولوجيا في التعليم

- ورشات عمل
- التدريب الذاتي عن طريق كتب او مشاهده فيديوهات تعليميه
- وسائل أخرى (الرجاء كتابها هنا) _____

الرجاء كتابة إجابتك للأسئلة التالية:

4. ما هو نوع الدعم الذي تحتاجه لكي تتمكن من تطوير طريقه تدريسك بإستخدام التكنولوجيا

5. هل لديك اي توصيه للباحثين الليبيين لكي يساهموا في تطوير التعليم العالي الليبي بإستخدام التكنولوجيا

APPENDIX D
ENGLISH VERSION OF THE CONSENT FORM



UNIVERSITY OF
NORTHERN
COLORADO

CONSENT FORM FOR HUMAN PARTICIPANTS IN RESEARCH UNIVERSITY OF
NORTHERN COLORADO

Research Title: Evaluating Educators' Competency in the use of Computer Technology towards Integrating Technology into Libyan Higher Education.
Researcher: Ilham Hbaci, Doctoral student, department of Educational Technology, UNC
Phone: (970) 402-4673. **E-mail:** hbac3324@bears.umco.edu
Instructor: Dr. Heng-Yu Ku (Educational Technology)
Phone: 970-351-2935 **E-mail:** Heng-Yu.Ku@unco.edu

The primary purpose of this quantitative survey research is to emphasize on the implementation of technology into Libyan higher education from the educators' perspective. First, the researcher wants to evaluate educators' competencies in using computer technology in four areas: Basic Computer Operation, the Use of Application Software, the Use of Internet, and the Use of Peripheral Technologies.

Second, the researcher seeks to test a Libyan stereotype that implies that Libyan educator disciplines will impact the future integration of technology into Libyan higher education. Hence, this research aims to determine if there is a difference in educators' competency between educators who major in technical areas and those who major in nontechnical disciplines. This comparison may provide rudimentary data indicating the need to make special efforts in particular educational areas or standardize efforts across all disciplines. All participants will be Libyan educators who work at the main universities in Eastern Libya (Benghazi and Omer Al-Moktar Universities). At this stage of the proposed study, the technology integration purview includes: computer hardware and software, Internet usage, and other digital equipment that converts information such as texts and sounds into a digital format.

You are being asked to participate in a 10-15 minute to complete a survey. No identifying information will be collected about you such as address and phone number, and all data and reports will be kept locked in order to protect your privacy. By your participation, you may actually perceive a benefit, because you can share your opinions and experiences, improve insight into this topic, and participate in serving your country.

Participation is voluntary. You may decide not to participate in this study and if you begin participation you may still decide to stop and withdraw at any time. Your decision will be respected and will not result in loss of benefits to which you are otherwise entitled. Having read the above and having had an opportunity to ask any questions please fill out the survey if you would like to participate in this research. By completing the survey, you give your permission to be included in the study as a participant. A copy of this form will be given to you to retain for future reference. If you have any concerns about your selection or treatment as a research participant, please contact Sherry May, IRB Administrator, Office of Sponsored Programs, 25 Kepner Hall, University of Northern Colorado Greeley, CO 80639; 970-351-1910.

APPENDIX E
ARABIC VERSION OF THE CONSENT FORM



UNIVERSITY OF
NORTHERN
COLORADO

نموذج موافقه على المشاركة فى تعبئه استبيان

الأخوه و الأخوات اعضاء هيئه التدريس بجامعة بنغازى و عمر المختار

University of Northern أنا طالبة دكتوراه دراسة فى تخصص تكنولوجيا التعليم بجامعة كولورادو الشمالية وارجو مشاركتك فى هذه الدراسة المسحية التى ستكون جزءاً من رسالتى للدكتوراه. قد تم اختيارك على اساس Colorado مؤهلك كعضو هيئه تدريس بأحدى الجامعتين اعلاه.

إن الهدف الأساسى من هذه الدراسة هو تقييم كفاءة اعضاء هيئه التدريس فى ليبيا عن مجموعه من المهارات التى تتضمن استخدام التكنولوجيا فى طرق تدريسهم. هذه المهارات تتضمن : المهارات الأساسيه لإستخدام التكنولوجيا, برامج وتطبيقات الكمبيوتر, إستخدام الإنترنت , و المهارات فى استخدام الأجهزة الخارجيه التى يتم اوصولها بالكمبيوتر لكى تفيد المدرس و الطالب فى التعليم. بالإضافة الى هذا الهدف, سوف تتضمن الدراسة تقييم كفاءة اعضاء هيئه التدريس فى استخدام التكنولوجيا فى جميع التخصصات سواءً كانت العلميه او الأدبيه وبالتالى إنشاء ورشات عمل لإعضاء هيئه التدريس التى سوف تمكنهم من الإستفاده القصوى من التكنولوجيا المتوفره لديهم والمساهمه فى بناء أجيال المستقبل التى يتلائم تعليمها مع عصر التكنولوجيا العالمى.

إن اسئله الإستبانة بسيطه ومباشره ولن تأخذ من وقتك اكثر ما بين 10 الى 15 دقيقه. تعبئه الإستبانة و إعادتها تعنى موافقتك على المشاركة فى هذه الدراسة. إن مشاركتك تطوعيه و اجابتك ستعامل بسريره تامه ولن يتم إستعمالها إلا لإغراض البحث العلمى. بحيث لا يمكن التعرف على اى شخصيه من المشاركين فيها. وسيتم أخذ جميع الإحتياطات الممكنه للحفاظ على السريه التامه. وسنزودك بملخص عن النتائج إذا رغبت بذلك. يمكنك توجيه اى استفسار عن هذه الدراسة على عنوانى الألكترونى أوالعنوان الألكترونى للمشرف على دراستى البروفسور هينق يو كو المعطى ادناه . كما يمكنك الأستفسار عن هذا المشروع مع لجنة الشؤون الإنسانيه فى جامعة كولورادو الشمالية على التلفون (970-351-1910).

الباحثه

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تحت إشراف الدكتور هينق يو كو

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APPENDIX F
BENHAZI UNIVERSITY APPROVAL

إيمان مع من أجروا
الأستبيان عينه من
أعضاء هيئة التدريس
جامعة بنغازي



التاريخ: 2016/11/10
الموضوع: موافقه على عمل دراسه

السلام عليكم ورحمه الله وبركاته
الأخ الفاضل عميد جامعة بنغازي:

أنا طالبه الدكتوراه إلهام عبدالرازق البوصيري حباق, تخصص استخدام التكنولوجيا في التعليم بجامعة اليو إن سي بالولايات المتحدة الامريكه (University Of Northern Colorado) اتقدم بطلبي هذا راجيه فيه منكم الموافقه على اجراء دراسه حول استخدام الوسائل التقنية الحديثه للتعليم في جامعة بنغازي. بحثي هذا يحتاج الى إجراء إستبيان على عينه من اعضاء هيئه التدريس بجامعة بنغازي وارجوا منكم الموافقه على تطبيق هذا البحث الهادف الى تطوير طرق التدريس بجامعة بنغازي.

لكم مني جزيل الشكر سلفا

إلهام عبدالرازق البوصيري حباق

التاريخ: 2016/11/10

التوقيع: 

APPENDIX G

OMER AL-MOKTAR UNIVERSITY APPROVAL

السادة
عميد جامعة عمر المختار
لدراسة
مع الرضا




التاريخ: 2016/11/10
الموضوع: موافقه على عمل دراسته

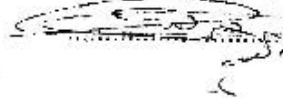
السلام عليكم ورحمه الله وبركاته
الأخ القاضى عميد جامعة عمر المختار:

أنا طالبه الدكتوراه إلهام عبدالرازق البوصيري حباقي، تخصصت استخدام التكنولوجيا في التعليم بجامعة اليواين سي بالولايات المتحدة الأمريكية (University Of Northern Colorado) اتقدم بطلبى هذا راجيه فيه منكم الموافقه على اجراء دراسته حول استخدام الوسائل التفتية لتحديثه للتعليم في جامعه عمر المختار. بحفى هذا يحتاج الى اجراء إستبيان على عينه من اعضاء هيئه التدريس بجامعة عمر المختار، وارجوا منكم الموافقه على تطبيق هذا البحث الهادف الى تطوير طرق التدريس بجامعة عمر المختار.

لكم سنى جزيل الشكر سلفا

إلهام عبدالرازق البوصيري حباقي

التاريخ: 2016/11/10

التوقيع: 

APPENDIX H
INSTITUTIONAL REVIEW BOARD APPROVAL



Institutional Review Board

DATE: April 14, 2017

TO: Ilham Hbaci
FROM: University of Northern Colorado (UNCO) IRB

PROJECT TITLE: [1046788-2] Evaluating Educators' Competency in the use of Computer Technology towards Integrating Technology into Libyan Higher Education.

SUBMISSION TYPE: Amendment/Modification

ACTION: APPROVAL/VERIFICATION OF EXEMPT STATUS

DECISION DATE: April 14, 2017

EXPIRATION DATE: April 14, 2021

Thank you for your submission of Amendment/Modification materials for this project. The University of Northern Colorado (UNCO) IRB approves this project and verifies its status as EXEMPT according to federal IRB regulations.

We will retain a copy of this correspondence within our records for a duration of 4 years.

If you have any questions, please contact Sherry May at 970-351-1910 or Sherry.May@unco.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Northern Colorado (UNCO) IRB's records.