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Evaluating higher education educators' computer technology competencies in Libya

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Abstract

The purpose of this study was to evaluate issues related to the integration of technology into Libyan higher education from Libyan educators' perspectives. A total of 161 Libyan educators who worked at the two main universities in Eastern Libya participated in the study. The study focused on four critical computer technology skill areas: (1) basic computer operation, (2) advanced computer operation, (3) use of the Internet, and (4) use of peripheral technologies. The three research objectives of the study were to (1) evaluate educators' skill levels in four areas of computer competency, (2) investigate educators' learning needs based on their specialty, and (3) explore educators' teaching needs regarding types of support that allow them to improve classroom teaching. The results showed levels of perceived competency in each skill area differed significantly from perceived competence in each of the other areas. In addition, the results showed a statistically significant difference between educators who are from technical disciplines and non-technical disciplines in overall competence in using computer technologies. Furthermore, it showed that educators in technical disciplines expressed more competence in the basic and advanced computer operations. 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. The supplemental data using an open-ended question presented that type of support Libyan educators need to improve their teaching using computer technology. Finally, several recommendations were provided to the stakeholders in Libyan higher education.

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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, in countries such as Libya, is still using traditional instruction throughout its educational settings (Rhema et al. 2013). Libyan education needs development and renovation because most college students in Libyan universities continue to experience and regard physical, non-technological classrooms as the only place to learn, receive materials, meet face-to-face with instructors and classmates, and have questions answered by instructors or colleagues (Rhema and Miliszewska 2010).

In the Libyan education system, university teachers are called educators to distinguish between them and school teachers. For educators, restriction to the physical classroom has become increasingly problematic due to continued civil unrest caused by the political upheaval that has been ongoing since 2011. Therefore, investing in educational technology, such as computers and Internet access, could improve Libyan education by providing alternative opportunities for students and educators to communicate.

Successful integration of technologies into classroom learning is associated with many factors, but one of the main supporting determinants is user competency (Abouchedid and 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). Furthermore, educators who were comfortable in using one technology were more likely to explore new technology (Kagima and Hausafus 2001). Hence, as part of an initiative to improve the Libyan higher education system, this study focused on the competencies of educators relative to technology integration.

The academic specialties of each educator also need to be investigated because of a unique characteristic in Libyan higher education (Rhema et al. 2013). Some disciplines are categorized in the Libyan education system as technical disciplines (e.g., engineering, science, and economics), where the curriculum content already has some built-in technologies such as computers (Bukhatowa et al. 2010). This group of educators is considered by the educational society to be skilled in using technology (Rhema et al. 2013). 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.

On the other hand, some disciplines are considered to be non-technical disciplines, such as law, arts, and education (Bukhatowa et al. 2010), where the curricula do not require the use of technology, leading to the speculation of lacked skills in using technology (Rhema et al. 2013). This speculation has been driven in part by the belief that incorporating technology into these disciplines was not necessary. Because of the assumptions related to a discipline's influence on technology

integration in Libya, this study included participants from both technical and non-technical disciplines in order to understand whether or not educators in different academic areas had different competency levels.

Libyan educators are used to teaching with the method of "chalk and talk", the way they were taught (Kember and Kwan 2000; Lane 2008). On the one hand, educators are blamed for weak education in Libya because they are reluctant to change their traditional ways of teaching (Elzawi and Underwood 2010). This explanation, however, is based on research indicating Libya does not specifically focus on educators and their different skills and needs (Elzawi and 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 and Underwood 2010). Therefore, exploring Libyan educators' competency in the use of computer technology was the main focus of this study.

On the other hand, 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, 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 educators have found it is easy and enjoyable to use technology for entertainment but become worried when it comes to teaching purposes (Rhema and Miliszewska 2010). Rhema et al. (2013) called attention to the need to gather more data confirming the 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.

Libya has always ensured access to suitable education for all members of society regardless of gender. The Libyan government has also sought to improve its entire educational system by providing full scholarships to students in pursuit of their education in different countries around the world (El Zoghbi et al. 2010). Hence, gender and source of highest academic degree earned whether from Arabic university or Western university might influence educators' computer competency. The researchers were not interested in including these two factors in the study, but to avoid their threat to the validity of the study findings, they were considered extraneous variables.

A substantial challenge to this research was the difficulty in finding current scientific research related to integrating technology into higher education in Libya. Lack of research in Libya might be explained by the fact that Libyan education has been isolated from the rest of the world, and, concurrently from technological advancements, due to political issues and instabilities such as the long period of the United Nation's embargo (1993–2003) and an ongoing revolution since 2011 (Khashkhush et al. 2011). Furthermore, almost all of the studies that focused on implementing technology into Libyan higher education were conducted in Western Libya (Elkaseh et al. 2015; Elmarzugi et al. 2014; Kenan et al. 2011; Rhema and Miliszewska 2010; Rhema et al. 2013) and excluded Eastern Libyan universities and institutions. This exclusion was a result of the country's centralized decision-making system, which is

centered in the Ministry of Education in Tripoli, on the Western side of Libya. This centralization generated a lack of resources and research budgeting, and delayed responses to the support and needs of the universities and institutions on the Eastern side of the country. Hence, this study focused on Eastern universities to fill the gap in the whole Libyan educational technology research.

In this study, we used statistical comparison tools to find differences in educators' competency in different computer areas and computer skills based on educators' discipline. 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. We also highlighted the type of support Libyan educators need to enhance their teaching in classrooms. The findings of this study could provide Libyan policy makers and administrators with initial data that might influence their decisions regarding the integration of technology into Libyan higher education.

Theoretical framework

The theoretical framework that formed the foundation of this research came from Rogers's (2003) diffusion of innovations theory. This theory encapsulates the idea of how new innovations spread among individuals via communication channels. Such innovations are initially perceived as uncertain and even risky. To overcome this uncertainty, it is important to understand the characteristics of the target population that will help or hinder the adoption of the innovation and to follow a specific process, which will assist in predicting whether those individuals adopt or reject the innovation. In the case of Libya discussed in this research, integrating computer technologies into university classrooms is considered as a new innovation.

In the educational field where innovations refer mostly to computer technologies, some educators tend to teach the way they were taught, and as such, expecting a change in behaviors related to teaching with technology can be constrained (Kember and Kwan 2000; Lane 2008). Furthermore, as described by Bourdieu (1990) that the lack of supportive environments when teaching with technology could make educators unwilling to pursue improving their own skills. With these conclusions, in the case of integrating computer technologies into Libyan higher education, the process that helps to encourage educators' adoption of using computers in their classrooms is necessary before the actual implementation takes place.

Rogers (2003) process typically as proceeding in five ordered stages: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) conformation. In the knowledge phase, an individual learns about the innovation and seeks information about it, however, two prior conditions of the knowledge phase need to be assessed: (1) specifying users' current skill (competence) and (2) felt needs and problems which is identifying teaching and learning needs in the context of our study. Both prior conditions need to be assessed before providing users with needed suitable information to be knowledgeable about how the innovation works (Rogers 2003). This research focuses only on the knowledge stage, specifically, prior conditions that need to be assessed in the knowledge stage. Then, analyzing the data obtained from

these conditions formulates an input to the ways that need to be used to provide users with information about how to use the innovation with recommendations.

The primary purpose of this study was to evaluate educators' competency in using computer technologies (the skills of using computer software and hardware) as an initial step needed towards the future implementation of technology into Libyan higher education. The following research objectives and questions guided this study:

Objective 1: Evaluating educators' competence in four areas of computer competency (to meet prior condition 1 of the knowledge stage): (1) basic computer operation, (2) advanced computer operation, (3) use of the Internet, and (4) use of peripheral technologies. This evaluation presents the level of the computer use skills Libyan educators express; hence, assisting in formulating workshops that provide Libyan educators with appropriate needed information about using computer technologies in their classrooms.
RQ1: Does the skill level of Libyan educators differ across the four computer technology competency areas (basic computer operation, advanced computer operation, use of the Internet, and use of peripheral technologies) as measured by a self-report instrument?
Objective 2: Investigating educators' learning needs (to meet prior condition 2 of the knowledge stage) influenced by their specialty to determine if a difference existed in levels of competency between educators who majored in technical areas and those who majored in non-technical disciplines. This in turn will assist in deciding whether to provide these two groups the same or different workshops.
RQ2: Do the competency levels of Libyan educators who specialize in a technical discipline differ from those who specialize in a non-technical discipline in the four computer technology competency areas as measured by a self-report instrument?
Objective 3: Exploring educators' teaching needs (to meet prior condition 2 of the knowledge stage) regarding types of support that allow them to improve classroom teaching.
RQ3: What kind of support do Libyan educators need to improve their teaching using technology?

Method

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 161 participants were Libyan citizens who resided in Eastern Libya and speak Arabic as their native language. Among these participants, 117 of them were males and 44 were females, 89 of them received their last degrees from Arabic countries while 72 of them received their last degreed from Western countries such as the United States or European countries. Furthermore, 93 of them were in the technical disciplines (College of Engineering,

College of Science, and College of Economics) while 68 of them were in the non-technical disciplines (College of Arts, College of Law, College of Education) at these two universities.

Instrumentation

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, a non-probabilistic sampling approach was appropriate for this study (Kumar 2014). Specifically, we decided to use convenience sampling, which allowed data collection within time, place, and safety constraints. This study also used a cross-sectional survey design as this design is utilized to identify "trends in attitudes, opinions, behaviors, or characteristics of a large group of people" (Creswell 2012, p. 21). This research 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; hence, survey was the best way to obtain more data.

Survey questions used to evaluate educators' competence in the use of computer technologies were adapted from Yusuf and Balogun's (2011) study that they developed the instrument based on established procedures in literature and they categorized it into four different areas. Yusuf and Balogun's (2011) 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.

The final survey instrument contained three sections. The first section of the survey asked demographic information about Libyan educators' discipline (technical: College of Engineering, College of Science, and College of Economic or non-technical: College of Law, College of Arts, and College of Education), gender (male or female), and source of highest academic degree earned (from an Arabic university or a Western university). The second section contained 32 items of Competency in Using Computer Technology Scale 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. Each of the four subscales (basic computer operation, advanced computer operation, the use of Internet resources, and the use of peripheral technologies) consisted of eight items with a possible score range of 8 to 32 points. The last section included one open-ended question that asked "what kind of support do you think will help you to improve your teaching using technology?".

Validity and reliability of the competency in using computer technology scale

Yusuf and Balogun (2011) tested their initial survey instrument's validity with 50 Nigerian participants, and the feedback obtained from their participants was used to refine their final instrument. Their final instrument was tested for reliability using test–retest method of three-week interval. Reliability coefficients obtained for

the four sections of their final instrument were .86 (basic computer operation and issues), .81 (advanced computer operation), .80 (use of the Internet resources), and .76 (use of peripheral information and communication technology).

To establish the content validity of this research survey, some changes to the initial survey were made based on feedback provided by three survey experts and recommendations from 10 Libyan educators who participated in the pilot survey. Suggestions and recommendations provided by these participants were made to verify the instrument measured technological competency and the survey questions were understandable, comprehensible, clear, and aligned with Libyan educators' technological culture. In addition, the method of forward and backwards translation (double 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. Then, a bilingual expert in the area accomplished the translation from Arabic to English and the first author then compared these two copies. Finally, additional changes were made by the first author after consultation and discussion with the bilingual expert.

The construct validity of the Competency in Using Computer Technology Scale was analyzed via exploratory factor analysis (EFA) instead of confirmatory factor analysis (CFA) because the original instrument was tested by a different method and on a different population than Libyan. 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 were examined using the Promax rotation method. After a careful examination of the pattern matrix, 24 items of the initial 32 items were retained because they had load values over .30 (Kline 1994). Eight items (2, 7, 8, 22, 23, 24, 30, and 31) were eliminated from the scale because they were loaded in two or three factors with less than a .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 emails"). However, this item was not eliminated because it had a strong primary loading of .63 and the difference between the loads was over .1 (Büyüköztürk 2002).

After deleting the eight items, the EFA results showed the remaining 24 items were loaded into four factors. The four factors of the Competency in Using Computer Technology Scale were labeled as (a) basic computer operation (nine items), (b) the use of Internet resources (five items), (c) the use of peripheral technologies (six items), and (d) advanced computer operation (four items). The results of factor analysis agreed with the number of factors identified for the original instrument. 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 χ^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%. 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 are presented in Table 1.

Regarding the reliability of the survey and the four subscales, Cronbach's alpha for the remaining 24 Likert-type survey items was .94. Individually, the reliability of basic computer operations and the use of Internet resources scores was the same ($\alpha = .92$). The reliability of use of peripheral technologies scores was .91 and the reliability for advanced computer operation scores was .89. The corrected item-total correlations were all above .5 (see Table 1), which is encouraging (Field 2016).

Procedure

After approval was obtained from the Institutional Research Board, a total of 240 printed copies of the Arabic version of the survey and the consent form were distributed by the first author to the designated departments within the two universities in Eastern Libya in Spring and Summer 2017. Unfortunately, the response rate was very low, using the printed copy of the survey package (82 paper responses). In order to increase the response rate, the first author created an electronic copy of the survey using a web-based survey tool called Qualtrics. The first author then requested that department chairs distribute the electronic survey via email and Facebook pages to their university educators in Fall 2017; hence, additional surveys (79 electronic responses) were obtained. 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 fill out 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.

Data analysis

According to Gall et al. (1996), when a deviation from the assumption of a normal distribution is presented, parametric tests should not be used; equivalent non-parametric tests should be used instead. 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). Hence, non-parametric tests were utilized throughout the analysis.

The first research question was tested with a Friedman's analysis of variance (ANOVA) test. The independent variable for this question was the type of computer competency, which was a categorical variable with four types of computer competency subscales. The dependent variables were survey responses on the Likert-type scale. In addition, a post hoc analysis using Wilcoxon signed-rank tests was also conducted. For the second research question, one-way multivariate analysis of covariance (MANCOVA) was used. The independent variable for this question was the discipline of the participants (either technical or non-technical). The dependent variables for the

Table 1 Factor loadings for the competency in using computer technology scale

	Basic computer operation	Use of Internet resources	Use of peripheral technologies	Advanced computer operation	Corrected item-total correlation
I can locate an application program (e.g., Word)	.881				.687
I can search for files on a computer system	.767				.677
I can access information on a CD/DVD	.780				.644
I can organize electronic files into folders	.891				.713
I can move files between folders	.754				.726
I can open a new document in Microsoft Word	.973				.723
I can use simple editing tools (e.g., bold, italics, centering, font size, etc.)	.614				.663
I can use a spreadsheet package to filter data				.863	.571
I can use a spreadsheet package to make reports				1.040	.588
I can use a spreadsheet package to sort data				.890	.604
I can create a basic presentation package	.360				.636
I can modify a slide (e.g., change colors of text, lines, and spaces, etc.)	.508				.706
I can include animations into slides				.370	.588
I can access an Internet site via its website address		.753			.563
I can download files from the Internet		.820			.617
I can send email messages		.903			.637
I can access received email messages		.844			.701
I can attach files to outgoing emails	.358	.637			.730
I can use a digital camera to capture images			.675		.671
I can transfer pictures from a camera to computers			.706		.666
I can use a web camera to communicate with others on the Internet			.875		.664
I can incorporate a multimedia projector into my teaching			.842		.735
I can perform connections to set up a multimedia projector			.815		.754

Table 1 (continued)

	Basic computer operation	Use of Internet resources	Use of peripheral technologies	Advanced computer operation	Corrected item-total correlation
I can connect speakers to computers			.509		.719
Eigenvalues	10.16	8.45	9.00	5.60	
% of variance	49.07	58.86	64.09	68.37	

MANCOVA consisted of the scores on the four computer competency subscales. Gender and source of highest academic degree earned are extraneous variables and controlled in the analysis to reduce potential error from them. Additionally, a follow up analysis was conducted using a Mann–Whitney U test. For the third research question, participants' responses to the open-ended question were initially analyzed using frequencies of the keywords and then ranked.

Results

Differences across computer technology competency areas

For the first research question, the output of the Friedman's ANOVA test showed that there was a statistically significant difference (at $\alpha = .05$) in educators' competency of using computers depending on the competency type: the use basic computer operation, the use of Internet resources, the use of peripheral technologies, and the advanced computer operation, $\chi^2(3) = 451.269$, $p < .001$. The Friedman test compares the mean ranks between the related groups and indicates how the groups differed, and it is also included for ranking the skills (ranks from one as the lowest and four as the highest). The mean rank for basic computer operations was 3.99 which is not considered relatively fully high skill ($M < 4$), the mean rank for the peripheral technologies skill was at the medium level with the value of 2.83 ($M \geq 2.00$ but ≤ 3.00), the mean rank for the use of Internet resources was very much lower, but it is still at the medium level ($M \geq 2.00$ but ≤ 3.00) 2.17, and the mean rank of the advanced computer operation was very poor with the value of 1.01 ($M < 2$).

To examine where the differences occur between the four skills areas, we run a post hoc analysis using Wilcoxon signed-rank tests, applying a Bonferroni correction, resulting in a significance level set at $p < .008$. A statistically significant difference was found between educators' competency in the basic operation of using computers and the use of the Internet resources ($Z = -11.198$, $p < .001$), between educators' competency in the basic operation of using computers and the use of peripheral technologies, ($Z = -11.135$, $p < .001$), and between educators' competency in the basic operation of using computers and the advanced computer operation ($Z = -11.048$, $p < .001$). In addition, there was a statistically significant difference between educators' competency in the use of the Internet resources and the use of peripheral technologies ($Z = -8.117$, $p < .001$) and between educators' competency in the use of the Internet resources and the advanced computer operation ($Z = -11.001$, $p < .001$). Finally, a statistically significant difference was found between educators' competency in using peripheral technologies and the advanced computer operation ($Z = -11.004$, $p < .001$). In simple words, educators' skills in each area of using computer technologies differed significantly from the other ones.

Computer technology competency areas by disciplines

For the second research question, the MANCOVA output indicated that there was a statistically significant difference between the discipline groups (technical and non-technical) on the overall computer technology competence (combined scores across the four types of competency) after controlling for gender and the source of highest academic degree earned, F (4, 154) = 4.121, p = .003. Moreover, the output of MANCOVA at $p < .0125$ showed that there were significant differences in basic computer operation skills and in the advanced computer operation skills between technical and non-technical educators, (F (1, 157) = 8.65, $p < .001$ and F (1, 157) = 14.08, $p < .001$), respectively. However, the output of MANCOVA at $p < .0125$ showed that there were no significant differences in the areas of use of Internet resources and the use of peripheral technologies between technical and non-technical educators, (F (1, 157) = 4.32, p = .039; F (1, 157) = 5.05, p = .026), respectively. A follow up analysis, Mann–Whitney U test, was conducted and indicated that the competence in basic computer operation skills and in the advanced computer operation was significantly higher for technical educators than for the non-technical educators, (U = 2096.50, $p < .001$ and U = 1994.00, $p < .001$), respectively.

Technological support for Libyan educators

For the third research question, the frequencies of the keywords from the statements made by participants about types of support Libyan educators need to improve their skills in teaching with technology were obtained. The top five ranked responses provided by participating educators were: (1) computers in classrooms (N = 81, 50%), (2) Internet access in classrooms (N = 76, 46%), (3) projectors in classrooms (N = 50, 31%), (4) workshops provided by unified center in each university (N = 33, 20%), and (5) individual financial support (N = 18, 11%).

Discussion

Towards our first objective, we evaluated the skill levels of Libyan educators across the four computer technology competency areas. The results indicated that there was a statistically significant difference in Libyan educators' perceived levels of competency across these four areas. Furthermore, based on the rank presented in the results section, it was noticeably large gaps and presented that although many Libyan educators had basic computer operation skills, many still lacked the ability to use Internet resources, peripheral technologies, and software applications for teaching. As a result, from this evaluation which was a condition of the knowledge stage of the diffusion of innovations theory, Libyan educators need workshops (the way to assist them to be knowledgeable about using computers for teaching purposes) 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 knowledge phase of the diffusion of innovations theory (Rogers 2003, p. 21).

According to Al Mulhim (2014), taking an appropriate approach to designing workshops for Libyan educators is critical. The results of this study supported Al Mulhim's claim 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 first. This does not mean pedagogical skills are unimportant components of these workshops, however, 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).

Towards our second objective, we attempted to explore whether competency levels of Libyan educators who specialized in a technical discipline differ from the competency levels of those who specialized in a non-technical discipline across the four skill areas. A statistically significant difference was found between the technical and non-technical groups on the four-combined computer technology competency areas, indicating the technical group was more competent in the overall use of computer technology than the non-technical group. In addition, the results also showed significant differences between the two groups in basic and advanced computer operating skills. These results 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 also supported the 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.

However, no significant differences were found between educator groups in their ability to use Internet resources and peripheral technologies. The absence of a significant difference between educator groups in their competence in using Internet resources might be explained by the fact that all participating educators had encountered similar 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 Libyan educators to socially communicate either inside or outside the country. Similarly, the results showed no significant difference between educator groups in their competence with using peripheral technologies that could be related to the survey questions that focused on using cameras and speakers as many educators used them frequently in Libya.

Towards our third objective, educators have listed types of support they need to improve their teaching with technology. The top ranked support (computers in classrooms, Internet access in classrooms, projectors in classrooms, workshops provided by the university, and individual financial support) that was made by participants are similar to what other Libyan researchers found in their studies (Bukhatowa et al. 2010; Kenan et al. 2011, 2014; Rhema and Miliszewska 2010). For instance, Kenan et al. (2011) 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 and initiate useful reports toward using technology in Libyan higher education. We believe documenting educators' call of support can ensure that their needs are recorded, heard, and can be carried to the administrators and policy makers to respond based on what the educators prioritized.

Recommendations

The findings of this study are of value to Libyan administrators, policy makers at the Libyan Ministry of Education, and Libyan educators. Therefore, we provide three recommendations for these stakeholders in Libyan higher education as they make efforts to support educators throughout the process of learning to enhance their teaching via computer technologies.

First, Libyan educators need technical workshops that establish basic competencies before the actual implementation of computer technologies in their classrooms takes place. The structure of the workshops should be comprised of four different workshops, as indicated in the Competency in Using Computer Technology Scale, each focused on a specific area. The activities in the workshops could be constructed as presented in Table 2.

Second, workshop designers must also 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 these workshops. As stated by Elzawi and Underwood (2010), the teaching load at Libyan universities is considered high. Therefore, the administrators in Libyan universities need to consider reconstructing policies that allow educators to participate in professional development workshops as a mandatory part of their profession.

Third, it seems improving the educational system using technology, especially the system of higher education, would be easier now than if Libya had planned to build the technology before the onset of war. During this period, people in Libya have become more skilled in the use of the Internet to follow the news, connect with the outside world, and have become familiar with technology through the use of texting, emailing, and Skyping. Therefore, higher education institutions should take advantage of this improvement in digital skills and incorporate them into the teaching and learning processes in Libya.

Limitations and future research

Although this study achieved its research objectives, numerous 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. Most current research evaluated the use of technologies was far in advance of those available in Libya; thus, much of the current research had limited relevance to this study. Secondly, the convenience sampling method used restricted the findings to the sample of Libyan educators who participated in the study. Therefore,

Table 2 Activities suggested for computer technologies workshops

Basic computer operations	Advanced computer operations	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 a 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 email messages	Perform connections to set up a multimedia projector
Organize electronic files into folders	Use a spreadsheet package to sort data	Access to received email 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.)	Connect printers to computers
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

Application software workshops might also include specific software that each department needs

the findings could not be generalized to all Libyan educators who had technical and non-technical backgrounds.

Thirdly, the versions of software and hardware surveyed in this study were not the same as the ones used in the survey of Yusuf and Balogun's (2011) study and there was no comparison of the technology versions used in the study survey based on benchmarks from different parts of the world. Therefore, the lack of computers and Internet in the two universities might have influenced educators' responses to evaluate their skills as one cannot expect an instructor to have skills in a specific area if the area is not fully supported. Finally, going through the double translation process of the survey instrument might lead to results not fully comparable with the results from Yusuf and Balogun's (2011) study. For future research, since the instrument adapted in this study was validated to be suitable to Libyan education culture, future studies can use it and include more Libyan universities; hence, assisting in providing more research related to integrating technology into Libyan higher education.

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