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Evaluation of Digital Competency of Public University Students for Web-Facilitated Learning: The Case of Saudi Arabia

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Abstract

Our public universities in Saudi Arabia have made considerable investments in digital hardware, on-site training, and online tutorials to improve the quality of e-learning. However, there is an observed gap among students between the expected and actual use of digital technology in their learning. To close that gap, this requires a conceptual evaluation model that illustrates technological actions students are involved in, the level of digital proficiency they are in, type of digital technology they use, and kind of support they need. This study used the Digital Competency Profiler to evaluate the digital competency of public university students in Saudi Arabia. Data on 94 students from a public university were collected using an online platform. Multiple procedures were used for instrument validation, data screening, and data analysis. Findings from the study suggest that the majority of public university students had high digital readiness for performing social and informational skills through smartphones. In addition, most of university students missed all skills in the epistemological competency and some technical skills. Finally, implications for practice, limitations for generalization, and directions for future research are presented.

Keywords: digital competency, digital readiness, digital access, evaluation, public university students, web-facilitated learning, confidence of use, frequency of use, Saudi Arabia

1. Introduction

Nowadays, all public universities across Saudi Arabia are turning their students and faculty towards academic users of e-leaning systems. The public universities offer e-learning for students in a variety of forms such as web-facilitated learning (Allen & Seaman, 2010); usually called web-dependent (OECD, 2005) or web-enhanced learning (Ko & Rossen, 2010), hybrid (Tabor, 2007) or blended learning (McGee & Reis, 2012), and distance (Kaplan & Haenlein, 2016) or online learning (Anderson, 2008). In the web-enhanced classes, digital technology is used to deliver course materials which enhance in-class sessions. For the hybrid learning, both online and in-class sessions are utilized for content delivery, while the distance learning depends totally on online sessions. The current study dealt with the web-facilitated learning since it is a common form of e-learning within the public universities in Saudi Arabia. In the web-facilitated classes, course materials are delivered to students via a Learning Management System (LMS), called Blackboard. Such materials include a course syllabus, homework assignments, lecture presentations, online discussion, and digital learning resources. The web-facilitated activities are utilized to reinforce in-class sessions.

The term competency is defined as “a combination of skills, knowledge, and attitudes appropriate to the context” (European Union, 2006). Thus, digital competency involves the effective and efficient use of digital technology to access and store information, to communicate with other users, and to process programs and data (Desjardins et al., 2015). In addition, digital competency involves the confident and critical use of digital technology for education, work, home, and etc. (European Union, 2006). For this study, the digital competency of university students was determined by the confident and frequent use of digital technology for their e-learning, where digital technology is essentially comprised of a variety of computerized equipment that has an ability to be connected to broad networks (Desjardins et al., 2015).

To evaluate means to judge the value of something based on a set of criteria (Kanar, 2014). The literature shows that the evaluation process in educational settings can lead to the improvement of instruction, greater growth in student learning, better learning environment, and right kind of support (Bennett, 1989). Even though public

universities in Saudi Arabia have made investments in digital hardware and software, in-service training, and online tutorials to improve the quality of e-learning, the LMS is still underutilized by students. Therefore, there is a need for a theoretical evaluation model that illustrates digital skills students are involved in, the level of digital readiness they are in, type of digital technology they use, and kind of support they need. The current study employed the Digital Competency Profiler (DCP) to evaluate the digital competency of public university students for their learning facilitated by an online learning platform.

1.1 Objectives of the Study

The present study utilized the DCP to evaluate the digital competency of public university students in Saudi Arabia. Specifically, the study sought to determine: (a) technological actions public university students are involved in, (b) level of digital proficiency they are in, (c) type of digital technology they use, and (d) kind of professional development they need.

2. Research Framework

The conceptual framework of the current study was mainly established on the DCP (EILAB, 2017), an outcome of long-term research on the General Technological Competency and Use (GTCU) framework (Desjardins et al., 2001; Desjardins, 2005).

2.1 The GTCU Framework

The GTCU is a multidimensional framework that conceptualizes multiple uses of digital technology and their related competencies (Desjardins et al., 2015). The GTCU is also a multi-contextual framework that is suitable for any area of human activity such as education, home, work, and etc. (Desjardins et al., 2015). Based on the GTCU, digital technology refers to any physical, computerized equipment that has an ability to interconnect through broad networks (Desjardins et al., 2015). Under the GTCU, digital technology allows a user to interact with digital devices, communicate with others, store and retrieve information, and automate virtual or physical processes. The GTCU states that when users utilize digital technology for different purposes, they will develop new skills that vary according to four orders of competency (Desjardins, 2005) as follows:

(1) Technical order of competency refers to user's interaction with a digital device and involves skills such as operating digital devices, managing accounts or systems, and creating or editing documents, audios, videos, and multimedia content.

(2) Social order of competency refers to user's interaction with others using electronic mail, text message, audio chat, video conference, social media, collaboration tools, and sharing media.

(3) Informational order of competency refers to user's interaction with information using digital technology and involves skills such as searching for journal articles, videos, movies, music, and e-books and using digital maps and multiple kinds of aggregators.

(4) Epistemological order of competency refers to user's interaction with processes using digital technology and involves computational skills such as programming, mathematical operations, data analysis, concept mapping, calendar sharing, and diagram creating.

2.2 Digital Readiness

The digital readiness refers to the extent to which students are ready to use digital technology for their learning (Hong & Kim, 2018). Digital readiness could be evaluated through students' confidence of use, attitudes, and access to digital technology in their learning environment (European Commission, 2013). In addition, digital readiness might imply students' knowledge and skills required to use digital media for successful academic engagement (Kim, Hong, & Song, 2019). Based on the data analysis of the DCP, individuals who use digital technology in their daily life are classified into three readiness levels, low, moderate, and high to predict individual's performance in a reliable manner (Blayone et al., 2017).

2.3 Digital Competency

Digital competency refers to a set of knowledge and skills that are required to perform a given task using digital technology (Rasmussen et al. 2018). The literature indicates that digital competency of an individual is enhanced with the breadth of experience and with one's ability and confidence to perform a given task (Desjardins et al., 2015). Thus, the GTCU framework considers both frequency of use and confidence of use as main indicators that measure digital competency (Desjardins et al., 2001).

2.3.1 Confidence of Use

Confidence of use refers to an individual's belief in his or her ability to use digital technology to perform a given

task (EILAB, 2017). It is a self-concept that is directly aligned with the concept of self-efficacy invented by Albert Bandura (1977). Self-efficacy is defined as an individual's judgment of his or her ability to perform a particular behavior (Bandura, 1986). Understanding the function of self-efficacy in technology is important for the successful use in institutions (Compeau & Higgins, 1995). The literature on self-efficacy in technology shows significant relationships with actual performance (Simmering et al., 2009) and behavioral intention to use digital technology (Irani, 2000; Chiu & Wang, 2008; Chen & Tseng, 2012). The concept of self-efficacy is similar to the concept of perceived behavioral control (Fishbein & Cappella, 2006) which determines behavioral intention and actual behavior in the theory of planned behavior (Ajzen, 1985; Ajzen & Madden, 1986). Thus, self-confidence is considered one of the major determinants of behavioral intention and actual performance, which in turn will affect the potential for reinforcing the relative competency.

2.3.2 Frequency of Use

Frequency of use refers to the number of times an individual performs a given task using digital technology. Frequent use of any skill or knowledge will contribute to the breadth of individual's experience, which in turn improves the relative competency of the individual. The literature shows a positive correlation between perceived competency and frequency of use of a skill (Meretoja et al., 2004; Salonen et al., 2007; Hengstberger-Sims et al., 2008; O'Leary, 2012). Research indicates that the frequency of use was commonly used as an indicator to measure the digital competency of foreign language teachers (Malinina, 2015), university students (Svensson & Baelo, 2015), and citizens (Jaaskelainen & Savolainen, 2003).

2.4 Nature of Digital Access

Digital access is not merely about the availability of digital hardware, software, Internet connections, and so forth in the learning environment (Barri, 2013). Effective access requires the employment of in-hand digital devices where instructors and students can use them effectively whenever and wherever they are (Fabry & Higgs, 1997). Based on the GTCU, digital technology could be any computerized equipment; such as a computer, tablet, smartphone, computer appliance, wearable digital device, or video game console; that has a capability to be connected to broad networks (Desjardins et al., 2015).

3. Method

3.1 Settings

The current study was conducted at a public university located in Medina, Saudi Arabia. This university was chosen because of convenience, accessibility, and proximity to the author. It operates under the supervision of Ministry of Education and is totally funded by the government budget. The university offers opportunities for students to learn in a variety of ways, such as traditional learning, technology-enhanced learning, blended learning, and distance learning. The majority of classrooms are equipped with advanced technology to facilitate teaching and learning. These classrooms offer access to technology tools such as a smartboard, desktop computer, laptop connectivity, LCD projector, and Internet connectivity. A collection of digital resources, such as online databases; e-books; and multimedia platforms, are available for students and academic staff to enhance education. In addition, most of services are implemented online using advanced software systems.

3.2 Population and Sampling

The target population of this study included students attending a public university in Saudi Arabia. The research instrument was delivered to all university students through an online learning platform and 94 students who voluntarily agreed to participate in the study by signing an online consent form. Outlier detection procedures indicated that there were no cases who might have a detrimental influence on the statistical analysis.

3.3 Participants

The participants considered in this study came from different disciplines as follows: business administration (7%), humanities (32%), education (24%), law (19%), science (3%), applied medical sciences (5%), engineering (6%), computer science (2%), and community (2%). They held a minimum of high school certificate and were pursuing a bachelor's degree. In addition, the participants consisted of males (86%) and females (14%), and their ages were between 18 and 24. For the ownership of digital device, all of the participants owned a smartphone, 90% owned a desktop or portable computer, 22% owned a tablet, 2% owned a computer appliance such as a smart TV, 1% had a gaming console, and 1% had a wearable digital device, such as a smart watch.

3.4 Research Procedure

This study was conducted during Fall 2019. University students were initially asked via an online learning platform for their participation in the study by clicking on a hyperlink to sign a consent form and complete an

online questionnaire. They were informed of important points relating to their participation in the study using an online, brief introduction that explained the purpose of the questionnaire, the number of items, and the estimated time for completion.

3.5 Instrumentation

The current study was quantitative in nature and utilized the DCP to evaluate the digital competency of students from a public university. The DCP was delivered to students through an online platform to collect data for this study. The DCP is a closed-end instrument which consists of 26 items split into four dimensions: technical, social, informational, and epistemological competencies. The items used to measure each competency are listed below in Table 1; five items for technical and seven for each of the remaining competencies. All 26 items are in a mixed order and are formulated in one direction. The students were asked to read each item carefully and then choose a response from three multiple-choice questions asking about the type of digital device, confidence of use, and frequency of use. In agreement with the DCP, the frequency of use is measured using a five-level Likert scale as follows: (1) never, (2) few times a year, (3) few times a month, (4) few times a week, and (5) daily. The confidence of use is measured using a five-level Likert scale that includes the following options: (1) do not know how to use, (2) not confident, require assistance to use, (3) confident, can solve some problems, (4) quite confident, can use with no assistance, and (5) very confident, can teach others how to use. For frequency and confidence of use, each response option represents an interval type of measurement. Having many response options within each item is a way to enhance variability (DeVellis, 2003), which would, in turn, produce reliable results. The type of digital device is selected using a six-option list that includes computer, tablet, smartphone, gaming system, computer appliance, and wearable device. Each option in the list represents a categorical type of measurement. The list would be automatically disabled if a participant never uses a digital skill or does not know how to use it.

Table 1. Digital competency profiler (DCP)

No.	Items
	D1: Technical Competency (5 items)
1	To create/edit electronic documents (word processing, presentations, spreadsheets)
2	To create/edit audio recordings (podcasts, voice memos)
3	To create/edit multimedia items (photographs, movies, slideshows)
4	To manage any of my accounts (email, bank, phone, video chat service, TV/movie service, etc.)
5	To manage or operate other devices (home entertainment system, thermostats, lights, etc.)
	D2: Social Competency (7 items)
6	To communicate with others using text chat or text messaging (SMS, etc.)
7	To communicate with others using audio (Skype, phone)
8	To communicate with others using video (Facetime, Skype)
9	To communicate with others using e-mail.
10	To use social networking systems (Facebook, Google+, LinkedIn, Twitter, etc.)
11	To use collaboration/shared document tools (Google Drive, Dropbox, etc.)
12	To share my works and ideas publicly (blogs [Wordpress], photo sharing [Flickr, Picasa], Pinterest, etc.)
	D3: Informational Competency (7 items)
13	To access digital maps (MapQuest, GoogleMaps) or a GPS (TomTom, Garmin, etc.) to find my way or to get directions.
14	To search for journal articles on the Web.
15	To search for short videos (YouTube) on the Internet.
16	To search for and download movies from the Internet.
17	To search for and download music from the Internet.
18	To search for and download books (text and/or audio) from the Internet.
19	To use an aggregator to automatically collect and organize documents (news aggregators, data feeds, RSS feeds, media aggregators etc.).
	D4: Epistemological Competency (7 items)
20	To use and share a calendar/personal agenda.
21	To create and use concept maps, flowcharts, sitemaps or algorithms.
22	To create, modify and use plans or other diagrams.
23	To sort large amounts of data.
24	To produce graphs from numerical data.
25	To do complex calculations.

26	To do some form of programming to automate certain processes (macros, scripts, robotics, any programming language, etc.)

3.6 Analysis of Instrument Validity and Reliability

3.6.1 Instrument Validity

Content validity refers to the degree to which a set of items are relevant to an intended dimension and the dimensions of the research instrument are relevant to an intended construct (Haynes et al., 1995). Construct validity refers to the extent to which a research instrument measures what it is supposed to measure. The original version of the DCP went through a process of content validation by participating a group of teachers and parents (Desjardins et al., 2001). Many existing frameworks such as information and communication technologies (ICT) in "Programme for International Student Assessment" (PISA), B2i Internet and Information Technology Certificate, and the C2i certification and sets of standards such as International Society for Technology in Education (ISTE) standards were consulted to enhance the overall content validity of the model. In addition, the original DCP underwent construct validation by a panel of experts, which involved an investigation of correlation matrices (Desjardins et al., 2001).

The DCP was translated to Arabic since the participants involved in the current study were from Arabic culture. Any research instrument is translated from one language to another must be exposed to pilot analysis, so the validity and reliability issues could be addressed (Griffee, 2001). Therefore, the pilot study was conducted through two phases in order to determine issues relating to the translation and administration of the research instrument. The first phase addressed issues resulting from translating the DCP from English to Arabic. The translation process must receive critical attention since the poor-translated research instrument might bring about low validity and reliability, which in turn produce irrelevant results (Carlson, 2000). Therefore, the procedure of back translation from Arabic to English was performed by an expert to address conceptual equivalence. The content across the original DCP and the back-translated version was compared and found to be conceptually alike.

In the second phase of the pilot study, the Arabic version of the DCP was piloted with a group of public university students. This phase was conducted to address issues relating to the initial administration of the research instrument. Such administration issues involved time spent to fill out the research instrument, difficulty in responding, and unclarity of some items. All of the proposed issues were resolved, and the research instrument was modified accordingly.

3.6.2 Instrument Reliability

Coefficient alpha (α) is a measure of internal consistency of a set of items within a research instrument (Cronbach, 1951). Multiple coefficient alphas were calculated to determine the reliability of four sets of items within the Arabic version of the DCP research instrument. According to Nunnally's (1978) recommendation to the reliability of research instrument used in basic research, Cronbach's alphas were found to be acceptable for the four constructs of the research instrument, ranging from 0.73 to 0.87.

4. Data Screening and Analysis

To determine the accuracy of data entry, the raw data were screened using multiple statistical measures, such as a mean; standard deviation; maximum; and minimum, for each of the instrument items. The data were found to be accurate on the basis of reasonable values for each measure. According to the number of participants for each item, none of them had missing responses. With the use of a $z > |3.3|$, $p < .001$ criterion (Tabachnich & Fidell, 2007), no univariate outliers among the participants were found.

The current study adopted a two-step procedure to analyze the DCP data. First, the confidence and frequency values were added up to generate competency scores based on the logic of the GTCU framework. The competency scores (CS) have a range of whole numbers from 1 to 10. The CS of 1 indicates that participants never use a digital skill and do not how to use it, while the CS of 10 indicates that participants uses the digital skill on a daily basis and with high confidence. The interpretation of such a value was based on the following adopted criteria (Blayone et al., 2018): $CS \geq 7$ indicates high readiness for participants and successful digital action is expected, $4 \leq CS \leq 6$ indicates moderate readiness and the digital action is not predicted, while $CS \leq 3$ indicates low level of readiness, where unsuccessful digital action is expected, and intended support is needed. Second, participants were sorted out in the three readiness levels based on their competency scores. Tables were used to display percentages of participants across the three readiness levels for each digital competency and skill.

5. Results

Table 2 displays percentages of public university students across three readiness levels (low, medium, and high)

and four types of digital competency (technical, social, informational, and epistemological). Findings indicate that the majority of students had high readiness for social and informational digital actions. However, the social digital actions were found to be the most commonly performed in comparison to the other kinds of digital actions. The findings show that most of students had low readiness for epistemological digital actions, which calls for substantial support in the area of information processing. For technical actions, the findings illustrate that proportions of students across the three readiness levels were almost similar. However, the density of students within the low readiness level is still disconcerting. Therefore, the students might be in need of support in technical issues.

Table 2. Readiness levels in percentages for each digital competency

Digital Competency	Readiness Level		
	Low	Medium	High
Technical	30	32	38
Social	17	16	67
Informational	19	26	55
Epistemological	58	21	21

Table 3 displays percentages of public university students across three digital readiness levels (low, moderate, and high) and five technical skills such as operating digital devices, managing online accounts or systems, and creating or editing documents, audios, videos, and multimedia content. The results revealed that the majority of university students have technical skills in the area of managing online accounts and creating or editing multimedia content and electronic documents. However, the majority of university students lacked technical skills in operating electronic devices and in creating or editing audio recordings. The results indicated that management of online accounts is the most commonly used skill in the technical order of competency.

Table 3. Readiness levels in percentages for each technical skill

Technical Skill	Readiness Level		
	Low	Medium	High
1. To create/edit electronic documents.	4	55	40
2. To create/edit audio recordings.	65	21	14
3. To create/edit multimedia.	11	38	51
4. To manage online accounts.	4	29	67
5. To manage/operate electronic devices.	65	18	17

Table 4 exhibits percentages of public university students across three digital readiness levels (low, moderate, and high) and seven social skills such as using electronic mail, text message, audio chat, video conference, social media, collaboration tools, and sharing media. The results indicated that all university students have the required social skills to communicate with others through text messaging and social networking. In addition, the majority of university students had social skills in using audio chats, electronic mails, and video conferences. However, there was a high percentage of university students who lack communicational skills in publishing their works and ideas online using weblogs. Nearly half of university students had the social skill in sharing media and documents online with collaborators; however, one fourth of students showed deficiency in this skill.

Table 4. Readiness levels in percentages for each social skill

Social Skill	Readiness Level		
	Low	Medium	High
1. To communicate using text.	0	1	99
2. To communicate using audio.	2	11	87
3. To communicate using video.	9	26	66
4. To communicate using e-mail.	4	27	69
5. To use social networking systems	0	2	98
6. To use collaboration/shared tools	26	31	44
7. To share works and ideas online.	78	15	7

Table 5 presents percentages of public university students across three digital readiness levels (low, moderate, and high) and seven informational skills such as using the Internet to access journal articles, e-books, short videos, movies, music, digital maps, and information aggregators. Findings overall revealed that most of university students are considered high-readiness users for all informational skills with the exception of aggregating information from multiple resources. Searching online for short videos was found to be the most utilized informational skill among university students, while information aggregation was the least employed skill. Around half of students were ready for searching or downloading audio clips, but one fourth of students were still unready for these skills. Such training is needed for how to deal with information aggregators and audio files.

Table 5. Readiness levels in percentages for each informational skill

Informational Skill	Readiness Level		
	Low	Medium	High
1. To access digital maps or a GPS.	2	37	61
2. To search for journal articles online.	3	35	62
3. To search for short videos online.	0	10	90
4. To search for/download movies.	5	37	57
5. To search for/download music.	24	31	45
6. To search for/download electronic books.	12	26	63
7. To aggregate information from multiple sources.	84	10	6

Table 6 demonstrates percentages of public university students across three digital readiness levels (low, moderate, and high) and seven epistemological skills such as programming, mathematical operations, data analysis, concept mapping, calendar sharing, and diagram and graph creating. Findings indicated that most of university students are in the low level of digital readiness for all epistemological skills. For data visualization such as diagraming, public university students showed the most deficiency in this skill. Even though the percentages of university students across the three readiness levels were almost alike in the area of numerical operations, the density of students within the low readiness level was still disconcerting. Based on these results, such training is required to cover all needed skills in the epistemological order of competency, with a focus on applications dealing with diagrams and programming.

Table 6. Readiness levels in percentages for each epistemological skill

Epistemological Skill	Readiness Level		
	Low	Medium	High
1. To use/share a calendar/personal agenda.	53	28	19
2. To create/use concept maps or flowcharts.	61	22	17
3. To create/modify/use plans or diagrams.	80	12	9
4. To sort large amounts of data.	45	28	28
5. To create graphs from numerical data.	52	21	27
6. To do complex calculations.	34	30	36
7. To do programming.	77	7	10

Table 7 shows percentages of times an electronic device was chosen or unchosen by university students for each order of digital competency and across all orders of digital competency. The results overall showed that smartphones and computers were the most widely chosen devices among the university students. But the overall selection of tablets, wearable devices, gaming systems, or computer appliances seem to be scarce. The result overall indicated that university students frequently did not use devices for digital skills. This indicates that university students did not know how to use the digital skills and never use digital devices for these skills. The results indicated that computers and smartphones were the most commonly used devices for the technical skills. While the smartphone was found to be the most widely used device for the social and informational skills. Even though university students do not frequently incorporate a digital device in the epistemological order of competency, the computer was the most widely used device for that order of competency.

Table 7. Percentages of times a digital device chosen or unchosen for each order of digital competency

Digital Competency	Digital Device						Not Chosen
	Computer	Tablet	Smart-phone	Wearable Device	Game Console	Computer Appliance	
Technical	34.68	3.40	32.98	0	0	.21	28.72
Social	8.36	1.37	73.25	0	.15	0	16.87
Informational	15.81	3.80	60.18	0	0	0	20.21
Epistemological	29.33	1.22	10.64	.15	0	.15	58.51
Overall	21.07	2.37	45.13	.04	.04	.08	31.26

6. Discussion

The DCP overall demonstrates that the majority of public university students in Saudi Arabia had high readiness for social and informational digital skills and smartphones were found to be the most used digital devices for performing these skills. Nevertheless, the DCP reveals that the majority of students showed high deficiency in the epistemological tasks which require a digital device such a computer to be performed. Even though the percentages of students across the three readiness levels were almost alike for technical skills, the density of students within the low level is still disconcerting. In addition, digital technology devices such as computers and smartphones were the most commonly utilized among students who perform the technical tasks. Based on the findings reported previously, this study came up with the following insights.

For social skills, results indicate that public university students had high readiness for using electronic mail, text message, audio chat, video conference, and social media to communicate with others. However, they had lack in the area of collaboration tools such as Google Drive and OneDrive and publishing tools such as blogs or any text, image, and/or video hosting service. In addition, smartphones were found to be the most commonly used devices across the social skills. These results call for on-site or online training that focuses on mobile apps and deals with storing files on remote servers, synchronizing files across mobile devices, and sharing files with others. The training should also include sessions for publishing multiple kinds of digital materials using blogs, forums, or webpages. Such materials include text, images, audio clips, animations, videos, and multimedia.

Regarding informational skills, findings indicate that public university students had high readiness for using smartphones to access journal articles, e-books, short videos, movies, music, and digital maps. However, they missed skills relating to information aggregators. These findings suggest on-site or online training that focuses on mobile applications or web sites dealing with information aggregation. The training sessions should provide public university students with skills required for collecting and organizing a specific kind of information from multiple online sources. Such information might include data, news, reviews, videos, blogs, social media content and etc.

Public university students were considered high-readiness users for technical skills relating to managing online accounts or systems and creating or editing electronic documents and multimedia content. Nevertheless, they lacked skills relating to operating digital devices and creating or editing audio recordings. The findings indicate that computers and smartphones were found to be the most widely used devices across the technical skills. Therefore, public university students should be trained on how to use both computer and mobile applications in order to acquire the missing skills belonging to the technical competency. Such skills might include: (a) managing or operating electronic devices such as computers, tablets, projectors, or any electronic device utilized for the educational purpose, (b) using built-in mobile applications to record audio and save it to the digital device, and (c) creating or editing audio recordings and uploading them to the learning management system.

Findings indicate that all epistemological skills, which are usually performed on desktop or laptop computers, were found to challenge most of public university students. Such epistemological skills might emerge from user's interactions with online calendar planners; software applications for concept mapping, diagramming, and graphing; software packages for statistical analysis; and programing software. These skills are necessary for university students in order to do their homework assignments such as reports, researches and projects. Therefore, the findings suggest immediate hands-on interventions for public university students in order to elevate their digital skills at the area of epistemological competency.

Evaluating digital competency of public university students using the DCP and sorting them into high, moderate, and low levels of readiness can help change agents to offer appropriate interventions and keep the e-learning process going smoothly. For those who are in the low and moderate levels of digital readiness, accessible interventions such as online short tutorials (video recordings, infographics, simulations, and visual documents) are needed for delivering the required skills and knowledge. While those who are in a higher level of digital readiness, they can serve as models or mentors for those who are uncomfortable with technology.

7. Conclusion

The current study utilized the DCP to evaluate the digital competency of public university students for the web-facilitated learning. Conclusions drawn from the study findings indicate that the public university students have high digital readiness for performing social and informational tasks through smartphones. In addition, the public university students are in need of training dealing with the epistemological and technical skills. To enhance the return on the investment in on-site or online training efforts, training programs must target software applications that can be run on computers to handle skills in the epistemological order of competency. For technical skills, training programs must target software applications that are available for both computers and mobile devices.

The DCP can help change agents find answers for inquiries such as: how technology-based environment can be improved, why users are reluctant to engage in technology-based activities, and what kind of digital hardware and software should be considered in the process. The DCP can help educational leaders explore the kind of digital action students are involved in, the level of proficiency they are in, type of digital devices they use, and kind of support they need.

Even though the current study provides insights into the current status of digital competency of public university students for e-learning, it has several limitations to note. Due to the convenience sampling approach utilized in the current study, the sample was not representative of the whole population. This kind of sampling might cause the study to produce results which are not capable of generalization. The study also took place at one public university in Saudi Arabia, so the results might not be generalized to other public universities across the country or beyond. In addition, the data were collected from a learning surrounding within a big urban area; therefore, generalization should be limited to these ecological conditions. The study was conducted in a specific point in time, so careful attention must be paid when any generalization is made in the future.

The current study highlights directions for future research. Since university instructors are closely associated with e-learning; they should be involved in the evaluation process. Therefore, further research is needed to develop a conceptual evaluation model which takes instructors' perceptions into consideration. The results of the current study are obtained from a closed-end questionnaire, so further research should use qualitative approaches (e.g., observation, interviews, or open-end questionnaire) for elaboration.

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