Mobile Use for Education: Insights into Students' Adoption of Course Management Systems on Mobile Devices

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Abstract

This paper investigates the use of mobile devices to interact with Course Management Systems at a public and a private university. A survey of students in both universities was conducted to study the level of confidence of the students in performing tasks such as accessing course materials, submitting assignments, taking quizzes, and viewing grades using mobile devices. The students were asked to rate the ease of use of mobile devices to access a course management system, the clarity of the information retrieved from the system, and the possibility of completing the tasks quickly using mobile devices. Some background information on the length of experience using a course management system and the types of mobile devices used was also obtained from the students. In addition to studying the aforementioned factors, it was decided to investigate whether there were any differences in the use of mobile devices between students attending a public and a private university. The results indicate that, in general, the students find it easy to use mobile devices for interacting with a course management system and to perform the associated tasks. They were more inclined to engage in passive interaction with a course management system, such as downloading and viewing contents posted on the system, as opposed to engaging in a two-way interaction with the system, such as taking a quiz hosted on the system. It is therefore likely that the students will be using mobile devices to perform certain simple tasks related to learning, leaving the more time-consuming and interactive tasks to be performed using a tablet or a desktop computer. This finding will hopefully be of help in fine tuning the contents hosted on a course management system for easy access on a mobile device. Further, the study found that there are no differences in the use of mobile devices between students attending a private and a public university. This means

studies related to mobile learning conducted in public universities should apply equally well to private universities.

Introduction

Mobile learning refers to the use of mobile devices to access learning materials (Ally 2005). Mobile learning is also known as 'm-learning'. M-learning is considered an extension of e-learning (Nedungadi et al., 2012). Earlier definitions of mobile devices include personal digital assistants (PDAs), mobile phones, Tablet PCs, Pocket PCs, and palmtop computers (Gay 2001; Lin et al. 2003; Nihalani et al. 2010). Lately, due to significant advancements in technology, these mobile devices are now available in three major categories, namely, smart phones, tablet computers, and laptop computers.

The advent of mobile devices is making a significant impact on learning in the classroom. Today's handheld devices are much more than connected personal organizers. These devices have enough computing power to serve as a platform for mobile learning (m-learning) in many ways, including the use of such devices to access cloud resources. As noted by others, handheld computers have begun to migrate from the corporate world to the classroom (Crawford and Vahey, 2002; Fozdar et al. 2007; James 2011) and Nielsen's study (Nielsen, 2013) supports the notion that students do use cell phones to learn.

With the proliferation of mobile devices, the current digital age has opened several possibilities in education. Previous studies have shown that technology has a significant impact on the changing landscape of education (Balanskat et al. 2006; Davies et al. 2009; Condie et al. 2007; Drent et al. 2008; Rudd et al. 2009; Rasmus 2013). According to Norris & Soloway (2004), mobile computing facilitates 'student-centered' learning. The advantage of mobile learning is that students can learn without being bound by time and spatial constraints. Another advantage is that the increased power of these devices can contribute to collaborative learning in addition to simply being a platform for disseminating course related materials and information.

Since the introduction of mobile devices in classrooms is a relatively new phenomenon, mobile learning practices are still evolving. Therefore, it is important to have a better understanding of the factors that influence mobile learning practices (Sarker and Wells 2003). In this respect, this paper is based on a study that analyzes the factors influencing and motivating students to access and use course management systems via mobile devices. It also investigates whether there are any differences between students from public and private universities in their use and adoption of mobile learning. The purpose of the study therefore is to provide an educator with a better understanding of factors that relate to mobile-centered learning.

Research Background

The acquisition and usage of mobile devices have increased due to their affordability. The current generation of students have become accustomed to fast and open access to information (Hooft et al. 2007). Until recently, smart phones have been viewed as a distraction in the classroom. This perception has changed as mobile learning is now used to access course materials, view feedback on assignments from instructors (Al-Masri et al. 2012), and interact with instructors and classmates (Mockus et al. 2011).

Considering the benefits that mobile devices provide to students and instructors, mobile learning (m-learning) is increasingly being adopted by educational institutions worldwide (Liu, Han, et al. 2010). There are also a growing number of mobile applications that are focused on collaborative learning as mobile devices lend themselves easily to such learning. M-learning has thus evolved into a learning model that allows students to obtain educational materials from anywhere and at any time, and to engage in collaborative learning using mobile technologies and the Internet (Lan and Sie, 2010).

Mobile devices can also be used for accessing common services available from an online learning management system such as Moodle. The services may support social networks for collaboration with classmates and the viewing and downloading of grades and lecture materials hosted on such services (Cavus et al. 2009). Moodle provides the resources for hosting forums, posting problems and exercises, and distributing lecture notes among others. Moodle also allows the hosting of multimedia resources such as graphics, video, audio, PowerPoint slides, and Flash-based applications (Goodwin-Jones 2003). Given the advantages of course management systems such as Moodle, more than 95% of universities and colleges in the USA have adopted one or more course management systems (Arroway et al. 2010). Being able to access the contents on Moodle through mobile devices is therefore an advantage of m-learning.

There are also other advantages of using mobile devices for learning. Kumar et. al. (2010) state that mobile devices such as cell phones are a vehicle for making educational opportunities accessible to rural children in places and times that are more convenient than attending a formal school. They conducted a study to investigate the extent to which rural children will voluntarily make use of mobile devices such as cell phones to access educational content. Their results show a reasonable level of academic learning and motivation among rural children to use mobile devices for learning.

When investigating the factors that influenced people's intention to embrace learning with smart phones, Wang, Wu, and Wang (2009) identified performance, effort, social influence, and self-management of learning as significant. Donner (2009) reviewed 200 studies of mobile phone use and found that portability, simplicity, and affordability of mobile devices make it a good fit for education.

Dean (2010) mentions a survey carried out in a selected number of universities that showed text messaging and emailing to be two of the commonly used features on smart phones by students. Other activities that were found to be popular were reading news, watching videos, and reading books. This observation led to the inference that students are more likely to use mobile devices for downloading and viewing content rather than in time-consuming activities that require the creation and uploading of lengthy information.

Given the potential for growth of m-learning, it is imperative that research on factors affecting the adoption of mobile learning is conducted to enhance the learning

experience of students. The research discussed in this paper is intended to examine various factors that impact the adoption and use of mobile devices in learning, especially in accessing and using course related information stored on course management systems. The research, at present, is focused on data collected from a public and a private university. The choice of two different types of universities is partly intended to shed light on the disparities, if any, in the use of mobile devices by students attending a private and a public university.

Methodology

Target Population and the Model

The target population for the current study was undergraduate students who were enrolled in a public university in California and in a private college in Florida. The purpose, as mentioned earlier, was to conduct a study based on a survey of students' attitudes towards mobile leaning.

Gathering of views and attitudes relating to mobile learning by means of survey questionnaires has been one of the strategies used for identifying factors that facilitate the incorporation of technology in education (Balanskat et al. 2006; Drent et al. 2008). Following the same methodology, a web-based form with questions was used for collecting the data. There were eleven questions in the survey form that focused on the following components:

- Length of Experience with Course Management Systems
- Mobile Learning Background
- Level of Confidence in Using Mobile Devices for Learning
- Ease of Interaction with Course Management Systems Using Mobile Devices

The first two areas are related to the collection of background information on the students' experience with course management systems and the type of mobile devices used by them to access the systems. The next two areas represent the collection of data for studying the users' attitude and comfort level on the use of mobile devices for learning. To measure the responses, the Likert scale was used. Likert (1932) developed the norm for measuring attitudes by asking people to respond to a series of questions about a topic. The responses were assessed in terms of the extent to which the respondents agreed. Figure 1 represents visually the research model.

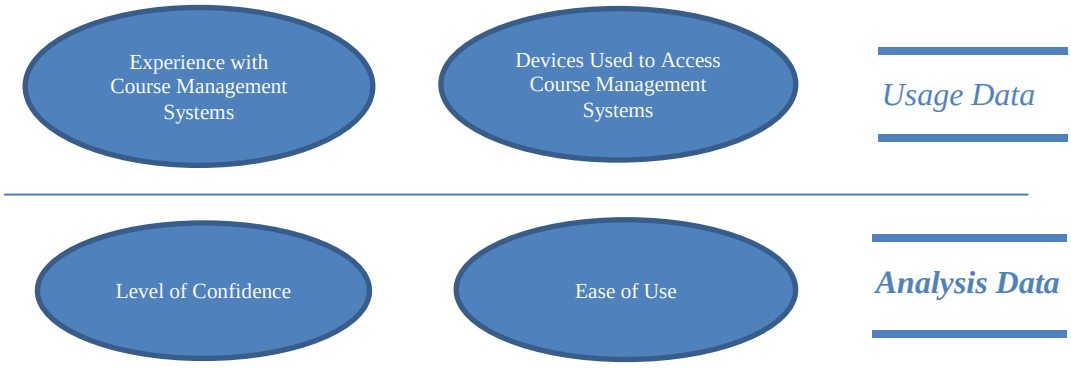

Figure 1. Research Model for the Study of Mobile Device Adoption of Course Management Systems

The data collected was used for measuring the following:

- The students' confidence levels in using mobile devices to access course contents, complete quizzes, submit assignments, and view grades.
- Ease of use of mobile devices to interact with learning management systems, the clarity and comprehensibility of the interaction, and the ability to quickly accomplish learning tasks.

Other than measuring the above factors, the data collected was used for investigating whether there were any differences in the level of confidence and the ease of use of mobile devices between the students in the public university and the private university.

Survey Platform

The form containing the questions was submitted online to the students. Different online services were explored to host the survey form. Among those considered were Survey-Monkey, Qualtrics, Google Forms, and Excel Forms. The first two are services dedicated to conducting surveys (SoftwareInsider 2016). They support advanced features such as multi-condition logic and piping. Other features supported include analytical tools to analyze the results using cross tabulations and correlation matrices. Both services are available as free and paid versions.

While Google Forms and Excel Forms could also be used for conducting the survey, they do not have advanced features found in the dedicated services such as Survey-Monkey. Both offer templates for creating simple forms that store the surveyed data in a spreadsheet. Further processing of the data, in this case, is usually carried out using the analytical functions and features of the respective spreadsheet software.

For this study, the capabilities of the Excel Forms and the Excel spreadsheet software were found to be adequate. Familiarity with the Excel Spreadsheet led to the choice of Excel Forms over Google Forms to host the survey instrument. To make the survey available online, the questionnaire was hosted on OneDrive. OneDrive is a cloud

storage service provided by Microsoft which is well integrated with Office 365. The link to the survey was shortened using tinyrul.com and given to the students to participate in the survey. The surveys were conducted during regular classroom hours.

Results and Analysis

The total number of students who responded to the survey from the public university in California was 94 and from the private university in Florida was 145. The questions, as mentioned earlier, were grouped into sections such as Length of Experience with Course Management Systems, Mobile Learning Background, Level of Confidence in Using Mobile Devices for Learning, and Ease of Interaction with Course Management Systems Using Mobile Devices. The questions in each section and the corresponding responses are discussed in the following sections.

Length of Experience with Course Management Systems

The first question in the survey was concerned with the "Experience in Using Course Management Systems". It was designed to gather information about the length of experience of the students in using a course management system. The reason for asking this question was partly to assess the students' familiarity with the system that may also have contributed to the willingness of the students to use mobile devices to access the system.

The number of students who had some prior experience with learning management system is tabulated in Table 1. Overall, the percentage of students who have used a course management system for at least a year is not as high as expected. Moreover, the students from the public university appear to have more course management experience compared to the students from the private university. A possible explanation is that the public university concerned is part of a large university system that had a well-established IT division dedicated to implementing and supporting a course management system whereas the same process may have taken a longer time at the smaller private university.

Table 1: Measure of Number of students who have used course management system before for at least 1 year

Public University- Frequency (N=94)	**Public University- Frequency- In percentage format**	**Private University- Frequency (N=145)**	**Private University- Frequency- In percentage format**
63	67.02%	74	51.03%

Mobile Learning Background

The next set of questions asked in the survey relate to the "Mobile Learning Background". These questions were intended to gather background information on the type of mobile devices used by the students and the type of information accessed from the course management system using the devices.

The reason for asking these questions was to help the instructors identify the type and brand of devices used by the students. The type and brand of devices used may have an influence on the design of course websites and the dissemination of information through a course management system. For example, depending on the results, instructors interested in designing their own course websites would be able to choose an appropriate platform that optimizes the website for the most frequently used type and brand of devices.

Several observations can be made from the results presented in Table 2. First, compared to the other types of mobile devices, smartphones are more frequently used by students in both public and private universities. This also means that instructors who opt to develop their own course websites may have to optimize their websites for access using mobile devices such as smartphones. For example, they may consider using Google Sites to design the website because it optimizes the websites for mobile access. Also, the survey results presented in Figure 2 indicate that among students from both public and private universities, there is no significant difference in the percentage of students using the different types of devices.

Table 2: Measure of Number of students based on type of Mobile Device they use

Measure-Type of Mobile Device	**Public University Frequency (N=94)**	**Private University Frequency (N=145)**	**Public and Private Universities Combined Frequency (N=239)**
Tablet	13 (13.82%)	18 (12.41%)	31 (12.97%)
Smartphone	68 (72.34%)	112 (77.24%)	180 (75.31%)
IPAD	6 (6.38%)	7 (4.83%)	13 (5.44%)

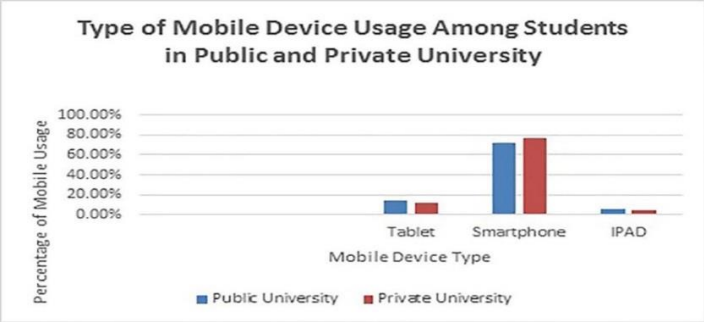

Figure 2: Percentage of Mobile Device Type Usage between Public and Private Universities

The responses to the question on the brand of mobile devices used by the students are presented in Table 3. In both the public and private universities, Apple is the preferred brand. Although the results are not surprising, they may have some implications in a business school where most students use a desktop device such as a Windows computer. From Figure 3, it can be inferred that a larger number of students in the private university are using Apple devices when compared to the students from the public university. This may partly be explained by the fact that software for the Android smartphones are relatively cheaper to obtain, prompting the students in the public university to own more Android phones.

Table 3: Measure of Number of students based on brand of Mobile Device they use

Measure- Brand of Mobile Device	**Public University Frequency- Actual number (N=94)**	**Private University Frequency- Actual number (N=145)**	**Public and Private Universities Combined Frequency- Actual number (N=239)**
Apple	45 (47.87%)	86 (59.31%)	131 (54.81%)
Android	35 (37.23%)	42 (28.97%)	77 (32.21%)
Windows	13 (13.83%)	15 (10.34%)	28 (11.72%)

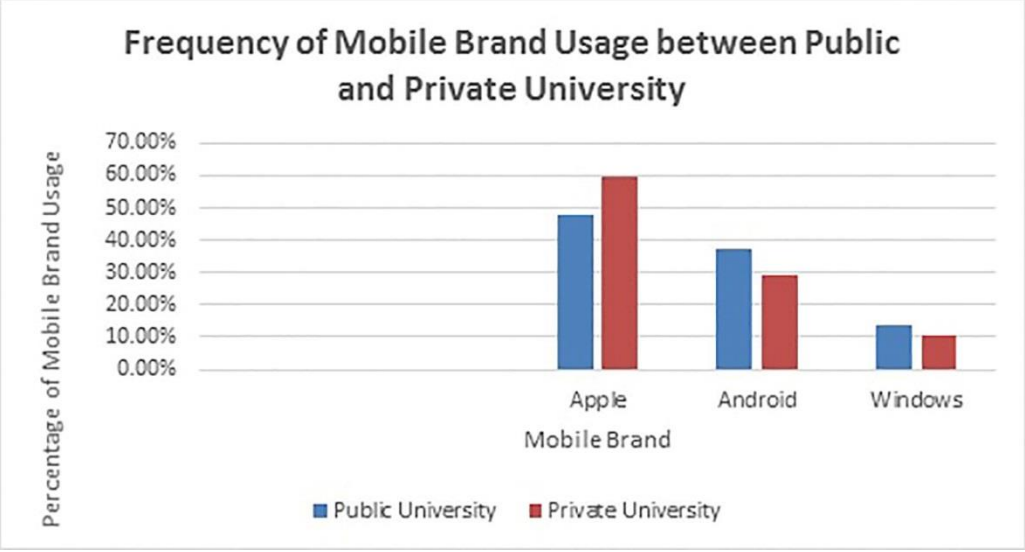

Figure 3: Percentage of Mobile Brand Usage between Public and Private Universities

Table 4 shows the responses to the question that relates to the type of information accessed from the course management system. The purpose of the question was to identify

the important section or sections in a course management system that is accessed frequently by the students. This section will require the most attention from the instructor in terms of providing comprehensible and easily accessible information to the students. It is not surprising that the students chose lecture related materials to be the most accessed information on a course management system. As mentioned earlier, this would require the instructors to dedicate more time on presenting the lecture related materials in a clear and concise manner. Also, compared to the students in the private university, a relatively larger number of students in the public university appear to be accessing quiz related information using mobile devices.

Table 4: Measure of type of content accessed via a Mobile Device

Type of content accessed via Mobile Device	**Public University Frequency- Actual number (N=94)**	**Private University Frequency- Actual Number (N=145)**	**Public and Private Universities Combined Frequency- Actual Number (N=239)**
Lecture slides/documents	85 (90.42%)	122 (84.13%)	207 (86.6%)
Exam	2 (2.12%)	6 (4.13%)	8(3.3%)
Quiz	6 (6.38%)	16 (11.03%)	22(9.2%)

Level of Confidence in Using Mobile Devices for Learning

The next set of questions in the survey relate to the "Level of Confidence in Using Mobile Devices for Learning". A scale of 1 to 5 was used to measure the responses with the following attributes assigned to the scale: Strongly agree = 5, Agree = 4, Neutral = 3, Disagree =2, and Strongly Disagree =1. The questions were designed to test the level of confidence of the students in using smart devices to access and interact with the different components of a course management system. They were asked to state their level of confidence in taking quizzes, submitting assignments, and viewing grades using mobile devices.

The responses to the questions from the students in the public university and the private university are summarized and presented in Tables 5 and 6 respectively. The results presented in these tables indicate that most of the students were confident in accessing the lecture contents, viewing the grades, and submitting the assignments using a mobile device. On using a mobile device to complete a quiz or an exam posted on the course management system, the responses received were mixed. This is understandable as students are more likely to be cautious when taking a quiz or an exam using a mobile device.

Table 5: Responses for Level of Confidence from Students in Public University

Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Weighted Average
1. Do you agree that you would be confident to complete a Quiz on the course management system via a mobile device?	20	30	17	20	7	3.38
2. Do you agree that you would be confident to access course contents on the course management system via a mobile device?	35	40	11	5	3	4.05
3. Do you agree that you would be confident to submit assignment on the course management system via a mobile device?	22	27	27	12	6	3.5
4. Do you agree that you would be confident to view grades on the gradebook on the course management system via a mobile device?	48	33	10	1	2	4.32

Table 6: Responses for Level of Confidence from Students in Private University

Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Average
1. Do you agree that you would be confident to complete a Quiz on the course management system via a mobile device?	32	45	31	29	8	3.4
2. Do you agree that you would be confident to access course contents on the course management system via a mobile device?	50	58	25	9	3	3.99
3. Do you agree that you would be confident to submit assignment on the course management system via a mobile device?	35	43	42	18	7	3.56
4. Do you agree that you would be confident to view grades on the gradebook on the course management system via a mobile device?	76	44	21	1	3	4.3

The responses presented in Table 5 and Table 6 indicate very similar levels of confidence among students in the public and private universities. The t-test presented in Table 7 confirms this observation. An unequal variance t-test with a significance level of 0.05 and confidence interval of 95% was performed to test the difference between the two populations. The results from Table 7 leads to the conclusion that studies related to mobile learning conducted at public universities should apply equally well to private universities

and vice-versa. Given the smaller number of private universities, this inference is significant, as they can now rely on the larger number of studies conducted in public universities.

Table 7: Level of Confidence in Using Mobile Devices to Access Course Related Information

	Submitting Quizzes		**Accessing Course Contents**		**Submitting Assignments**		**Viewing Grades**	
	Public	**Private**	**Public**	**Private**	**Public**	**Private**	**Public**	**Private**
Mean	3.37	3.44	4.05	3.96	3.5	3.55	4.32	4.31
Variance	1.56	1.43	0.99	1.06	1.37	1.28	0.76	0.79
Observations	93	145	94	146	94	146	94	146
Two-Tailed t-Test: P (T<=t)	0.69		0.48		0.75		0.93	
t Stat	-0.39		0.70		-0.31		0.09	

The responses to individual questions designed to measure the level of confidence are interpreted as follows. The students appear to be confident in accessing course materials and viewing grades using mobile devices. The same level of confidence is not present when taking quizzes or submitting assignments. From these observations, it appears that the students, in general, are confident in using a mobile device for learning provided the information flows downwards in one direction to their mobile devices. They seem to be less willing to interact with the course management system when they are required, for example, to upload information to the system.

A possible explanation for the above observation is that, for the most part, the students are used to downloading and consuming large amount of information on a mobile device as opposed to using the device to compile and upload the same. This is evident in services such as Twitter where the upload is limited to 140 charters. Furthermore, the screen size of mobile devices and the positioning of the device are not conducive to compiling and submitting large amount of information, which is required when completing assignments.

To encourage students to use mobile devices to take quizzes, the instructors may have to design the quizzes to be mobile-friendly, such as properly formatting multiple-choice questions for touch input. Instructors may also want to consider implementing easier options for students to submit the assignments using mobile devices. This may, however, not be a critical design issue because the students are likely to complete and submit the assignments, such as their written assignments, using either a desktop or a tablet computer. More research

therefore is needed to find ways of facilitating quizzes to be taken using movable devices and the assignments to be submitted using the same devices as well.

Ease of Interaction with Course Management Systems Using Mobile Devices

The next set of questions in the survey relate to the "Ease of Interaction with the Course Management System" aspect of the research model. As in the previous case, a scale of 1 to 5 was used to measure the responses. The following attributes were assigned to the scale: Strongly agree = 5, Agree = 4, Neutral = 3, Disagree =2, and Strongly Disagree =1.

The questions were intended to investigate whether the adoption of mobile devices was influenced by the ease of use of such devices to interact with a course management system. If the students considered it convenient and easy to use mobile devices to interact with a course management system, then there is an opportunity for mobile learning to become popular among students. The responses to the questions from students in the public university and the private university are summarized in Table 8 and Table 9 respectively.

Table 8: Responses for Ease of Use from Students in Public University

Question	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**	**Average**
1. Do you agree that interaction with LMS/Moodle via a mobile device is easy for you?	22	42	18	8	4	3.74
2. Do you agree that interaction with LMS/Moodle via a mobile device would be clear and comprehensible?	19	44	18	10	3	3.70
3. Do you agree that interaction with LMS/Moodle via a mobile device would enable you to accomplish tasks more quickly?	21	39	24	6	4	3.71

Table 9: Responses for Ease of Use from Students in Private University

Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Average
1. Do you agree that interaction with LMS/Moodle via a mobile device is easy for you?	39	55	32	12	6	3.77
2. Do you agree that interaction with LMS/Moodle via a mobile device would be clear and comprehensible?	38	59	33	10	5	3.79
3. Do you agree that interaction with LMS/Moodle via a mobile device would enable you to accomplish tasks more quickly?	38	55	40	7	5	3.78

The results presented in Table 8 and Table 9 indicate that most students agreed that interacting with a course management system using a mobile device is easy and that it enabled them to accomplish the tasks more quickly. Furthermore, they agreed that interaction with a course management system using a mobile device is clear and comprehensible. Although only a few students disagreed on all three questions, some students did remain neutral in their responses to the questions. The reasons for students remaining neutral and for disagreeing need further investigation. One possible explanation would be that many students prefer to interact with a course management system using a device with a larger screen. Nevertheless, the results do point to the possible use of mobile devices to interact with a course management system for a multitude of purposes as described here.

Also, as in the previous case, the responses for all three questions are strikingly similar among students from the public and private universities. An unequal variance t-test with a significance level of 0.05 and confidence interval of 95% was carried out to test the differences between the two student populations. The results of the t-test, summarized and presented in Table 10, confirm that there is no difference in the ease of interaction with the course management system between students from the public and private universities.

Table 10: Ease of Use in Using Mobile Devices to Access Course Related Information

	Access to LMS/Moodle is Easy with Mobile Devices		**Interaction with LMS/Moodle is Clear and Comprehensible with Mobile Devices**		**Interaction with LMS/Moodle using Mobile Devices will Enable Tasks to be Completed Quickly**	
	Public	**Private**	**Public**	**Private**	**Public**	**Private**
Mean	3.73	3.71	3.70	3.77	3.71	3.76
Variance	1.09	1.23	1.03	1.13	1.05	1.09
Observations	93	145	94	146	94	146
Two-Tailed t-Test P (T<=t)	0.92		0.32		0.36	
t Stat	0.09		-0.48		-0.35	

Conclusion

The purpose of the research model presented was twofold. One was to investigate the factors that facilitate the use mobile devices by students to interact with course management systems. The other was to study any differences that may exist between students in a public and a private university in the use of mobile devices to interact with a course management system. There was a clear answer to the latter question. The results indicate that there is no difference in the attitude of the students from public and private universities in using mobile devices to interact with a course management system. As mentioned earlier, it is therefore reasonable to suggest that studies conducted on m-learning in public universities apply equally well to private universities and vice-versa.

As for the first objective of the research model, there is some evidence to suggest that the students find mobile devices easy to use for interacting with a course management system. They also appear to be confident in performing certain tasks such as accessing course materials and viewing grades posted on a course management system. In general, the students are more likely to use mobile devices for downloading and viewing content than for uploading and engaging in a two-way interaction with a course management system. As two-way interaction requires longer periods of time to be spent in front of a device, the students may prefer a device with a larger screen and a better positioning option for two-way interaction. It is therefore reasonable to assume that there are certain types of interactions with a course management system that are conducive to the use of mobile devices. A study on identifying and differentiating these types of interactions is warranted

as the students are likely to use both the mobile devices and the desktop or the tablet computers to interact with a course management system. Identifying such interactions will contribute to a better understanding of the use of mobile devices to access a course management system and to promote the use of such devices in learning.

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