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The Mediating Role of Technological Innovation and Personal Development in M-Learning: The Egyptian Higher Education Sector

Abstract

Revolution in mobile technologies and the widespread access to mobile devices can lead to a paradigm shift in education. Mobile Learning (ML) is considered the upcoming trend of education, taking advantage of those mobile technologies and the opportunity to learn regardless of time and place. It is within this context that ML can and should contribute to the quality of education because of the rich communication and interaction environment it provides. Thus, schools and universities have started to realise their potential for solving the educational service problems. This is particularly highlighted in developing countries with very high population such as Egypt.

Despite the clear attempts of the Egyptian higher education (HE) sector to utilise e-business in the learning process, yet it still suffers from declining quality of education; especially due to the overcrowded classrooms, and poor communication. Accordingly, this paper seeks to investigate ML adoption and utilisation in the Egyptian HE sector. The current study focuses on exploring students' acceptance in both; public and private universities. The study achieves its aim through answering the following questions:

1. How do Egyptian HE students view ML adoption in universities?
2. What are the main factors that affect ML adoption and utilisation in the Egyptian HE?

Technology Acceptance Model (TAM) was extended, developed and tested with TAM constructs; namely Perceived Ease of Use, Perceived usefulness, Mobility and Compatibility.Two other main constructs were added, which are Economic and Social factors; as they are viewed to currently affecting ML sector in Egypt. Technological innovation and personal development were proposed as mediators for the relationship between the research variables and the ML performance.

Questionnaires were designed and randomly distributed over 600 HE students in both public and private sectors, where only 470 valid responses were returned. A comparative study was conducted between public and private universities and the research model was tested twice; once for every sector type. Data was entered and statistically analysed using SPSS and AMOS to compute the reliability,validity, descriptive statistics and the Structural Equation Modeling (SEM) was also used.

Data analysis brought several findings to light. First, traditional TAM dimensions; Perceived Ease of Use and Perceived Usefulness are insignificant in the presence of other dimensions in both sectors. A significant effect of Mobility, Compatibility, Economic and Social Factors on the ML performance in both sectors was also found. Comparing the Integrated TAM model in public versus private universities, revealed that the model is able to explain and contribute with higher percentage of ML performance in private universities than in public universities. Technological Innovation and Personal Development were proven to have a full mediation role between Mobility and ML performance in public universities. A partial mediation role was found of both; Technological Innovation and Personal Development between the research variables; Compatibility, Economic factors and Social Factors on ML Performance. Finally, there is a preference towards TAM dimensions and ML performance in private universities than in public ones.

Keywords: M-learning, higher education, perception, readiness, students, Egypt.

دور الوساطة للمتغيرين الإبتكار التكنولوجى والتنمية الشخصية في التعليم عبر الهاتف الجوال:قطاع التعليم العالي المصري

ملخص البحث

أن الثـورة فـي تكنولوجيـات الهـاتف الجـوال واتسـاع إمكانيـة الوصـول إلـى الأجهـزة المتنقلـة قـد تؤدى إلى تحول نموذجي في التعليم .ويعتبر التعلم بإسـتخدام الهـاتف الجـوال الاتجـاه القـادم للتعلـيم، والاستفادة من تلك التكنولوجيات الجوالة وفرصة للتعلم بغض النظر عن الزمان والمكان .وفي هذا السياق، يمكن للتعلم بواسطة الهاتف الجوال أن يسهم فـي نوعيـة التعليم، نظـرا لبيئـة التواصـل والتفاعـل الغنيـة التـي يوفرهـا. وهكـذا، بـدأت المـدارس والجامعـات فـي تحقيـق إمكانياتهـا لحـل مشـاكل الخـدمات التعليميـة .ويبـرز ذلـك بشـكل خـاص فـي البلدان النامية ذات الكثافة السكانية العالية جدا مثل مصر.

وعلـى الـرغم مـن المحـاولات الواضـحة لقطـاع التعلـيم العـالي المصـري للاسـتفادة مـن الأعمـال الإلكترونية في عملية التعلم، إلا أنـه لا يزال يعاني من انخفاض نوعية التعليم؛ وخاصة بسبب الفصول الدراسية المكتظة، وضعف التواصل .وبناء على ذلك، تهدف هذه الورقة إلى التركيز والتحقيق في اعتمـاد وإدارة اسـتخدام الهـاتف الجـوال فـي قطـاع التعليم العـالي فـي مصـر .تركـز هذه الورقـة علـى استكشـاف قبـول الطـلاب فـي الجامعـات العامـة والخاصة .وتحقق الدراسة هدفها من خلال الإجابة على الأسئلة التالية:

١. كيف ينظر طلبة التعليم العالي المصري إلى تطبيق التعليم عبر الهاتف الجوال؟
٢. مـا هـي العوامـل الرئيسـية التـي تـؤثر علـى تطبيـق واستخدام التعليم عبر الهـاتف الجـوال في التعليم العالي المصرى؟

تـم تطـوير واختبـار نمـوذج قبـول التكنولوجيـا و همـا سـهولة الاسـتخدام ، والفائـدة المدركـة، والتنقل، والتوافق .مع إضافة متغيرين رئيسيين و هما عوامل اقتصـادية واجتماعيـة؛ حيـث ينظـر إليهـا علـى أنهـا تؤثر فى تطبيق التعليم عبر مع إضـافة متغيرين . وتم اقتـرح الابتكـار التكنولـوجي والتنميـة الشخصـية كوسطاء للعلاقة بين متغيرات البحث وأداء التعليم عبر الهاتف الجوال.

قد تم تصميم الاستبيانات وتوزيعها عشوائيا على أكثر من ٦٠٠ طالب في كل من القطاعين العام والخاص، حيث تم رد ٤٧٠ استبانات صحيحة فقط . وأجريـت دراسـة مقارنـة بـين الجامعـات الحكوميـة والخاصـة، وتـم اختبـار نمـوذج البحـث مـرتين .مـرة لكل نوع من القطاعات .تم إدخال البيانات وتحليلها إحصـائيا باسـتخدام SPSS و AMOS لحسـاب الموثوقيـة، الصـلاحية، الإحصـاء الوصـفي وتـم استخدام النمذجة المعادلة الهيكلية (SEM) أيضا.

جلـب تحليـل البيانـات العديـد مـن النتـائج إلـى النور .أولا لم يثبت تـأثير سـهولة الاسـتخدام والفائـدة المتوقعة كـلا القطـاعين .كمـا تـم العثـور علـى تـأثير كبيـر منـد التنقـل، التوافـق، العوامـل الاقتصـادية والاجتماعية على أداء التعليم عبر الهاتف الجوال في كـلا القطـاعين .مقارنـة النمـوذج المتكامـل فـي الجامعات العامة مقابل الجامعات الخاصة، كشفت أن النموذج قادر على التفسير والمساهمة مع نسبة أعلى من أداء التعليم عبـر الهـاتف الجـوال فـي الجامعـات الخاصة مما كانت عليه في الجامعات الحكومية .وقد ثبت أن الابتكـار التكنولـوجي والتنميـة الشخصـية لـه دور الوسـاطة الكامـل بـين التنقل ومعـدل الأداء فـي الجامعـات العامـة .ووجـد دور الوسـاطة الجزئـي لكليهما .الابتكار التكنولوجي والتنمية الشخصية بين متغيـرات البحـث .التوافـق، العوامـل الاقتصـادية والعوامل الاجتماعيـة علـى أداء التعليم عبـر الهـاتف الجـوال. وأخيـرا، هنـاك تفضـيل لمتغيـرات النمـوذج (TAM) وأداء التعلـيم عبـر الهـاتف الجـوال فـي الجامعات الخاصة أكثر من تلك العامة.

الكلمات الدالة: التعليم عبر الهاتف الجوال ،التعليم العالى، المعرفة، الاستعداد، الطلبة، مصر

1. Introduction

In the last three decades numerous approaches have appeared to adopt information and communication technologies for the purpose of learning and education. The dramatic growth of local and wide area computer networks accelerated the evolution of the Internet and growth of online education, web-based education, education via computer-mediated communication, and virtual education. Nowadays, educational institutes face a number of challenges some of which are; low governmental budgets, high demand on the HE sector, and the changing needs of students, and global competition as well as, advances in information and communication technologies. Hence, there is a great demand for re-examining how universities keep up with the latest trend of e-applications (Rajasingham, 2011) (Abd El Halim and Abd El Aziz, 2017).

The IT infrastructure has been developing significantly. Children from early childhood have Smartphones and tablet PCs. Currently, even a child in grade 1 is using computers and tablets (Ali and Arshad, 2015). The global adoption of smart phones and the rapid development of information and communication technologies (lCT), together with the massive usage of mobiles and the expanded coverage of mobile telecommunications infrastructure has raised the chances for the new educational methods and learning activities, as well as, providing means for knowledge generation, development and enhancements (Fady and Abd El Aziz, 2015).

E-learning refers to transforming educational processes through application of different up-to-date electronic media and to customize learning to students' needs in terms of study style, culture, time, and space. Regardless of the fact that e-learning has not reached the explosive growth figures which we-re commonly predicted in the mid-1990s, scholars and industry representatives are now turning their attention towards the m-learning (Alzaza and Yaakub, 2010) (El Gamal and Abd El Aziz, 2012).

M-learning is a natural extension of e-learning. One of the key benefits of m-learning is its potential for increasing productivity by making learning available anywhere and anytime, allowing learners to participate in educational activities without the restrictions of time and place. Mobile technologies such as; mobile computing and technology, wireless laptops, hand-held PDAs, tablets and smart phones make education more accessible than that in traditional e-learning environments. It is time to think of mobile devices as a new form of hand held computers that has capabilities to be used in the learning process; as their usage has re-shaped and altered several social facets (Conejar and Kim, 2014).

1.1Problem Domain

Despite the fact that Egypt has one of the largest education systems in Africa, and the developing world, HE in Egypt currently suffers from a lot of problems some of which are; a decline in the quality of education due to several reasons including; crowded classrooms and universities low budgets.

E-learning and m-learning have become common techniques to support learning. Yet, it seems that Egypt is still in a fundamental stage of adopting and implementing both despite the plentiful

factors that suggest m-learning as a supportive tool which might enhance the process of learning. Although literature is rich with studies about e-learning, most studies were conducted in the west, with very few on m-learning (El-Gamal, 2014) with negligible contribution on the Egyptian context.

The overall effect of using mobile devices in learning is better than when using desktop computers (Sung Et al., 2016); as the easy usage and easy accessibility of these mobile devices have made them more significant than ever (Gokdsu and Atici, 2013). Although m-learning can contribute to improving education, challenges face HE institutes; especially in developing countries (Khan et al.,2012). Literature is rich with studies on e-learning, yet, mle-arning is still in its early phases in Eg-ypt. Egypt in particular has many su-ccess factors for m-learning adoption due to the high penetration rate of ha-ndsets that exceeded the number of citizens (Abd El-Aziz, et al., 2014).While modern mobile technologies enables ML, they have thus far been inadequate for providing the necessary foundation to make the necessary shift (Ho,et al.,2017), and the use of mobile phones in learning is in its immaturity phase and is facing doubts in Egypt.

In the context of this background, the primary goal of this study was to understand ML adoption and utilisation in the Egyptian HE sector. The research seeks to identify the main factors that increase the possibilities of engaging m-learning in Egyptian HE through exploring students' acceptance in both; public and private universities. The study achieves its aim through answering the following questions:

(1) How do Egyptian HE students view ML adoption in universities?
(2) What are the main factors that affect ML adoption and utilisation in the Egyptian HE?

2. The Higher Education Sector in Egypt

Egypt is a major country that is considered a cultural center in the region (Tutton, 2011). It has the largest population in the Arab world, with over 95 million. The current population of Egypt is equivalent to 1.27% of the total world population, placing Egypt as the 15th country in the list in terms of population. This very high population gives e-learning/m-learning adoption a great potential in Egypt(Worldometers,2017).

There are 19 countries defined in the Arab region by the U.S. News. The list includes all of the larger countries who are members of the Arab League. The overall Best Arab Region Universities rankings encompass the top 124 institutions across countries. Egypt is the top-performing country, with 25 universities in the overall rankings, accounting for 20.2 percent of all the ranked schools (US News, 2016).

Egypt also has a long history of welcoming international students to its HE institutions (Ghazal, 2012), with 75% literacy rate. In 2014/2015, according to the Central Agency for Public Mobilization and Statistics, private universities have 110.9 thousand students. Currently, the Egyptian education system has 17 public universities and 16 private universities. The HE is expected to increase by around to 6 percent per year (Abd El Halim and Abd El Aziz, 2015; Clark, 2015). This large sector suffers from major problems centralized main-

ly in governmental HE. Free admission to governmental universities in Egypt lead to major drawbacks. High class capacities (El Gamal and Abd El Aziz, 2012),underfunding of universities (poor building conditions, unequipped labs and libraries)are the most important ones.(ElGamal and Abd El Aziz, 2011).

E-Learning refers to the effective integration of a range of technologies across all areas of learning. E-Learning technologies are designed to support learning by including a range of media, tools, and environments. HE institutions seek to implement e-Learning in HE due to its potential advantages in education all around the world (Akaslan and Law, 2011). Due to the speed and efficiency of the Internet, e-Learning is assumed to take a competitive advantage over traditional methods(Intel, 2012).

According to the CIA factbook in 2014, Egypt considered number 15 in terms of using the internet, according to the CIA factbook in 2014. According to the advantages of e-Learning, the Egyptian HE authorities launched Egypt's first Electronic University (EELU) in 2009, as a starting point for introducing new modes of online educational services for the HE sector, which is assumed to help in solving part of the problems that HE suffers from. The readiness of the Egyptian society for accepting and adopting ML is a debate that has raised a lot of questions in the Egyptian context (Abd El Aziz, 2012).

3. Factors affecting Mobile Learning Adoption

Many research studies have cited, referenced, extended, and modified the UTAUT model in order to determine user's acceptance in the education industry. As discussed earlier, ML has the potential for improving the HE experience through its various benefits compared to traditional on-campus education. However, social and economic aspects can have a negative influence on accepting and adopting this mode of education in Egypt if local needs are not addressed. Determining the extent of opportunities that ML could provide to the Egyptian HE system in the Egyptian context is important for setting up framework strategies reflecting local needs. As ML indicates a new opportunity for education system research and development, the acceptance of ML by students is critical to successfully adopting it. Therefore, it is important to understand the factors that affect students' perceptions of mobile learning.

With this increasing number of mobile phone owners, especially among the student population in Malaysia, a study investigated the readiness, skills readiness, psychological readiness and budget readiness of students at two different universities in relation to ML. The findings revealed that the students are familiar with computing skills and welcome the integration of ML, but were uncertain as to how much money they needed to spend for the telephone line and Internet line apart from the software and hardware requirements (Hussin, et al., 2012). On the other hand, an investigation conducted in Taiwan revealed that mobile applications enhances information availability and access.Compatibility, self-efficacy, perceived ease of use seem to be important factors as viewed by students, while usefulness was reported to be of less importance (Chung et al., 2014).

Encouraged by this new trend in learning, another research employed both quantitative and qualitative research methodologies to explore the factors that affect students' ML acceptance.The results indicate that performance expectancy, perceived enjoyment, ubiquity, service quality, attainment value, and self-management of learning are significant predictors of behavioral intention to use ML; facilitating conditions, social influence, effort-expectancy, and self-efficacy are insignificant (Huang, 2014). In the same year, an investigation conducted in in Vietnam, validate the power of TAM constructs and its appropriateness for predicting acceptance of ML, and shows that usefulness is a strong predictor of ML acceptance (Khanh and Gim, 2014).

In 2014, a study conducted in Saudi Arabia found out that performance expectancy is the main factor affecting students' ML acceptance. Then, effort expectancy and social influences factors were next on the list respectively (Hujran1, et al., 2014). A systematic review of existing literature was reported in a study in 2015, to find the success factors for effective ML, where 13 critical success factors were found to strongly impact ML adoption (Bidin and Ziden, 2013) (Alrasheedi et al., 2015).

In 2015, student acceptance of ML in three Islamic universities in Malaysia were investigated, where the TAM model and the Innovation Diffusion Theory (IDT) were expanded by including service quality, as an important key success indicator to ML adoption (Alzu'bi, et al., 2015). After that, a study in New Zealand reported that the educational context could be considered as a moderator in students' perception towards ML. The study redefined the original Social Influence and Facilitating Conditions constructs (Ahmed, 2016).

Based on TAM theory, a study conducted in Omani HE, shows that ease of use, usefulness, suitability, social, enjoyment, and economic factors were more influential on students' ML acceptance (Sarrab, 2016). Another investigation studied ML practices among undergraduates in HE in Nepal in the same year. Results indicate that almost all undergraduates owned mobile devices, and used them informally for learning purposes. The majority of students had positive attitudes towards ML. However, many were not satisfied with the effectiveness of their practices or with the level of institutional support for using mobile devices to support their learning (Parajuli, 2016). A study investigating factors influencing students' ML at Malaysian technical universities, proposed a model adopted from UTAUT. Findings show that self-management performance expectancy of learning affects ML adoption.On the other hand, effort expectancy, playfulness, and social influence do not affect intention to use ML (Kim-Soon, 2016).

Later in 2017, an analytical review of the educational innovation field in the USA was studied, and illustrated tha US education needs effective innovations of scale to produce high-quality learning outcomes. A critical area of research and innovation can be cost and time efficiency of the learning (Serdyukov, 2017). On a different context, a study conducted in Tehran, Iran to measure the HE students' perception towards ML adoption, based on UTAUT and two other variables, results show

that performance, effort, social factors, facilitating conditions, perceived playfulness, and self-management are the key determinants to ML acceptance (Masrek and Samadi, 2017). Another study in the same year also modified UTAUT to investigate students' acceptance of ML, and reported that learning expectancy, effort expectancy, social influence, and ML characteristics are significant predictors of students' intentions to adopt ML. The exploratory analysis revealed an interesting finding that distance education students showed significantly higher intentions to use mobile learning technology than on-campus students, but there was no significant difference between them in the actual use of ML (Alasmari, 2017). On the other hand, a study investigated the challenges of ML adoption in science education in HE. The result of the study revealed the challenges to include among others; lack of funding, lack of educators knowledge of mobile technologies, lack of wifi facilities, fear of examination malpractice (Ndidi, et al., 2017).

4. Mobile Learning in Egypt

Literature illustrated limited practices and studies aiming at assessing the perception and readiness for introducing ML in different educational tracks in Egypt. As any new technological innovation is introduced, there is a debate between its acceptance and resistance from the context to which it is introduced (Lauer and Rajagopalan, 2003; Mansoor and Kamba, 2010; TC and Janetius, 2012). Culture has been a major factor that affects the structure of business and society (Hofstede, 2013). Therefore, the acceptance and success of e-Learning in Egypt depend on the degree to which the needs and concerns of the main stakeholder, namely students, are met (Wagner, 2008). Consequently, the potential developments that ML can provide to the Egyptian HE are affected directly by students' perceptions.

According to El-Gamal (2012), although there are current trends in Egypt such as open source learning applications and social media, yet ML is not expected to dominate the Egyptian market in the near future. Studies that investigates ML acceptance and usage in Egypt are limited. For these reasons, and in order to support ML in Egypt, it is considered a necessity to identify key success factors that may affect students' intentions to adopt ML (Ali and Arshad, 2016). Although a number of research investigations have studied the technology adoption in the education sector, they have mainly synthesized their findings based on e-learning rather than m-learning.

5. Research Methodology

5.1 Research Model and Hypotheses

This section will present the research model proposed as well as the research hypotheses developed from the model. Figure 1 depicts the ML model adopted to investigate its acceptance of students in both; public and private universities to cope with the Egyptian ML sector required improvement. The model includes four constructs for the technology acceptance model (TAM), which are: Perceived Ease of Use, Perceived usefulness, Mobility and Compatibility.

Two other main constructs are added by the researcher to the TAM model, which are Economic and Social factors.

Both constructs are viewed as currently affecting the situation in the ML sector in Egypt. As the TAM is considered a model for ML, the technological innovation and personal development are proposed by the researcher as mediators for the relationship between the research variables (represented in the integrated TAM model) and the ML performance.

Therefore, the six constructs mentioned above are considered as the factors affecting the ML performance in Egypt, and they are mediated by technological innovation and personal development. Since the current research is a comparative study between public and private universities, the research model will be tested twice; once for the public universities and another for the private universities. Thus, the research hypotheses could be developed as follows:

H1: There is a significant impact of the Integrated TAM dimensions on the Mobile Learning Performance.

H11: There is a significant impact of the Integrated TAM dimensions on the Mobile Learning Performance in the Egyptian public universities.

H12: There is a significant impact of the Integrated TAM dimensions on the Mobile learning Performance in the Egyptian private universities.

H_2: There is a significant impact of Innovation dimensions on the Mobile learning Performance.

H21: There is a significant impact of Innovation dimensions on the Mobile learning Performance in the Egyptian public universities.

H22: There is a significant impact of Innovation dimensions on the Mobile learning Performance in the Egyptian private universities.

H3: Innovation dimensions mediate the relationship between Integrated TAM dimensions and the Mobile learning Performance.

H31: Innovation dimensions mediate the relationship between Integrated TAM dimensions and the Mobile learning Performance in the Egyptian public universities.

H32: Innovation dimensions mediate the relationship between Integrated TAM dimensions and the Mobile learning Performance in the Egyptian private universities.

H4: There is a significant difference in Integrated TAM dimensions and Mobile Learning Performance between different types of universities.

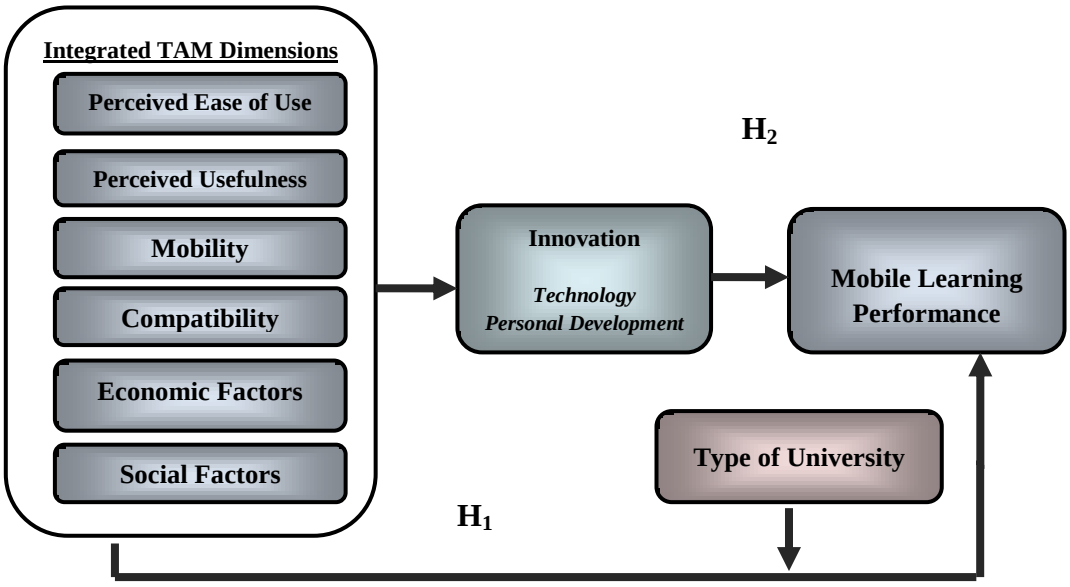

Figure 1. Research Model

5.2Research Design

A survey was conducted to investigate the impacts of integrated TAM model on ML services and its role in improving the ML performance in Egypt. Adapted from the work of Kucukusta et al. (2015), Lin and Lu (2015), Wang et al. (2017) and Upadhyay and Chattopadhyay(2015),this study employs a questionnaire, as shown in appendix, containing 36 statements regarding various aspects of ML. A five-point Likert scale is used to capture the level of agreement with each statement.

600 questionnaires were randomly distributed to students of each type of university, where a number of 470 respondents were actually collected from public universities with a response rate of 78.3%, while a number of 444 respondents were shown from private universities, with a response rate of 74%.

Data was entered and analyzed using SPSS and AMOS to compute the reliability, validity, descriptive statistics and the Structural Equation Modeling (SEM). The following section will display the results obtained from such analysis for the purpose of testing the research hypotheses.

6. Empirical Study and Results

6.1 Descriptive Statistics

Tables 1 and 2 below show the mean, standard deviation and frequencies of the research variables in both; public and private universities respectively. It could be observed that all of the means were above the midpoint of the scale (5-point likert scale), which indicates the fact that the research variables were recognized in the ML services utilized by the students.

Table (1)Descriptive Statistics and Frequencies for Research Variables in Public Universities

Type of University	Variable	Mean	SD	Frequencies				
				1	2	3	4	5
Public Universities	Perceived Ease of Use	4.1872	0.83055	0	0	126	130	214
	Perceived Usefulness	4.2362	0.73125	0	0	83	193	194
	Mobility	2.7447	1.30716	136	35	145	121	33
	Compatibility	3.2468	1.20356	46	99	77	189	59
	Economic Factors	3.4936	1.06653	18	74	116	182	80
	Social Factors	3.5851	1.02433	13	69	99	208	81
	Technological Innovation	3.7234	1.25785	24	77	79	115	175
	Personal Development	3.6638	1.10135	16	74	72	198	110
	ML Performance	4.0787	1.19173	11	58	76	63	262

Table (2). Descriptive Statistics and Frequencies for Research Variables in Private Universities

Type of University	Variable	Mean	SD	Frequencies				
				1	2	3	4	5
Private Universities	Perceived Ease of Use	4.4617	0.84237	5	9	45	102	283
	Perceived Usefulness	4.3225	0.73570	0	0	115	204	125
	Mobility	3.4932	1.04199	19	72	80	217	56
	Compatibility	3.5721	1.01088	5	57	161	121	100
	Economic Factors	3.7725	0.88889	3	38	105	209	89
	Social Factors	3.6712	0.92616	5	48	113	200	78
	Technological Innovation	3.9302	1.02214	3	48	86	147	160
	Personal Development	3.8694	0.87403	3	34	82	224	101
	ML Performance	4.2230	0.85114	3	13	65	164	199

6.1.1Reliability and Validity Analysis

Table 3 shows the reliability and validity analysis for research variables in both; public and private universities. The cronbach's alpha is computed for testing reliability, where all values are shown to be greater than 0.7, which is an acceptable level for reliability. Also, the average variance extracted (AVE) and factor loadings (FL) are computed, where it could be observed that all AVEs are greater than 50% and all FLs are greater than 0.4.

Table (3). Reliability and Validity Analysis for Research Variables in Public and Private Universities

Variable	Items	Public Universities			Public Universities		
		FL	AVE	Cronbach's Alpha	FL	AVE	Cronbach's Alpha
Perceived Ease of Use	Item 1	0.947	90.934	0.966	0.615	53.932	0.714
	Item 2	0.902			0.481		
	Item 3	0.888			0.569		
	Item 4	0.900			0.492		
Perceived Usefulness	Item 1	0.879	82.410	0.925	0.807	73.813	0.873
	Item 2	0.802			0.840		
	Item 3	0.751			0.571		
	Item 4	0.864			0.710		
Mobility	Item 1	0.980	95.881	0.986	0.859	85.084	0.941
	Item 2	0.949			0.864		
	Item 3	0.924			0.838		
	Item 4	0.982			0.842		
Compatibility	Item 1	0.873	85.399	0.914	0.749	78.93	0.866
	Item 2	0.840			0.836		
	Item 3	0.849			0.783		
Economic Factors	Item 1	0.881	84.767	0.939	0.755	76.247	0.896
	Item 2	0.834			0.761		
	Item 3	0.839			0.822		
	Item 4	0.837			0.712		
Social Factors	Item 1	0.812	80.205	0.876	0.688	74.558	0.829
	Item 2	0.809			0.795		
	Item 3	0.784			0.754		
Technological Innovation	Item 1	0.947	94.714	0.972	0.714	75.586	0.838
	Item 2	0.929			0.763		
	Item 3	0.965			0.790		
Personal Development	Item 1	0.944	94.524	0.985	0.868	86.470	0.961
	Item 2	0.952			0.889		
	Item 3	0.937			0.873		
	Item 4	0.954			0.878		
	Item 5	0.941			0.816		
Mobile Learning Performance	Item 1	0.926	88.461	0.956	0.816	85.58	0.943
	Item 2	0.847			0.871		
	Item 3	0.843			0.883		
	Item 4	0.923			0.853		

6.2Hypotheses testing

6.2.1 Testing the First Hypothesis of the Direct Relation of Integrated TAM Dimensions and Mobile Learning Performance

Structural Equation Modeling was utilized to examine the integrated TAM and evaluate its goodness of fit. The modification indices recommended by AMOS 18 were adopted, and the standardized residuals were verified. Figure 2 summarizes the model specification and fitness measures. The path coefficients for the items corresponding to each research variables were all above 0.7. The CMIN value indicated that the integrated TAM model fitted the collected data for the public universities, where CMIN = 2.647 < 3, P-value = 0.000 < 0.05. The GFI (Goodness-of-Fit Index) and AGFI (Adjusted Goodness-of-Fit Index) values are 0.891 and 0.869 respectively, which is acceptable level for the model. Further, the RMSEA (Root Mean square Error) value of 0.059 was within the acceptable level.

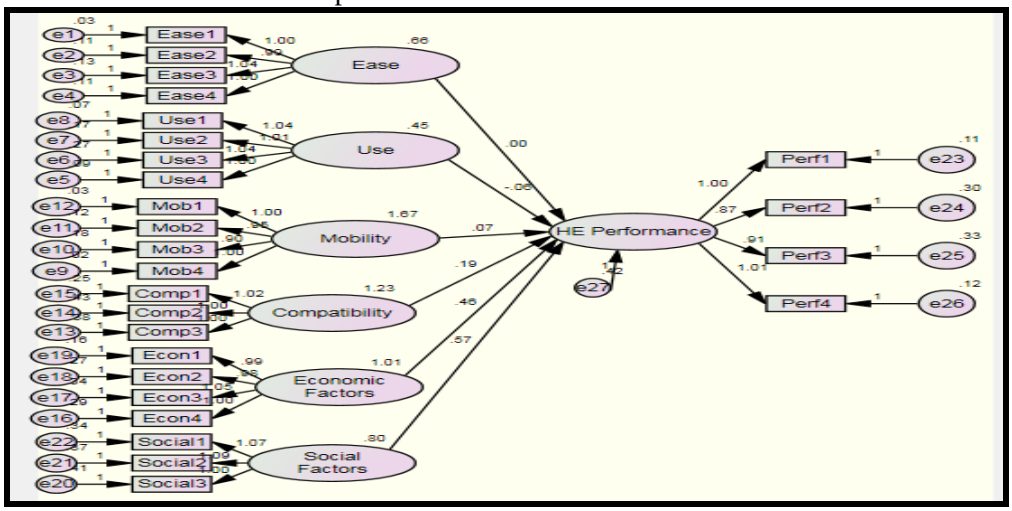

Figure 2. Estimates of AMOS for the Direct Relations in the Public Universities

Table 4 shows the estimated parameters and the corresponding p-values of the integrated TAM. It was found that the squared multiple correlations is 0.559, which means that the model explains around 56% of the variation in ML performance in the public universities. The direct path of Mobility was significant, since the regression coefficient was 0.070 with p-value of 0.005.

Similarly, the direct path of Compatibility, Economic and Social Factors on ML Performance was significant, since the regression coefficients were 0.190, 0.460 and 0.570 with p-value of 0.000. On the other hand, the direct path of Perceived Ease of Use and Perceived Usefulness on ML Performance was insignificant, since the regression coefficients were 0.004 and -0.059 with P-values of 0.927 and 0.248 respectively.

Table (4). SEM for Direct Impact of Research Variables on Mobile Learning Performance in Public Universities

			Estimate	S.E.	C.R.	P-value
ML Performance	<---	Perceived Ease of Use	.004	.041	.091	.927
ML Performance	<---	Perceived Usefulness	-.059	.051	-1.155	.248
ML Performance	<---	Mobility	.070	.026	2.750	.006
ML Performance	<---	Compatibility	.190	.031	6.054	***
ML Performance	<---	Economic Factors	.460	.036	12.797	***
ML Performance	<---	Social Factors	.570	.044	12.880	***

Therefore, the first hypothesis H11 was partially supported for the public universities.

Considering the private university model, SEM was utilized again to examine the integrated TAM and evaluate its goodness of fit for the private universities, where the modification indices recommended by AMOS 18 were adopted, and the standardized residuals were verified. Figure 3 summarizes the model specification and fitness measures. The CMIN value indicated that the integrated TAM model fitted the collected data, where CMIN = 2.918 < 3, P-value = 0.000 < 0.05. The GFI (Goodness-of-Fit Index) and AGFI (Adjusted Goodness-of-Fit Index) values are 0.861 and 0.833 respectively, which is acceptable level for the model. Further, the RMSEA (Root Mean square Error) value of 0.066 was within the acceptable level.

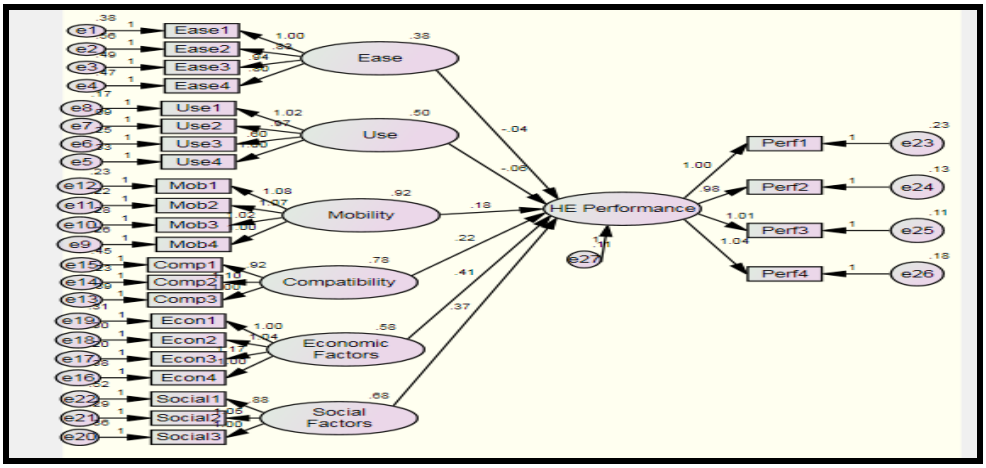

Figure 3. Estimates of AMOS for the Direct Relations in the Private Universities

Table 5 shows the estimated parameters and the corresponding p-values of the integrated TAM. It was found that the squared multiple correlations is 0.704, which means that the model explains around 70% of the variation in ML performance in the private universities. The direct path of Mobility was significant, since the regression coefficient was 0.181 with p-value of 0.000. Similarly, the direct path of Compatibility, Economic and Social Factors on ML Performance was significant, since the regression coefficients were 0.219, 0.414 and 0.367 with p-value of 0.000. On the other hand, the direct path of Perceived Ease of Use and Perceived Usefulness on ML Performance was insignificant, since the regression coefficients were -0.042 and -0.064 with P-values of 0.278 and 0.132 respectively.

Table (5). SEM for Direct Impact of Research Variables on ML Performance in Private Universities

			Estimate	S.E.	C.R.	P-value
ML Performance	<---	Perceived Ease of Use	-.042	.038	-1.085	.278
ML Performance	<---	Perceived Usefulness	-.064	.030	-2.148	.132
ML Performance	<---	Mobility	.181	.023	7.914	***
ML Performance	<---	Compatibility	.219	.026	8.290	***
ML Performance	<---	Economic Factors	.414	.035	11.799	***
ML Performance	<---	Social Factors	.367	.033	11.261	***

Therefore, the first hypothesis H12 was partially supported for the private universities.

6.2.2 Testing the Second Hypothesis of the Relation between Innovation Dimensions and Mobile Learning Performance

First, for the public universities, SEM was utilized to examine the impact of technological innovation and personal development on ML performance, as well as evaluating its goodness of fit. Figure 4 summarizes the model specification and fitness measures. The CMIN value indicated that the innovation dimensions model fitted the collected data, where CMIN = 1.859, P-value = 0.000<0.05. The GFI and AGFI values are 0.811 and 0.717 respectively, which is acceptable level for the model. Further, the RMSEA value of 0.09 was within the acceptable level.

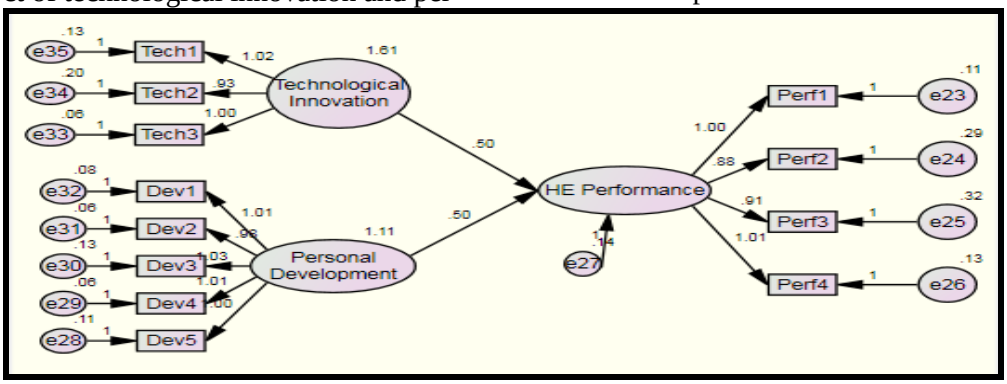

Figure 4. Estimates of AMOS for Innovation Dimensions Impact in Public Universities

Table 6 shows the estimated parameters and the corresponding P-values for the model. The squared multiple correlations is 0.825. The direct path of both; Technological Innovation and Personal Development on ML Performance was significant, since the regression coefficients were 0.497 and 0.502 with p-value of 0.000 < 0.05.

Table (6).SEM for Direct Impact of Innovation Dimensions on ML Performance in Public Universities

			Estimate	S.E.	C.R.	P-Value
ML Performance	<---	Technological Innovation	.497	.018	27.237	***
ML Performance	<---	Personal Development	.502	.022	22.712	***

Therefore, hypothesis H21 was fully supported, suggesting that the innovation dimensions in the public universities significantly affected ML performance in such universities.

Second, for the private universities, SEM was utilized to examine the impact of technological innovation and personal development on ML performance, as well as evaluating its good ness of fit.

Figure 5 summarizes the model specification and fitness measures. The CMIN value indicated that the innovation dimensions model fitted the collected data, where CMIN = 1.587, P-value = 0.000<0.05. The GFI and AGFI values are 0.882 and 0.823 respectively, which is acceptable level for the model. Further, the RMSEA value of 0.092 was within the acceptable level.

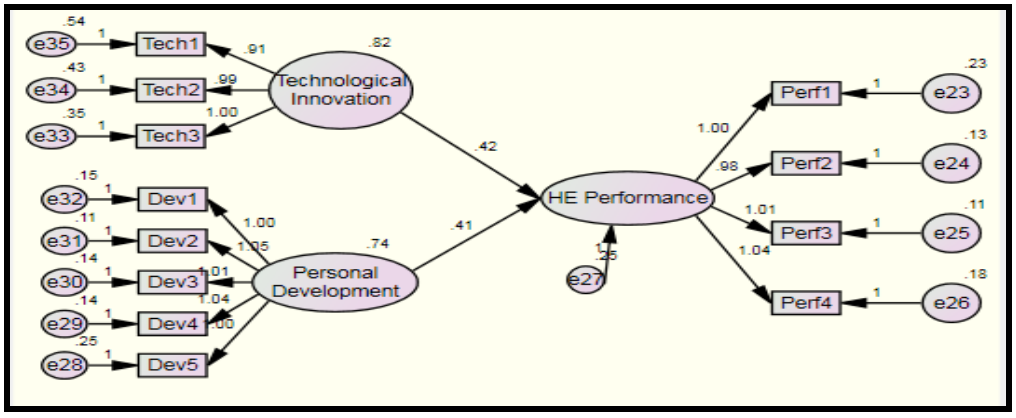

Figure 5. Estimates of AMOS for Innovation Dimensions Impact in the Private Universities

Table 7 shows the estimated parameters and the corresponding P-values for the model. The squared multiple correlations is 0.520. The direct path of both; Technological Innovation and Personal Development on ML Performance was significant, since the regression coefficients were 0.422 and 0.406 with p-value of 0.000 < 0.05.

Table(7). SEM for Direct Impact of Innovation Dimensions on ML Performance in Private Universities

			Estimate	S.E.	C.R.	P-Value
ML Performance	<---	Technological Innovation	.422	.037	11.298	***
ML Performance	<---	Personal Development	.406	.035	11.444	***

Therefore, hypothesis H2 was fully supported, suggesting that the innovation dimensions in the private universities significantly affect ML performance in such universities.

6.2.3 Testing the Third Hypothesis of the Mediation Role of Innovation Dimensions between Integrated TAM Dimensions and Performance

Regarding the public universities, SEM is conducted to test the mediation role of innovation dimensions in the direct impact of Integrated TAM on ML Performance in the public universities. Figure 6 summarizes the model specification and fitness measures. The CMIN value is 3.417 which is greater than 3 but still less than 5, P-value = 0.00<0.05. GFI and AGFI values are 0.832 and 0.803 respectively. RMSEA value is 0.072.

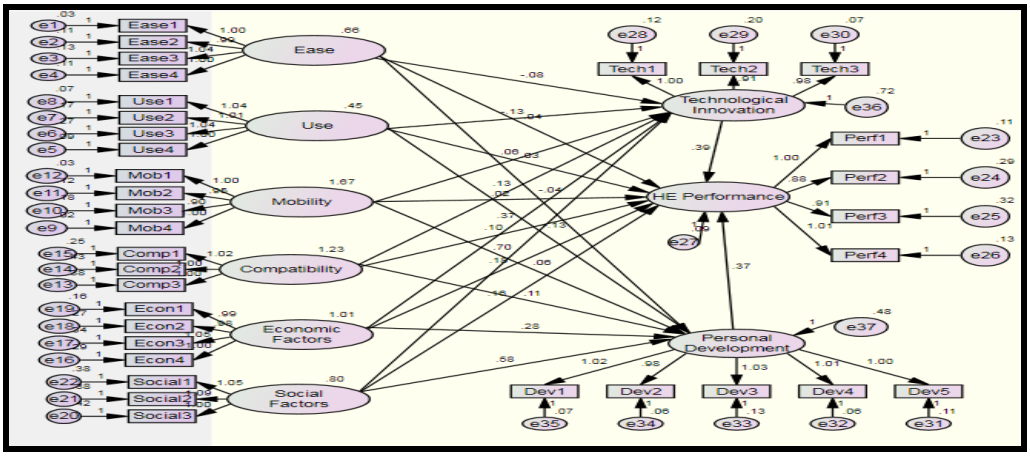

Figure 6. Estimates of AMOS for the Mediation Role in the Public Universities

Table 8 shows the estimated parameters and the corresponding P-values. To test the mediation role, the direct relations are obtained first, then the impact of Integrated TAM on Innovation Dimensions were proved to be significant, as well as the impact of Innovation Dimensions on ML Performance. It was found that there is a full mediation of both; Technological Innovation and Personal Development between Mobility and ML performance, as P-value is 0.145 >0.05. It was also found that there is a partial mediation role of both; Technological Innovation and Personal Development between the research variables; Compatibility, Economic factors and Social Factors on ML Performance as all corresponding p-values are 0.000<0.05. Also, the squared multiple correlation was found to be 0.895. Other variables are shown to have insignificant impact.

Table (8). SEM for Mediation Role of Innovation Dimensions in Private Universities

			Estimate	S.E.	C.R.	P-Value
ML Performance	<---	Perceived Ease of Use	.042	.022	1.886	.059
ML Performance	<---	Perceived Usefulness	.034	.028	1.216	.224
ML Performance	<---	Mobility	.020	.014	1.458	.145
ML Performance	<---	Compatibility	.101	.018	5.749	***
ML Performance	<---	Economic Factors	.180	.022	8.020	***
ML Performance	<---	Social Factors	.159	.034	4.686	***
ML Performance	<---	Technological Innovation	.390	.024	16.591	***
ML Performance	<---	Personal Development	.368	.028	12.988	***

Therefore, hypothesis H31 was partially supported, suggesting a partial mediation role of both; Technological Innovation and Personal Development in the public universities.

Considering the mediation role in the private universities, SEM was conducted to test the mediation role of innovation dimensions in the direct impact of Integrated TAM on ML Performance. Figure 7 summarizes the model specification and fitness measures. The CMIN value is 2.473, P-value =0.00 <0.05.GFI and AGFI values are 0.850 and 0.824 respectively. RMSEA value is 0.058.

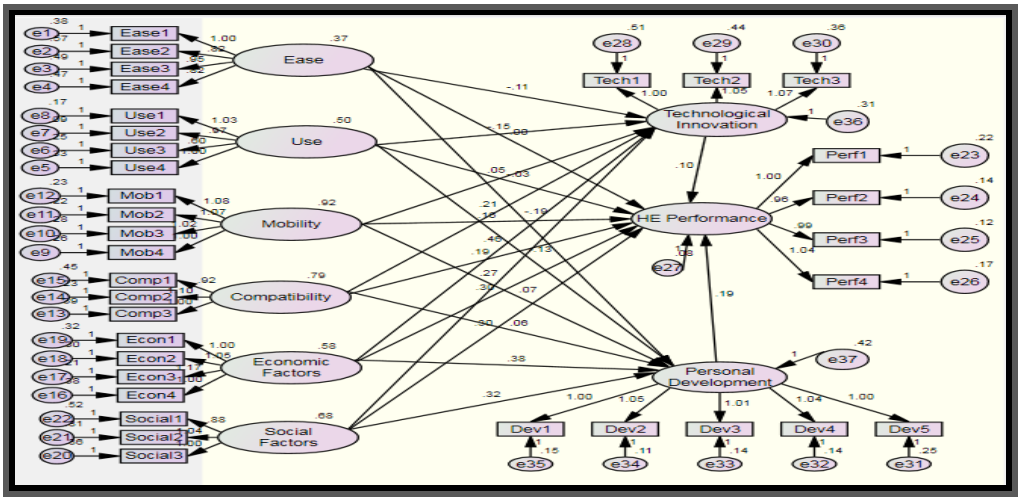

Figure 7. Estimates of AMOS for the Mediation Role in the Private Universities

Table9 shows the estimated parameters and the corresponding P-values. It was found that there is a partial mediation role of both; Technological Innovation and Personal Development between the research variables; Mobility, Compatibility, Economic factors and Social Factors on ML Performance as all corresponding p-values are 0.000 < 0.05. Also, the squared multiple correlation was found to be 0.783.

Table (9). SEM for Mediation Role of Innovation Dimensions in Private Universities

		Estimate	S.E.	C.R.	P-Value
ML Performance <---	Perceived Ease of Use	-.001	.036	-.034	.972
ML Performance <---	Perceived Usefulness	-.028	.028	-.995	.320
ML Performance <---	Mobility	.162	.021	7.855	***
ML Performance <---	Compatibility	.192	.025	7.611	***
ML Performance <---	Economic Factors	.301	.038	7.998	***
ML Performance <---	Social Factors	.296	.033	9.077	***
ML Performance <---	Technological Innovation	.099	.041	2.429	.015
ML Performance <---	Personal Development	.190	.031	6.134	***

Therefore, hypothesis H32 was supported, suggesting a partial mediation role of both; Technological Innovation and Personal Development in the private universities.

6.2.4 Testing the Fourth Hypothesis of Comparing Integrated TAM Dimensions and Mobile Learning Performance between Different Types of Universities

Table 10 shows the comparison in research variables between public and private universities. It could be observed that there is a significant difference in the research variables; Perceived Ease of Use, Perceived Usefulness, Mobility, Compatibility, Economic Factors, Technological Innovation, Personal Development and ML Performance between public and private universities. Observing the mean values, it could be found that the mean values for the research variables in the public universities are less than the corresponding one in the private universities. For example, the mean value for the Perceived Ease of Use in the public universities (4.1872) is less than that in the private universities (4.4617). Similarly, the mean value for the Perceived Usefulness in the public universities (4.2362) is less than that in the private universities (4.3225).

Table (10). Comparing Means of Research Variables according to Type of University

Research Variables	Type of University	N	Mean	Std. Deviation	P-value
Perceived Ease of Use	Public	470	4.1872	.83055	0.000
	Private	444	4.4617	.84237	
Perceived Usefulness	Public	470	4.2362	.73125	0.000
	Private	444	4.3225	.73570	
Mobility	Public	470	2.7447	1.30716	0.000
	Private	444	3.4932	1.04199	
Compatibility	Public	470	3.2468	1.20356	0.000
	Private	444	3.5721	1.01088	
Economic	Public	470	3.4936	1.06653	0.000

	Private	444	3.7725	.88889	
Social	Public	470	3.5851	1.02433	0.184
	Private	444	3.6712	.92616	
Technological Innovation	Public	470	3.7234	1.25785	0.007
	Private	444	3.9302	1.02214	
Personal Development	Public	470	3.6638	1.10135	0.002
	Private	444	3.8694	.87403	
ML Performance	Public	470	4.0787	1.19173	0.036
	Private	444	4.2230	.85114	

7. Findings and Discussion

The current research illustrates several findings through the empirical study done regarding the ML services provided in the public and private universities in Egypt. First, regarding the direct impact of Integrated TAM dimensions as the factors affecting ML performance in Egypt, it was found that the traditional TAM dimensions; Perceived Ease of Use and Perceived Usefulness became insignificant in the presence of other dimensions in both; public and private universities (P-values < 0.05).

Also, it was found that there is a significant effect of the dimensions; Mobility, Compatibility, Economic and Social Factors on the ML performance, as corresponding P-values in both; public and private universities models are less than 0.05. The research variables; Mobility and Compatibility are considered as consistent with the nature of the ML performance, which is the main reason of their significant impact on ML performance in both; public and private universities models. Besides, the research variable; Economic factors is considered as one of the contributions for the current research, as students prefer using ML due to the fact that the internet services prices are convenient for them. In addition the research variable; Social factors is considered as another contribution for the current research, because students prefer using ML as they like to interact with each other through the electronic networking as they think this is an easier way to communicate and socialize with each other.

Second, comparing the Integrated TAM model in public versus private universities, it was found that the square multiple correlation of the public universities model is around 56%, while that of the private universities model is around 70%. This means that the integrated TAM model is able to explain and contribute with higher percentage of the ML performance in private universities than in public universities. This might be due to the challenges that are still facing public universities in introducing ML for students of such universities. Yet, there is still a percentage of 44% of unexplained variation in the ML performance of public universities, as well as a percentage of 30% of unexplained variation in the ML performance in the private universities. This might be referred to other variables that had not been included in the research model and which are considered as effective for ML performance, such as institutional support.

Third, considering the mediation role of Technological Innovation and Personal Development, it had been proved that there is a full mediation of both; Technological Innovation and Personal Development between Mobility and ML performance in public universities, as corresponding p-value was greater than 0.05. It was also found that there is a partial mediation role of both; Technological Innovation and Personal Development between the research variables; Compatibility, Economic factors and Social Factors on ML Performance as all corresponding p-values are 0.000 < 0.05. On the other hand, It was found that there is a partial mediation role of both;Technological Innovation and Personal Development between the research variables; Mobility, Compatibility, Economic factors and Social Factors on ML Performance as all corresponding p-values are 0.000 < 0.05.Therefore, Technological and Personal development role – varying between full and partial – had been proved to be important for improving the ML performance in both; public and private universities.

Finally, it was found that the mean values of almost all the research variables in the private universities are higher than the corresponding variables of the public universities. This means that there is better preference towards the TAM dimensions and the ML performance in the private universities than in the public universities, which proves the challenges that are still facing the public universities performance, which in turn restrict their role in the ML in Egypt relative to that of the private universities, such as the overcrowded class rooms, and low budgets.

8. Conclusion

Mobile Learning seems to be the upcoming trend of education, taking advantage of the mobile technologies, and utilising the very high rate of mobile usage. This is why ML can and should contribute to the quality of education because of the rich communication and interaction environment it provides. Accordingly, universities have started to make attempts to adopt ML. Despite the clear attempts of the Egyptian HE sector to utilise ML in the learning process, yet it does not dominate the Egyptian market. Accordingly, this study investigates the students' perception towards ML adoption and utilisation in the Egyptian HE sector, in both; public and private universities.

An extended Technology Acceptance Model (TAM) was developed and tested with four TAM constructs; together with two other main constructs added; namely Economic and Social factors. The research variable; Economic factors is considered a contribution of this study, as students prefer using ML due to the convenient internet service prices. Moreover, Social factors is also another contribution for the research, because students prefer using ML as they like to interact with each other through the electronic networking as it is an easier way to communicate and socialize with each other.

Technological innovation and personal development were proposed as mediators for the relationship between the research variables and ML performance. 600 questionnaires were distributed over both public and private Egyptian HE studennts, and 470 valid ones were returned. A comparative study was conducted between public and private universities and the research model

was tested twice; once for every sector type. Data was statistically analysed using SPSS and AMOS to compute the reliability, validity, descriptive statistics and the Structural Equation Modeling (SEM) was also used.

Traditional TAM dimensions; Perceived Ease of Use and Perceived Usefulness are insignificant in the presence of other dimensions in both sectors. A significant effect of Mobility, Compatibility, Economic and Social Factors on the ML performance in both sectors was also noted. Comparing the Integra-ted TAM model in public versus private universities, illustrated that the model is able to contribute with higher percentage of ML performance in private universities than the case with public universities.

Technological Innovation and Personal Development were proven to have a full mediation role between Mobility and ML performance in public universities. A partial mediation role was found of both; Technological Innovation and Personal Development between the research variables; Compatibility, Economic factors and Social Factors on ML Performance. On the other hand, it was found that there is a partial mediation role of both; Technological Innovation and Personal Development between the research variables; Mobility, Compatibility, Economic factors and Social Factors on ML Performance. Therefore, Technological and Personal development role had been proved to be important for improving the ML performance in both; public and private universities. The mean values of almost all the research variables in the private universities were higher than the corresponding variables of the public universities.

Finally, this indicates that there is better preference towards the TAM dimensions and the ML performance in the private universities than in the public universities, which proves the challenges that are still facing the public universities performance, which in turn restrict their role in the ML in Egypt relative to that of the private universities.

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Appendix

Dear participant;

Initially, I would like to thank you for your support and participation in this customer opinion survey which is done as part of one of my researches. This survey deals with your personal opinions, where data obtained will be handled with complete privacy for the sake of this research only. *Please answer all of the following questions.*

Personal Information

1. **Gender** Male□ Female□
2. **Do you have a smart phone?** ○ **Yes** ○ **No**
3. **Does your smart phone has Internet access?** ○ **Yes** ○ **No**
4. **Your Internet access is mostly from** ○ **Mobile device** ○ **Desktop Computer**
5. **How often do you access the Internet?** ○ **Daily** ○ **Weekly** ○ **Monthly**
6. **Do you know anything about mobile learning?** ○ **Yes** ○ **No**
7. **Do you want to know more about mobile learning?** ○ **Yes** ○ **No**
8. **Do you prefer using mobile learning more than traditional learning?** ○ **Yes** ○ **No**

Statements	Scale				
	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1. Using internet would be easy for me to learn					
2. Using internet would not require much mental effort					
3. Using internet make it simple to learn					
4. Using internet make it easy to learn following the instructions present.					
5. Using Internet for learning is easier					
6. Using Internet for learning is useful					
7. Using Internet for learning helps me to learn faster					
8. Using Internet for learning helps me to learn efficiently					
9. Using mobile learning is an efficient way to manage my time					
10. Using mobile learning would be convenient for me					
11. Using mobile learning would allow me to save time					
12. Using mobile learning would allow me to use learning services instantly					
13. Using mobile learning is consistent with my experience in using other website					
14. Using e-banking in this bank is consistent with my experience in using other universities Website					
15. Using mobile learning fulfills my service needs					

Statements	Scale				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
16. Mobile learning is financially convenient for me.					
17. Mobile learning is cost effective					
18. Mobile learning saves my time					
19. Mobile learning saves my effort					
20. My colleagues think I should use mobile learning					
21. My classmates think I should use mobile learning					
22. My friends think I should use mobile learning					
23. Use of mobile learning services is relevant to my perspectives.					
24. Use of mobile learning services is helpful to my perspectives.					
25. Use of mobile learning services is desirable to my perspectives.					
26. Other people come to me for advice on new mobile technologies and services.					
27. In general, I am among the first in my circle of friends to acquire new mobile technology and services when it appears.					
28. I can usually figure out new high tech products and services without help from others.					
29. I have fewer problems than others in making technology based services work for me.					
30. I enjoy the challenge of figuring out high tech gadgets and their usage.					
31. Using mobile learning would enhance my effectiveness in using learning services					
32. Using mobile learning would improve my performance in using learning services					
33. Using mobile learning would improve my productivity in using learning services					
34. I find mobile learning useful					