

Exploratory Factor Analysis (EFA) Towards Determining Factor of Acceptance, Usage and Engagement of 'MClass' Mobile Application Amongst Public University Students, Malaysia

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Abstract: The growing demand for smartphones anticipate that there is an opportunity to implement m-Learning in Malaysia (SKMM, 2013). MClass development is seen as one of the efforts to enhance learning as well as bridging the digital divide of students through mobile devices. Exploratory Factor Analysis (EFA) is carried out to validate instruments in which were adapted from Venkatesh, Morris, Davis and Davis by [1] using the modified UTAUT model. This study involved 115 respondents which were randomly selected from the research population. An EFA analysis is performed to measure and validate the suitability of each item prior to the Confirmatory Factor Analysis (CFA). EFA findings show that there are six items in the performance expectancy, effort expectancy, facilitating condition and engagement construct need to be aborted.

Keywords: *Exploratory Factor Analysis (EFA), m-Learning, UTAUT Model*

1. Introduction

Implementation of m-learning through the use of mobile applications has the potential to support more democratic, more flexible, more autonomic, more comprehensive learning which also support formal and informal learning. Mobile apps are developed to enable users to gain access to a variety of information, content, entertainment and more in which to help users perform tasks efficiently [2]. Access to education through mobile devices is not just a necessity today but has become an essential needs for students and educators to achieve [3].

Sharples [4] describes the teaching and learning activities (TaL) through mobile applications are seen to exceed the curriculum. This aspect is seen as a prominent advantage considering the application involve students connecting with friends and lecturers through mobile applications to carry out learning activities. Additionally, this app is also capable of

overcoming the physical limitations of a laptop where students are unable to access learning materials from any place or at any time [5]. However, m-learning in public universities is a new field and the rate of usage is slow. This is due to the refusal of the user to accept the technology which will only resulted in failure through its implementation.

Based on today's scenario, a mobile application, known as 'MClass' is introduced to allow a much faster link to the Learning Management System (LMS). MClass is a mobile application that allows quick access to Internet from mobile devices to a course content. The MClass concept is similar to the Learning Management System (LMS) but it is an application that needs to be downloaded online from the Android operating system. Among the categories of information that are offered through MClass are announcements, course materials, forums, online quizzes, exam grades and list of students. Thus, this study aims to explore and validate the instruments used to identify factors that determines the

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acceptance, usage and involvement of students in MClass mobile applications amongst the public university students.

2. Literature Review

Various research were conducted to study the acceptance of students and the effects of mobile devices usage in the context of m-learning. Studies by Nassuora [6] and Abu-Al-Aish [7] showed that although there are a widespread use of mobile devices, students are still not ready to adapt to mobile learning technology in the TaL process. However, respondents believe that m-learning will grow as a new learning technology in the future [7].

Corlett, Sharples, Bull and Chan [8] in their study at Birmingham University regarding the use of Pocket PC in offering various mobile applications for students in the form of 'mobile learning organiser'. The primary use of this organiser is to facilitate dissemination of information, management of studies and access to course materials. Students can also communicate via e-mail and text messaging services provided rather than referring to university calendars to facilitate the learning management. Shao, Crook and Kolevas [9] also carried out similar studies at the University of Nottingham. Their study relates to the usage of mobile devices and Pocket PC software as a tool to support students in the m-learning culturing process. The findings of this study showed that students were able to adapt and showed high interest in the implementation of m-learning.

The study by Jairak, Praneetpolgrang and Mekhabunchakij [5] regarding the acceptance of students towards m-learning at five public universities in Thailand also found that although most of the students were not yet familiar with the m-learning system, the students portrays a good perception of m-learning. The study also showed that the positive perceptions from students on m-learning and the support from university were two of the major factors that led to the successful implementation of the m-learning system there. Therefore, university administration should support and pay attention in designing a good m-learning environment which are suitable for students.

3. Exploratory Factor Analysis (EFA)

The researchers have combined two theories to build this conceptual framework of the study which is the

Uniform Theory of Acceptance and Use of Technology model by Venkatesh et al., [12] as the main framework by adding the involvement constructs into the model.

Exploratory Factor Analysis (EFA) is conducted to measure the suitability of each item in the construct before the instrument is used at Confirmatory Factor Analysis (CFA). EFA refers to the use of data reduction techniques to reduce the number of items to several factors so that the items can be summarized in that factor [10]. This analysis aims to divide the study variables into smaller groups. This technique will drop the items that have a high correlation value, items that cannot be included in any factor and variables that have very low load value. This means that variables with a load factor of less than 0.30 or greater than 0.90 will be eliminated [10]. For this study, the load factor value used by the researcher is 0.5 since the items used in the questionnaire were adapted from the previous study.

There are also other requirements to implement EFA analysis. Bartlett's Test of Sphericity and Measure of Sampling Adequacy (MSA) need to be done to ensure that the variables have a correlation in order to produce factors. Bartlett's Test of Sphericity is a statistical test that tests significant degrees of each correlation in the correlation matrix [10]. Furthermore, factor suitability would occur when the MSA test based on the Kaiser-Meyer-Olkin (KMO) sample Sufficiency value exceeds 0.50 and the Bartlett test is significant ($p < 0.05$) [10].

Additionally, the number of samples required to implement EFA is at least 100 samples as suggested by Hair et al., [10]. The EFA analysis for this study involved 115 respondents randomly selected from the study population. This respondent will not be involved with the actual study which is to implement the Confirmatory Factor Analysis.

3.1 Exploratory Factor Analysis (EFA) for Performance Expectancy Construct

Exploratory Factor Analysis (EFA) with Varimax rotation on 10 items of Performance Expectancy construct were conducted on 115 samples to identify items that fall into the construct. The Kaiser-Meyer-Olkin (KMO) sample sufficiency value is 0.896 which is more than 0.7 indicates the existing data is suitable for Principal Component Analysis. Bartlett's Test of Sphericity was significant ($p < 0.001$) indicates that the relationship between items were sufficient for EFA. However, comparisons were made with items in the original construct which then resulted that two items had to be aborted, namely the PE5 item (MClass provided the information I needed in learning) and PE10 (MClass gave a positive impact on my learning).

Table 1: EFA Performance Expectancy Results

Item	Factor
PE1 I found MClass useful in my studies	0.710

PE2 Using MClass allows me to perform learning tasks more quickly	0.796
PE3 Using MClass can improve my learning efficiency	0.818
PE4 Using MClass increases my learning productivity	0.734
PE6 MClass can improve my collaboration with classmates	0.726
PE7 The usage of MClass can increase my chances of getting better grades	0.815
PE8 MClass makes my learning easier in the university	0.763
PE9 MClass makes my learning more effective	0.770
Eigenvalue	4.713
Variance percentage explained	58.917
Amount of variance explained = 58.917%	
Kaiser-Meyer-Olkin (KMO) Sufficiency Sample = 0.896	
Bartlett's Test of Sphericity, $\chi^2 = 458.645$, $p < .000$	

3.2 Exploratory Factor Analysis (EFA) for Effort Expectancy Construct

Exploratory Factor Analysis (EFA) with Varimax rotation is carried out on seven items in the Effort Expectancy Construct to identify the construct item. The Kaiser-Meyer-Olkin (KMO) sample sufficiency value is 0.874 which is more than 0.7 indicates that the existing

data is suitable for Principal Component Analysis. Bartlett's Test of Sphericity was significant ($p < 0.001$) indicating the relationship between items was sufficient for EFA. Comparisons made with items in the original construct found that an item need to be aborted which is item EE1 (My interaction with MClass is clear).

Table 2: EFA Effort Expectancy Results

Item	Factor
EE2 My interaction with MClass is easy to understand	0.795
EE3 Learning materials are readily available from MClass	0.819
EE4 It's easy for me to master the Mclass usage	0.831
EE5 Saya mendapati MClass mudah untuk digunakan	0.894
EE6 I found MClass easy to use	0.702
EE7 I found that MClass was easy to learn	0.889
Eigenvalue	4.076
Variance percentage explained	67.927
Amount of variance explained = 67.927%	
Kaiser-Meyer-Olkin (KMO) Sufficiency Sample = 0.874	
Bartlett's Test of Sphericity, $\chi^2 = 444.718$, $p < .000$	

3.3 Exploratory Factor Analysis (EFA) for Social Influence Construct

Exploratory Factor Analysis (EFA) with Varimax rotation is carried out on seven items in the Social Influence Construct to identify the construct item. The Kaiser-Meyer-Olkin (KMO) sample sufficiency value recorded is 0.854 which is more than 0.7 indicates that

the existing data is suitable for Principal Component Analysis. Bartlett's Test of Sphericity was significant ($p < 0.001$) indicating that the relationship between the items was sufficient for EFA. Comparisons made with items in the original construct found no items to be aborted as all items had a load value of more than 0.5.

Table 3: EFA Social Influence Results

Item	Factor
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SI1 Individuals who influence my behavior felt that I need to use Mclass	0.784
SI2 The lecturer felt I needed to use Mclass	0.823
SI3 A college friend felt I need to use MClass	0.826
SI4 Lecturers provide a lot of support for the usage of Mclass	0.770
SI5 Friends were very helpful in using MClass	0.743
SI6 Friends who have been using MClass seem more prestigious	0.817
SI7 Overall, individuals around me support the use of MClass in teaching and learning activities	0.802
Eigenvalue	4.429
Variance percentage explained	63.264
Amount of variance explained = 63.264%	
Kaiser-Meyer-Olkin (KMO) Sufficiency Sample = 0.854	
Bartlett's Test of Sphericity, $\chi^2 = 480.293$, $p < .000$	

3.4 Exploratory Factor Analysis (EFA) for Facilitating Condition Construct

Exploratory Factor Analysis (EFA) with Varimax rotation is carried out on seven items in the Facilitating Condition Construct to identify the construct item. The Kaiser-Meyer-Olkin (KMO) sample sufficiency value recorded is 0.803 which is more than 0.7 indicates that the existing data is suitable for Principal Component

Analysis. Bartlett's Test of Sphericity was significant ($p < 0.001$) indicating that the relationship between the items was sufficient for EFA. Comparison were made with the items in original construct found that two items need to be aborted which are item FC1 (I have Internet access required to access MClass) and FC2 (I have enough knowledge to use Mclass).

Table 4: EFA Facilitating Condition Results

Item	Factor
FC3 There is a complaint line provided to solve technical problems related to MClass	0.681
FC4 Complaints via email to technical support groups are available if students are experiencing problems using Mclass	0.686
FC5 I can rely on a technical support team if I encounter problems while using MClass	0.928
FC6 The provided MClass User Manual is sufficient	0.664
FC7 There is a technical support team in standby ready to help solve problems regarding MClass	0.925
Eigenvalue	3.771
Variance percentage explained	68.435
Amount of variance explained = 68.435%	
Kaiser-Meyer-Olkin (KMO) Sufficiency Sample = 0.854	
Bartlett's Test of Sphericity, $\chi^2 = 418.594$, $p < .000$	

3.5 Exploratory Factor Analysis (EFA) for Behavioral Intention Construct

Exploratory Factor Analysis (EFA) with Varimax rotation on seven item for Behavioral Intention Construct are conducted with 115 samples to identify item to identify items that fall within the constructs. The Kaiser-Meyer-Olkin (KMO) sample sufficiency value is

0.905 which is more than 0.7 indicates that the existing data is suitable for Principal Component Analysis. Bartlett's Test of Sphericity was significant ($p < 0.001$) indicating that the relationship between the items was sufficient for EFA. Comparisons made with items in the original construct which eventually found no items to be aborted.

Table 5: EFA Behavioral Intention Results

Item	Factor
BI1 I intend to increase the use of MClass in the future	0.790
BI2 I intend to improve my skills in using MClass in the future	0.801
BI3 I expect that I will often use MClass in my learning activities	0.821
BI4 I would recommend others to use MClass	0.881
BI5 I expect that I will continue to use MClass if it was offered in another course	0.817
BI6 I will always try to make MClass part of my daily activities	0.838
BI7 I hope I can use MClass every semester	0.804
Eigenvalue	4.797
Variance percentage explained	68.535
Amount of variance explained = 68.535%	
Kaiser-Meyer-Olkin (KMO) Sufficiency Sample = 0.905	
Bartlett's Test of Sphericity, $\chi^2 = 541.885$, $p < .000$	

3.6 Exploratory Factor Analysis (EFA) for Use Behavior Construct

Exploratory Factor Analysis (EFA) with Varimax rotation on five items of Use Behavior Construct with 115 samples is to identify items that fall within the

constructs. The Kaiser-Meyer-Olkin (KMO) sample sufficiency value is 0.744 which is more than 0.7 indicates that the existing data is suitable for Principal Component Analysis. Bartlett's Test of Sphericity was significant ($p < 0.001$) indicating that the relationship between the items was sufficient for EFA.

Table 6: EFA Use Behavior Results

Item	Factor
UB1 Using MClass has become part of my daily activity.	0.838
UB2 While using a smartphone, I often log in to MClass	0.824
UB3 I often use MClass in my free time	0.591
UB4 I will feel lost if I no longer use MClass	0.758
UB5 I'll be disappointed if I cannot use MClass again	0.829
Eigenvalue	2.994
Variance percentage explained	59.873
Amount of variance explained = 59.873%	
Kaiser-Meyer-Olkin (KMO) Sufficiency Sample = 0.744	
Bartlett's Test of Sphericity, $\chi^2 = 245.372$, $p < .000$	

3.7 Exploratory Factor Analysis (EFA) for Engagement Construct

Exploratory Factor Analysis (EFA) with Varimax rotation on 20 items of the Involvement constructs with 115 samples is conducted to identify items that fall into the construct. The Kaiser-Meyer-Olkin (KMO) sample sufficiency value is 0.939 which is more than 0.7

indicates that the existing data is suitable for Principal Component Analysis. Bartlett's Test of Sphericity was significant ($p < 0.001$) indicating that the relationship between the items was sufficient for EFA. Comparison were made with the items in original construct found that one item need to be remove which is item EG17 (I feel really involved when using Mclass).

Table 7: EFA Engagement Results

Item	Factor
EG1 I seem to forget the surrounding environment while using Mclass	0.795
EG2 I'm too engrossed in using MClass until I ignore what's happening around	0.797
EG3 I'm obsessed with the learning experience of using Mclass	0.774
EG4 Time passes fast when I use Mclass	0.798
EG5 I'm fully focused on my assignment while using Mclass	0.819
EG6 The learning experience of using MClass is difficult	0.709
EG7 I was able to control the learning experience while using MClass	0.740
EG8 The MClass interface is appealing	0.867
EG9 I like the graphics and images used in MClass	0.670
EG10 The MClass screen layout draws my visual senses	0.805
EG11 The layout of the MClass screen display is fun	0.776
EG12 Learning to use MClass is worth it	08.11
EG13 I feel that learning experience using MClass is as successful	0.840
EG14 Learning experience using MClass is as planned	0.837
EG15 Learning experience using MClass is useful	0.862
EG16 I would recommend MClass to other friends	0.811
EG18 I keep using MClass on a curious basis	0.754
EG19 The contents of MClass attracts my curiosity	0.686
EG20 I'm interested in the assignment given in MClass	0.790
Eigenvalue	12.032
Variance percentage explained	60.162
Amount of variance explained = 60.162%	
Kaiser-Meyer-Olkin (KMO) Sufficiency Sample = 0.939	
Bartlett's Test of Sphericity, $\chi^2 = 1935.261$, $p < .000$	

3.8 Cronbach's Alpha Value After EFA

After the factor analysis, the reliability analysis is done again to measure the consistency of each item in the scale used for theoretical construct measurement. The method used to measure reliability is the Alpha

Cronbach coefficient value. Hair et al., (2010) suggested the minimum value for the Alpha Cronbach coefficient was 0.7 because the item used was the adaptation of the existing instrument.

Table 8: Cronbach's Alpha Value After EFA

Construct	No. of Original Item	Items Aborted	No. of Items after EFA	Alpha Cronbach coefficient
Performance Expectancy	10	2	8	0.896
Effort Expectancy	7	1	6	0.899
Social Influence	7	0	7	0.902
Facilitating Condition	7	2	5	0.845
Behavioral Intention	7	0	7	0.922
Use Behaviour	5	0	5	0.831
Engagement	20	1	19	0.965
Amount of items aborted				6
Amount of items left after EFA				57

4. Discussion and Conclusion

Exploratory Factor Analysis is performed to measure the suitability of each item by using data reduction techniques to reduce the number of items having a high correlation value and a very low load value before the whole item is used at the Confirmatory Factor Analysis. Bartlett' Test of Sphericity and Measure of Sampling Adequacy (MSA) is required to ensure that variables have a correlation to produce factors. The EFA result for performance expectancy, effort expectancy, facilitating condition and engagement constructs showed that six items were aborted.

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