



## THE DEVELOPMENT AND VALIDITY OF BEHAVIORAL INSTRUMENT OF MOBILE LEARNING APPLICATIONS USAGE AMONG UNDERGRADUATE STUDENTS



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### ABSTRACT

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The emergence of m-learning is perceived to support the success of the 2015-2025 Malaysia Education Blueprint. Access to education through mobile devices is not just a requirement today but has become a necessity for students and educators to achieve. Therefore, this study aims to develop and validate eight constructs to observe the behavior of acceptance and the use of mobile learning application among students in public universities. This study involved 120 respondents amongst undergraduate students in Universiti Pendidikan Sultan Idris, Malaysia who were randomly selected from the study population. Exploratory Factor Analysis (EFA), is done to measure the suitability of each item and validate the Acceptance and Use of Mobile Learning Application Instrument among Bachelor Degree students. EFA results find that all load factor values exceed 0.5; all items are accepted and no items are dropped. Based on the analysis conducted, it can be concluded that the instruments used have high degree of validity and reliability to determine the acceptance and use of Mobile Learning Application among students.

**Contribution/ Originality:** This study contributes to the body of knowledge as it successfully explore and validate constructs in determining the acceptance and usage factors of m-Learning among higher education students.

### 1. INTRODUCTION

M-Learning has been introduced in the educational system which aimed at supporting the teaching and learning (T&L) process. M-Learning means enhanced learning with the use of mobile devices and mobile communications that can take place anywhere and anytime, and take advantage of the learning opportunities offered by mobile technology (Cheung, Yuen, & Tsang, 2011; Chuang, 2009). M-Learning is seen to have the potential to support more democratic, flexible, autonomous, comprehensive learning and support formal and informal learning

through the mobile app. Mobile app allows users to access a variety of information, content, entertainment and so on to help users perform tasks more easily (Pollara, 2011).

Online learning using this electronic method is one of the key tools in widening access to education, improving teaching and learning quality, while enabling learning tailored to the needs of students. Therefore, the use of apps for learning purposes is a necessity that has a positive impact on students because by simply filling in android-based learning app software on smartphones, all learning activities can be easily carried out wherever the students are and whenever they need.

The rapid advancement of technology has witnessed the ever increasing relevance of mobile app usage in T&L including the institutions of higher education. According to the [NMC Horizon Project \(2016\)](#) there has been an increase in the number of tertiary institutions moving from conventional to technology-based methods. A study by [Abu-Al-Aish \(2014\)](#) on students in the Public Universities found that most students are more prepared for the implementation of m-Learning since the ownership of mobile devices is high while also accustomed to the implementation of e-Learning. Students also agree that m-learning will make the learning process more interesting and flexible and save time. In addition, it will improve communication between students and lecturers ([Abu-Al-Aish, Love, & Hunaiti, 2012](#); [Ooms, Linsey, Webb, & Panayiotidis, 2008](#)).

The study conducted by [Subramaniam and Harun \(2013\)](#) found that students have positively received the use of mobile devices in learning sessions. This is because mobile devices are promoting the m-Learning environment even more among students especially in institutions of higher education. A study by [Abu-Al-Aish \(2014\)](#) shows that students have a positive view on the usage of m-Learning in their learning activities and perceive it as a support system for conventional learning.

Access to education via mobile has become a necessity for students and educators. Consequently with the rapid growth of information technology, the challenge of embracing this technology in the social environment is increasing ([Venkatesh & Bala, 2008](#)). Studies by [Nassuora \(2013\)](#) show that despite the widespread use of mobile devices, students are still not ready to adapt to mobile learning technology in the T&L process. From a pedagogical aspect, mobile learning applications are seen as a burden in the T&L process. This is because mobile learning depends on continuous internet access. In addition, the location also affects the speed of the internet. A study conducted by [Wang, Wu, and Wang \(2009\)](#) found that students were more likely to use smartphones for entertainment purposes than for educational purposes. [Abu-Al-Aish \(2014\)](#) in his study added technical issues, institute infrastructure and student readiness were also contributing to the issues in the process of implementing m-Learning.

It is found that most studies related to m-Learning focus on the readiness of students using m-Learning [Ismail, Azizan, and Gunasegaran \(2016\)](#); [Shorfuzzaman and Alhussein \(2016\)](#); [Nurulhuda and Norfadziah \(2017\)](#) student attitudes towards m-Learning. Furthermore, most studies are aimed at investigating the factors that influence the acceptance and usage of students in the m-Learning environment of [Uğur, Koç, and Koç \(2016\)](#) and [Wu \(2016\)](#) but lack research focusing on mobile app usage research in m-Learning environment. Therefore, it is necessary to conduct a study on the Usage Behaviour of Mobile Learning Application among students.

This study aims to develop and validate the Application Instrument of Mobile Learning Application among Students of Bachelor Degree in Universiti Pendidikan Sultan Idris. In particular, this study aims to:

- i. Develop a Behavioral Acceptance and Usage of Mobile Learning Application Instrument among students.
- ii. Verify Behavioral Acceptance and Usage of Mobile Learning Application among students.

The instruments were adopted from the model of Extending The Unified Theory of Acceptance and Use of Technology 2 by [Venkatesh, Thong, and Xu \(2012\)](#) which consist of eight constructs; Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Hedonic Motivation, Price Value, Habit and Behavioral Intention. [Figure 1](#) shows the conceptual framework of the study;

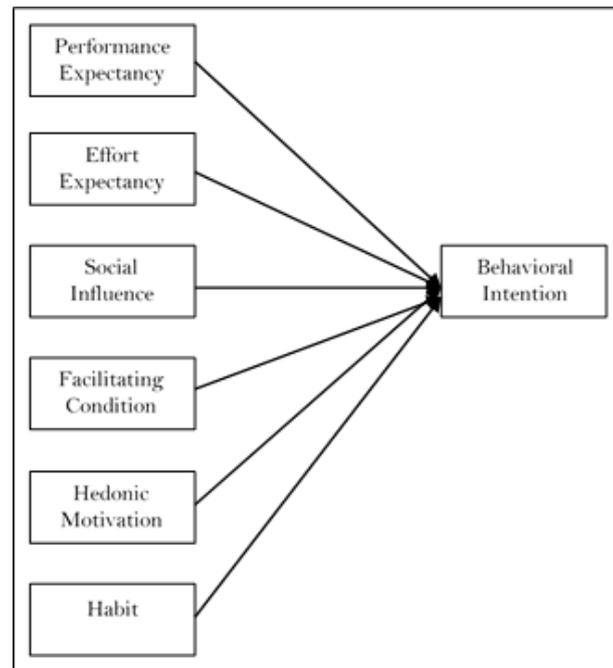


Figure-1. Conceptual Framework

## 2. RESEARCH METHODOLOGY

The study was conducted at Universiti Pendidikan Sultan Idris (UPSI), Perak, Malaysia. A total of 120 students from UPSI Bachelor's Degree (ISM) students were selected as survey respondents. This number is sufficient because the number of samples required for implementing EFA is at least 100 as suggested by Hair, Black, Babin, and Anderson (2010). The data were obtained by using questionnaires consisting of two parts, namely Part A and Part B. Part A consists of student demographic factors, while part B consists of seven constructs such as performance expectations, initiative expectations, social influences, behavioral conditions, hedonic motivation, habits and behavioral intentions of students. Each item in each construct is measured using a Likert Interval Scale. The rating scale used is from 1 (strongly disagree) to 6 (strongly agree). To determine the validity of the instrument construct, the researcher performed Exploratory Factor Analysis (EFA) to measure the suitability of each item in the construct before the instrument is used at the Confirmatory Factor Analysis (CFA) level. The data was analyzed using SPSS version 23 software to run Exploratory Factor Analysis to see the suitability of the item before the actual survey was conducted.

## 3. RESEARCH FINDINGS

### 3.1. Exploratory Factor Analysis (EFA) for Performance Expectancy Construct

Exploratory Factor Analysis (EFA) with Varimax rotations on 7 items of Performance Expectancy Construct to identify items that fall within the construct. Kaiser-Meyer-Olkin (KMO) Sampling Adequacy value is 0.876 which is more than 0.7 indicates the existing data is suitable for Principal Component Analysis. Bartlett's Test of Sphericity was significant ( $p < 0.001$ ) indicating the relationship between items was sufficient for EFA.

The percentage variance explained for this factor was 59.467%. Based on the rotated component matrix, only one factor is identified with an eigenvalue greater than 1 with a factor load greater than 0.5. Comparison with items in the original construct found that no item needed to be dropped because all items had a load value greater than 0.5. The EFA results for the Performance Expected Buildings can be referred in Table 1:

**Table-1.** Performance expectancy EFA results.

| Item   | Factor |
|--|--------|
| PE1 I found that the mobile app for learning purpose are useful in my everyday life                  | .708   |
| PE2 Using the mobile app for learning purposes tends to increase my chances of getting better grades | .727   |
| PE3 Using the mobile app helps me solve things related to learning more quickly                      | .745   |
| PE4 Using the mobile app increases my learning productivity  | .887   |
| PE5 The Mobile app has a positive impact on my learning  | .820   |
| PE6 Using the mobile app can improve my learning efficiency  | .748   |
| PE7 Mobile app makes my learning easier at university  | .747   |
| Eigen Value  | 4.163  |
| Variance percentage explained  | 59.467 |
| Amount of variance explained = 59.467%   |        |
| Kaiser-Meyer-Olkin (KMO) Sampling Adequacy = .876  |        |
| Bartlett's's Test of Sphericity, $\chi^2 = 417.248$ $p < .000$                                       |        |

### 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 those construct items. The Kaiser-Meyer-Olkin (KMO) Sampling Adequacy value is 0.888 which is more than 0.7 indicates the existing data is suitable for Principal Component Analysis. Bartlett's Test of Sphericity was significant ( $p < 0.001$ ) indicating the relationship between items was sufficient for EFA.

The percentage variance explained for this factor was 65.810%. Based on the rotated component matrix, only one factor is identified with an eigenvalue greater than 1 with a factor load greater than 0.5. Comparison with items in the original construct found that no item needed to be dropped because all items had a load value greater than 0.5. The EFA results for the Expected Initiative Construct can be referred in [Table 2](#):

**Table-2.** Effort expectancy EFA results.

| Item   | Factor |
|--|--------|
| EE1 The use of the mobile app for learning purposes is easy to learn               | .788   |
| EE2 Learning materials are easy to be obtained when using the mobile app           | .764   |
| EE3 My interaction with mobile app for learning purposes is clear                  | .807   |
| EE4 I found mobile app for learning purpose so easy to use                         | .904   |
| EE5 It's easy for me to master in using the mobile app for learning purposes       | .862   |
| EE6 I found the mobile app for learning purpose is flexible                        | .725   |
| EE7 My interaction with the mobile app for learning purposes is easy to understand | .815   |
| Eigen Value  | 4.607  |
| Variance percentage explained  | 65.810 |
| Amount of variance explained = 65.810%   |        |
| Kaiser-Meyer-Olkin (KMO) Sampling Adequacy = 0.888                                 |        |
| Bartlett's's Test of Sphericity), $\chi^2 = 538.940$ $p < .000$                    |        |

### 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 items. The Kaiser-Meyer-Olkin (KMO) Sampling Adequacy value is 0.852 which is more than 0.7 indicates the existing data is suitable for Principal Component Analysis. Bartlett's Test of Sphericity was significant ( $p < 0.001$ ) indicating the relationship between items was sufficient for EFA.

The percentage variance explained for this factor was 64.161%. Based on the rotated component matrix, only one factor is identified with an eigenvalue greater than 1 with a factor load greater than 0.5. Comparison with items in the original construct found that no item needed to be dropped because all items had a load value greater than 0.5. The EFA results for the Social Influence Construct can be referred in [Table 3](#).

### 3.4. Exploratory Factor Analysis (EFA) for Facilitating Condition Construct

Exploratory Factor Analysis (EFA) with Varimax rotation is carried out on five items in the Facilitating Condition Construct to identify the construct items. The Kaiser-Meyer-Olkin (KMO) Sampling Adequacy value is 0.830 which is more than 0.7 indicates the existing data is suitable for Principal Component Analysis. Bartlett's Test of Sphericity was significant ( $p < 0.001$ ) indicating the relationship between items was sufficient for EFA.

**Table-3. Social influence EFA results**

| Item   | Factor |
|--|--------|
| SI1 Lecturer thinks I need to use the mobile app for learning purpose                                    | .781   |
| SI2 My friends think I need to use the mobile app for learning purposes                                  | .849   |
| SI3 The Family also thinks I need to use the mobile app for learning purposes                            | .846   |
| SI4 Friends help a lot in the use of mobile apps for learning purposes                                   | .818   |
| SI5 The community around me supports the use of the mobile app for learning purposes                     | .736   |
| SI6 I should use the mobile app for learning purposes because most of my friends are also using it       | .804   |
| SI7 The suggestions from friends have influenced my decision to use the mobile app for learning purposes | .766   |
| Eigen Value  | 4.491  |
| Variance percentage explained  | 64.161 |
| Amount of variance explained = 64.161%   |        |
| Kaiser-Meyer-Olkin (KMO) Sampling Adequacy = 0.852   |        |
| Bartlett's Test of Sphericity, $\chi^2 = 529.696$ , $p < .000$   |        |

The percentage variance explained for this factor was 64.093%. Based on the rotated component matrix, only one factor is identified with an eigenvalue greater than 1 with a factor load greater than 0.5. Comparison with items in the original construct found that no item needed to be dropped because all items had a load value greater than 0.5. The EFA results for the Facilitating Condition Construct can be referred in [Table 4](#):

**Table-4. Facilitating condition EFA results.**

| Item  | Factor |
|---|--------|
| FC1 Internet access is sufficient for learning purposes using the mobile app                                | .747   |
| FC2 I have enough knowledge to use the mobile app for learning purposes                                     | .815   |
| FC3 I can rely on materials on the Internet if I encounter problems while using the mobile app for learning | .828   |
| FC4 I can get help from others when I'm having trouble using the mobile app for learning purposes           | .731   |
| FC5 Mobile Learning Application is equivalent to the other technologies that I use for learning             | .874   |
| Eigen Value   | 3.205  |
| Variance percentage explained   | 64.093 |
| Amount of variance explained = 64.093%  |        |
| Kaiser-Meyer-Olkin (KMO) Sampling Adequacy = 0.830  |        |
| Bartlett's Test of Sphericity, $\chi^2 = 265.880$ , $p < .000$  |        |

### 3.5. Exploratory Factor Analysis (EFA) for Hedonic Motivation Construct

Exploratory Factor Analysis (EFA) with Varimax rotation over seven items in the Hedonic Motivation construct. The Kaiser-Meyer-Olkin (KMO) sampling Adequacy value is 0.932 which is more than 0.7 indicates the existing data is suitable for Principal Component Analysis. Bartlett's Test of Sphericity was significant ( $p < .001$ ) indicating the relationship between items was sufficient for EFA.

The percentage variance explained for this factor was 77.599%. Based on the rotated component matrix, only one factor is identified with an eigenvalue greater than 1 with a factor load greater than 0.5. Comparison with items in the original construct found that no item needed to be dropped because all items had a load value greater than 0.5. The EFA results for the Hedonic Motivation Construct can be referred in [Table 5](#).

**Table-5. Hedonic motivation EFA results.**

| Item  | Factor |
|---|--------|
| HM1 Using the mobile app for learning purposes is fun                                 | .904   |
| HM2 I enjoy using the mobile app for learning purposes                                | .909   |
| MH3 Using the mobile app for learning purposes is very entertaining                   | .890   |
| HM4 The Mobile app for learning purpose motivates me to learn                         | .882   |
| HM5 Using the mobile app for learning purpose satisfies me                            | .899   |
| HM6 Using the mobile app for learning purpose is exciting                             | .875   |
| HM7 The use of the mobile app for learning purposes is a trend of today's generation. | .803   |
| Eigen Value   | 5.432  |
| Variance percentage explained   | 77.599 |
| Amount of variance explained = 77.599%  |        |
| Kaiser-Meyer-Olkin (KMO) Sampling Adequacy = 0.932                                    |        |
| Bartlett's Test of Sphericity, $\chi^2 = 790.385$ , $p < .000$                        |        |

### 3.6. Exploratory Factor Analysis (EFA) for Habit Construct

Exploratory Factor Analysis (EFA) with Varimax rotation on nine Habit Construct items. Kaiser-Meyer-Olkin (KMO) Sampling Adequacy value is 0.885 which is more than 0.7 indicates the existing data is suitable for Principal Component Analysis. Bartlett's Test of Sphericity was significant ( $p < 0.001$ ) indicating the relationship between items was sufficient for EFA.

The percentage variance explained for this factor was 62.516%. Based on the rotated component matrix, only one factor is identified with an eigenvalue greater than 1 with a factor load greater than 0.5. Comparison with items in the original construct found that no item needed to be dropped because all items had a load value greater than 0.5. The EFA results for the Habit Construct can be referred in Table 6:

**Table-6.** Habit construct EFA results.

| Item  | Factor |
|---|--------|
| H1 The use of the mobile app for learning purposes has become my routine                  | .739   |
| H2 I'm addicted to the mobile app for learning purposes                                   | .757   |
| H3 I must use the mobile app for learning purposes  | .749   |
| H4 Using the mobile app for learning purposes has become a habit to me                    | .817   |
| H5 The use of the mobile app for learning purposes has become part of my daily activities | .835   |
| H6 I often use the mobile app for learning purposes at leisure                            | .826   |
| H7 I will be disappointed if I can no longer use the mobile app for learning purposes     | .795   |
| H8 While using a smartphone, I often use the mobile app for learning purposes             | .833   |
| H9 I would feel lost if I did not use the mobile app for learning purposes                | .757   |
| Eigen Value   | 5.626  |
| Variance percentage explained   | 62.516 |
| Amount of variance explained = 62.516%  |        |
| Kaiser-Meyer-Olkin (KMO) Sampling Adequacy = 0.885  |        |
| Bartlett's Test of Sphericity, $\chi^2 = 727.397$ , $p < .000$                            |        |

### 3.7. Exploratory Factor Analysis (EFA) for Behavioral Intention Construct

Exploratory Factor Analysis (EFA) with Varimax rotation of seven items on the Behavioral Intention Construct. Kaiser-Meyer-Olkin (KMO) sampling Adequacy value is 0.895 which is more than 0.7 indicates the existing data is suitable for Principal Component Analysis analysis. Bartlett's Test of Sphericity was significant ( $p < 0.001$ ) indicating the relationship between items was sufficient for EFA.

The percentage variance explained for this factor was 72.501%. Based on the rotated component matrix, only one factor is identified with an eigenvalue greater than 1 with a factor load greater than 0.5. Comparison with items in the original construct found that no item needed to be dropped because all items had a load value greater than 0.5. The EFA results for the Intentional Behaviour Construct can be referred in Table 7:

**Table-7.** Behavioral intention EFA results.

| Item   | Factor |
|--|--------|
| BI1 I aim to continue using the mobile app for future learning purposes                    | .835   |
| BI2 I will always use the mobile app for learning purposes in my daily life                | .864   |
| BI3 I plan to continue using the mobile app for learning purposes frequently               | .874   |
| BI4 I would recommend to my friends to use the mobile app for learning purposes            | .881   |
| BI5 I aim to improve my skills in using the mobile app for learning purposes in the future | .883   |
| BI6 I expect that I will often use the mobile app for learning purposes                    | .716   |
| BI7 I aim to improve the use of the mobile app for future learning purposes                | .893   |
| Eigen Value  | 5.075  |
| Variance percentage explained  | 72.501 |
| Amount of variance explained = 72.501%   |        |
| Kaiser-Meyer-Olkin (KMO) Sampling Adequacy = 0.895   |        |
| Bartlett's's Test of Sphericity, $\chi^2 = 705.659$ , $p < .000$                           |        |

### 3.8. Cronbach's Alpha Coefficient Value Analysis after EFA

After the factor analysis, the reliability analysis is again carried out aiming at measuring the consistency of each item in the scale used for theoretical construct measurement. The method used to measure reliability is the Cronbach's Alpha coefficient value. Hair et al. (2010) suggested the minimum value for the Cronbach's Alpha coefficient value was 0.7 because the item used was adaptation of the existing instrument. Table 8 showed the Cronbach's Alpha Coefficient Value Analysis after EFA:

**Table-8. Cronbach's Alpha coefficient value after EFA.**

| Construct               | Original Item Number | Items Dropped | Number of Items After EFA | Cronbach's Alpha Coefficient |
|-------------------------|----------------------|---------------|---------------------------|------------------------------|
| Performance Expectancy  | 7                    | 0             | 7                         | 0.909                        |
| Effort Expectancy       | 7                    | 0             | 7                         | 0.897                        |
| Social Influence        | 7                    | 0             | 7                         | 0.889                        |
| Facilitating Condition  | 5                    | 0             | 5                         | 0.900                        |
| Hedonic Motivation      | 7                    | 0             | 7                         | 0.894                        |
| Habit                   | 9                    | 0             | 9                         | 0.908                        |
| Bahavioral Intention    | 7                    | 0             | 7                         | 0.895                        |
| Number of items dropped |                      | 0             |                           |                              |
| Total items after EFA   |                      | 49            |                           |                              |

## 4. DISCUSSIONS AND CONCLUSION

EFA results for Expected Performance Construct, Expected Initiative Construct, Social Constructs, Facilitating Condition Construct Hedonic Motivation Constructs, Habit Construct and Intentional Behavior Construct showed no items dropped. However, studies conducted by Fairus, Yunus, and Jabar (2015) against the Small and Medium Industry (SMI) organization show that EFA's results for the Expected Initiative Construct has been dropped. This study has contributed to the knowledge organisation as it successfully explores and validates constructs that are the determinant factor of m-Learning acceptance and usage among users. These determinants are expected performance, expected initiative, social influences, facilitating conditions, hedonic motivation and habits. Next, the UTAUT model uses behavioral intentions as predictors of technology usage behaviors.

This study also contributes to the research methodology especially to instrument development and validity through the Exploration Factor Analysis (EFA). With respect to that, the findings of this study can serve as a starting point for future studies into an in-depth research of m-Learning in order to make the m-Learning system more comprehensive.

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