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The Acceptability of Developing Mobile Learning Applications for Easy Access to Electronic Learning Modules: A Technology Acceptance Model Approach

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Abstract:
Assessing the acceptance of new technologies being integrated into the teaching and learning process is an important area to be considered in order to know whether a group of individuals is ready to willingly adopt new technologies to improve the quality of education. This study aimed to determine the acceptance of undergraduate students to the use of a mobile learning application where electronic learning modules are incorporated for easy access and use. The study utilized the technology acceptance model (TAM) with the following constructs: perceived usefulness, perceived ease of use, attitude towards, and intention to use the technology. A quantitative research design was utilized for this study. It involved undergraduate students who willingly participated and served as respondents. The results revealed that the respondents accepted the proposed technology in consideration of all the constructs of TAM. Further, analysis revealed that the acceptance differs between males and females in terms of the perceived ease of use, attitude towards, and intention to use the technology. Meanwhile, no significant difference was found in relation to their age brackets. The results suggest that application developers may use the results of this study to design and develop a mobile application integrating the contents of learning modules for easy access and flexible measures in the delivery of instructions.

Keywords: Attitude Towards, Electronic Learning Modules, Intention to Use, Perceived Ease of Use, Perceived Usefulness, TAM

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1. INTRODUCTION

The field of information and communications technology (ICT) has become an essential part of today's era and it has been one of the key drivers for change and innovation in different sectors and industries of society. In the field of education, ICT has significantly contributed to an enormous change in the delivery of instruction [1], particularly in the time of the Coronavirus 2019 (COVID-19) pandemic [2], in teaching practice, and in school management. This has led to a more active, productive, and improved quality of education provided to different stakeholders.

The 21st century teaching and learning process necessitates learning institutions and educators to integrate technology in the achievement of educational goals and objectives for the holistic development of learners. The need to incorporate technology tools and appropriate techniques is essential to equip learners to become productive and literate digital citizens.

Technology integration is the use of technology in daily classroom practices and in the management of schools. It is the meaningful use of technology to achieve learning goals [3]. Technologies include computers,

mobile devices such as tablets and smartphones, digital cameras, social media platforms, networks, virtual classrooms, and information systems solutions [4]. Integrating technology enhances the student learning experiences and creates an active, engaging environment for the learners to participate in the successful achievement of their learning objectives. According to [5], mobile games have both somewhat favorable and small detrimental effects on students' university learning experiences. The use of social networking sites was also found to be frequently used by students, which contributes to their learning experiences. The practice of integrating technology into teaching and learning creates a pathway for differentiated instruction to meet the individual needs of different types of learners.

Understanding the acceptability of new technologies being incorporated into the teaching and learning process has been one of the growing fields of research in the education sector, particularly the assessment of its acceptability using a technology acceptance model. Several studies have been undertaken in the past focusing on technology assessments and its acceptance [6-7], and the need to contribute to this growing body of literature available is still necessary.

This study aims to conduct an assessment on the acceptability of a mobile learning application wherein the electronic learning modules are incorporated using a technology acceptance model to provide a basis for application developers on how they can improve the actual design and development of an application for the benefit of different types of learners.

1.1. Statement of the Problems

In general, this study aims to investigate the variables of the Technology Acceptance Model (TAM) to provide a basis for instructional technology integration.

Specifically, it seeks to answer the following:

1. What are the respondents' demographic profile in terms of
   1.1. Sex; and
   1.2. Age?
2. What is the level of agreement among the respondents based on the constructs of the technology acceptance model on the utilization of mobile application devices for e-learning modules, which include
   2.1. Perceived Usefulness;
   2.2. Perceived Ease of Use;
   2.3. Attitude Towards; and
   2.4. Intention to Use?
3. Is there a significant difference between the perceived usefulness, perceived ease of use, attitude towards, and intention to use mobile application devices for e-learning modules based on sex?
4. Is there a significant difference between the perceived usefulness, perceived ease of use, attitude towards, and intention to use mobile application devices for e-learning based on age?

1.2. Hypothesis

H_0: There is no significant difference between the demographic profile of the respondents in terms of sex and age group, and the Technology Acceptance Model variables.

2. MATERIALS AND METHODS

2.1. Research Design

A quantitative method was utilized in this study. This approach necessitates the use of numerical data to analyze the responses of the respondents. Using a descriptive-correlation design, the researcher employed the use of a survey questionnaire to collect the data in order to describe the perceptions of the students and the acceptance of technology once designed, developed, and implemented. Using the correlational approach, the researcher also looked into the difference between the variables under investigation.

2.2. Research Locale and Respondents

This study was conducted at a higher learning institution in Nueva Ecija, Philippines. The researcher used purposive sampling for this study. Purposive sampling is a technique that requires criteria to be laid-out and must be satisfied by the prospective respondents to be considered and included as participants. The following criteria are included: 1.) the respondent must be of legal age; 2.) the respondent must be enrolled in the Applications Development and Emerging Technology Course; and 3.) the respondent must be introduced to the concept of having a mobile application technology to be used as a means of integrating the learning modules for

the course. A total of 82 respondents willingly participated in the conduct of this study and satisfied the criteria mentioned.

2.3. Research Instrument

The research instrument used for this study was based on [8]. However, it was modified to suit the context of this study. It consists of two parts. The first part covers the demographic profile of the respondents. The second part includes the assessment of the perceived usefulness, perceived ease of use, attitude towards, and intention to use the technology.

To ensure that the instrument used was valid and reliable, the researcher sought the help of other experts and researchers to review the item statements included. This activity forms part of ensuring the content validity of the instrument. The comments and suggestions given by the reviewers were considered so that the contents of the instrument were improved. After reviewing its content and face validity, the instrument was subjected to reliability analysis. Pilot testing was performed on randomly selected respondents. It is important to conduct this activity to ensure that the items in the questionnaires gather the results they are intended to offer. Using Software Packages for Social Sciences version 26, the reliability analysis was performed. In table 1, the result of the analysis is presented.

Table 1: Reliability Analysis

SCALE	CRONBACH'S ALPHA	ITEMS
Perceived Usefulness	0.805	4
Perceived Ease of Use	0.726	4
Attitude Towards	0.835	5
Intention to Use	0815	5

Based on the reliability analysis, the item statements for the perceived usefulness, perceived ease of use, attitude towards, and intention to use were valid and reliable. Thus, the instrument is acceptable and can be used for this study.

In the instrument, a 4-point Likert scale was used to describe whether the respondents strongly agree, agree, disagree, or strongly disagree with the item statement presented. Table 2 shows the scoring scale and its range used for this study.

Table 2: Scoring Scale and Range

WEIGHT/SCALE	INTERVAL	VERBAL INTERPRETATION
4	3.25 – 4.00	Strongly Agree
3	2.50 – 3.24	Agree
2	1.75 – 2.49	Disagree
1	1.00 – 1.74	Strongly Disagree

2.4. Data Gathering Procedures

The conduct of this study commenced in June 2020. It happened months after the announcement of community lockdowns due to the COVID-19 pandemic. The researcher had to utilize other available means to gather data to ensure the safety of everyone. The researcher sought approval for the conduct of the study and made sure that the research instrument did not collect personal and confidential data from the respondents. The developed Google Form also stipulated all of the needed instructions and information for the respondents so that they were guided in answering the questionnaire. It was clearly mentioned that participation in the study was voluntary and that the data collected was only used for the purpose of this study. It was further specified that the utmost anonymity and confidentiality of responses were ensured and observed. The researchers also mentioned that no harm of any form was inflicted on the respondents by participating in the conduct of this study. Utmost confidentiality and adherence to acceptable ethical research conduct were observed and applied.

2.5. Data Analysis

Statistical techniques were used to extract useful meanings from the responses. The researcher used frequency and percentage distribution to describe the demographic profile of the respondents. Meanwhile, in order to understand the assessment made for the perceived usefulness, perceived ease of use, attitude towards, and intention to use, the researcher used a mean.

3. RESULTS

3.1. Demographic Profile of the Respondents

The demographic profile of the respondents in terms of sex and age is presented in the following tables. Table 3 shows the frequency and percentage distribution of the respondents in terms of sex, while Table 4 presents the frequency and percentage distribution in terms of age groups.

Table 3: Demographic Profile of the Respondents according to Sex

SEX	FREQUENCY	PERCENTAGE (%)
Male	54	65.9%
Female	28	34.1%

Table 4: Demographic Profile of the Respondents according to Age

AGE GROUPS	FREQUENCY	PERCENTAGE (%)
18 – 19 years old	27	32.9%
20 – 21 years old	52	63.5%
22 – 24 years old	2	2.4%
25 years old and above	1	1.2%

The results revealed that there was a larger number of male participants in this study than females, constituting 65.9%. In computing programs from different higher learning institutions in Central Luzon, Philippines, the Commission on Higher Education (CHED) has reported a larger number of male students compared to female students. Based on the enrollment data for the Academic Year 2021-2022, 68.60% of undergraduate students in Information Technology Education are male, while 31.40% are female [9]. In a study conducted by [10], they also found that the number of male students was greater than the number of female students enrolled in a computing program like information technology.

In terms of age group, respondents belonging to the 20–21-year-old bracket have the largest number of participants, equivalent to 63.5%. It is followed by respondents from the 18–19-year-old age bracket with 32.9%. Respondent's ages 22-24 years old have a 2.4% representation and a 1.2% for those who are over 25 years old.

3.2. Level of Agreement based on the Technology Acceptance Model constructs

The tables below show the results of the respondents' evaluations of their level of agreement in the various item statements representing the constructs of the Technology Acceptance Model.

Table 5 shows the assessment of the perceived usefulness of using the technology.

Table 5: Perceived Usefulness

ITEM STATEMENTS	MEAN	VERBAL DESCRIPTION
Using the e-learning module application will help me to understand the lesson better	2.85	Agree
Using the e-learning module application will enhance my academic performance	2.84	Agree
I find the e-learning module application useful for my class	3.09	Agree
Using the e-learning module application will make it easier to catch my attention and learn the lesson better	2.72	Agree
OVERALL GRAND MEAN	**2.88**	**AGREE**

As shown, respondents generally agree that the technology is useful, as reflected in the overall computed grand mean of 2.88. Respondents specifically agreed that using e-learning module applications can help them better understand the lesson. They also expressed that they agree with the idea that the e-learning module application can enhance their academic performance. Moreover, the respondents perceived that the use of the e-learning application can easily attract their attention, which can result in better acquisition of knowledge and the development of new learning. It is noteworthy to mention that, with the highest computed mean of 3.09, the respondents agreed that the use of technology could be useful in their class. This provides more opportunities for the respondents to understand the lessons, acquire new knowledge, and develop new skills relevant to their undergraduate program and to their future profession in general.

In table 6, the assessment made by the respondents on the perceived ease of use construct is shown.

Table 6: Perceived Ease of Use

ITEMS	MEAN	VERBAL DESCRIPTION
It will be easy to become skillful at using the e-learning module application	2.76	Agree
I find it easy to apply the e-learning module application in my class	2.85	Agree
Using e-learning module application will be easy and understandable	2.80	Agree
Using e-learning module application will be more flexible than traditional printed learning material	3.02	Agree
OVERALL GRAND MEAN	**2.86**	**AGREE**

As presented, the respondents generally agreed that the e-learning module application can be easily used and manipulated as depicted in the computed overall grand mean of 2.86. To be specific, the respondents believed that through the use of technology they can become skilled because technology provides them with essential tools that can contribute to the development of new skills in the field of information technology. By using the technology, respondents also expressed that the technology can be easily used in the class, resulting in a more productive class time and learning session. Moreover, the respondents perceived that the technology could be easy to use and understand, and that using the technology would provide them with a more flexible way of learning the lessons.

In table 7, the result of the assessment on the attitude towards technology is presented.

Table 7: Attitude Towards

ITEMS	MEAN	VERBAL DESCRIPTION
Using e-learning module application in class is good.	2.94	Agree
My experience in using the e-learning module application in class would be favorable	2.77	Agree
It is a positive influence for me to use e-learning module application in class	2.91	Agree
I think it is valuable to use e-learning module application in class	2.89	Agree
I think it is a trend to use e-learning module application in class	2.99	Agree
OVERALL GRAND MEAN	**2.90**	**AGREE**

Generally, the respondents' attitude towards technology was positive, as shown by the overall computed grand mean of 2.90. This rating shows that the respondents generally accept such technology because they think that using it is good in their class. They also agreed that the use of technology can be favorable, resulting in a more active and engaging learning experience and the acquisition of knowledge. When students feel good about a certain technology being integrated into the teaching and learning process, improved academic performance can be attained and a better quality of learning output can be achieved. Using technology, the respondents also expressed that it has a positive influence on them in their class, and that technology can be a valuable instrument or tool for them to even better understand the lessons. Lastly, using technology as integrated into the teaching and learning processes was viewed by the respondents as a positive effect, as it is becoming the trend of different learning institutions nowadays. Thus, the use of electronic learning modules in mobile applications is positively accepted and viewed by the respondents as an impactful and effective technology in education.

In table 8, the result of the assessment on the intention of using the technology is being presented.

Table 8: Intention to Use

ITEMS	MEAN	VERBAL DESCRIPTION
I intend to use e-learning module application in my class	2.89	Agree
I increase the occurrences of using e-learning module application in class	2.89	Agree
Using e-learning module application in my class to enhance students' learning interest	2.78	Agree
I'd love to use e-learning module application in my class	2.77	Agree
I use e-learning module application to provide multi-approaches on learning	3.02	Agree
OVERALL GRAND MEAN	**2.87**	**AGREE**

Respondents generally expressed that they agree that they intend to use the application once it has been developed and made available for the class, as reflected in the overall computed mean of 2.87. Specifically, they expressed that when the application is developed, the respondents will use it in the class to aid them in learning the different lessons of the course. Also, the respondents asserted that they intend to frequently use the technology to be able to maximize its benefits in the learning process. To be able to further enhance their skills in programming, the respondents expressed that they intend to use the application so that they can reap the positive benefits of it, and that they are positively in favor of it. Lastly, the respondents intend to use the technology because they believe that such innovation provides multiple approaches to learning.

3.3. Test of Difference Between Males and Females

Table 9 below shows the result of testing the hypothesis for this study. Testing the difference among the variables involved provides a deeper understanding of their correlations using appropriate statistical treatment.

Table 9: Test of Difference Between Male and Female on the TAM Variables

VARIABLES	MALE	FEMALE	MEAN DIFFERENCE	T-TEST
	Mean	*Mean*		
Perceived Usefulness	2.828	2.964	-0.136	0.312
Perceived Ease of Use	2.773	3.026	-0.253	0.038*
Attitude Towards	2.800	3.092	-0.292	0.010*
Intention to Use	2.770	3.064	-0.294	0.005*

**Statistically significant at less than 5% level based on two-tailed tests.*

The hypothesis tests if the perceived usefulness, perceived ease of use, attitude towards, and the intention to use the technology differs between male and female. The Levene's test of equality of variances in terms of perceived usefulness is not significant in the perceived usefulness. Thus, equal variances are assumed. Results revealed that there is no significant difference between male (*M = 2.828, SD = 0.578)* and female *(M = 2.964, SD = 0.559), t* (80) = -1.017, *p* = 0.312. Meanwhile, the Levene's statistics for the perceived ease of use is also not significant. Therefore, equal variances are also assumed. Between male (*M = 2.773, SD = 0.554)* and female *(M = 3.026, SD = 0.432),* analysis showed a significant difference with *t* (80) = -2.109, *p* = 0.038. Meanwhile, Levene's statistics for the attitude towards it are significant. Therefore, equal variances are not assumed. Analysis revealed that there is a significant difference between male *(M = 2.800, SD = 0.593)* and female (*M = 3.092, SD = 0.405), t (73.83) = -2.632, p* = 0.010. Finally, Levene's test of equality of variances for the intention to use is not significant. As a result, equal variances are assumed. Analysis revealed that there is a significant difference between male (*M = 2.770, SD = 0.505),* and female (*M = 3.064, SD = 0.385) t (80), p = 0.005.*

3.4. Test of Difference Between Age Group

In table 10, the result of testing the difference between the age group of the respondents and the TAM variables is being presented.

Table 10: Test of Difference Between Age Group on TAM Variables

VARIABLES	AGE GROUP	MEAN	STD. DEVIATION	TEST OF HOMOGENEITY OF VARIANCES		ANOVA	
				Levene's statistics	*Sig.*	*F*	*Sig.*
Perceived Usefulness	18-19	2.824	0.522	2.472	0.091	0.173	0.914
	20-21	2.908	0.614				
	22-24	2.750	0.000				
	25 and above	2.750	-				
Perceived Ease of Use	18-19	2.731	0.509	0.310	0.734	1.502	0.221
	20-21	2.947	0.524				
	22-24	2.500	0.707				
	25 and above	2.500	-				
Attitude Towards	18-19	2.792	0.542	0.516	0.599	0.554	0.647
	20-21	2.957	0.567				
	22-24	2.800	0.282				
	25 and above	3.000	-				
Intention to Use	18-19	2.755	0.530	0.787	0.459	1.075	0.365
	20-21	2.938	0.464				
	22-24	2.600	0.282				
	25 and above	3.000	-				

The hypothesis tests if the perceived usefulness, perceived ease of use, attitude towards, and intention to use of the respondents differ across different age groups. The age of the respondents was divided into four groups (Group 1: 18-19; Group 2: 20-21; Group 3: 22-24; Group 4: 25 and above). The ANOVA results suggest that the perceived usefulness has no significant difference among the groups ($F_{3, 78} = 0.173$, $p = 0.914$). Also, there was no significant difference between the groups on the perceived ease of use ($F_{3, 78} = 1.502$, $p = 0.221$). There was also no significant difference in the attitude towards technology ($F_{3, 78} = 0.554$, $p = 0.647$). Lastly, there was no significant difference among the age groups in terms of the intention to use technology ($F_{3, 78} = 1.075$, $p = 0.365$).

4. DISCUSSION

Perceived usefulness refers to "the degree to which a person believes that using a particular system would enhance his or her job performance" [8,11]. In the context of the current study, it is the degree to which the respondents believe that using the e-learning module application can contribute to the improvement of their academic performance, the acquisition of new knowledge, and the development of new skills.

In the assessment made, it was generally found that the respondents regard the use of this new technology as aiding them. Such technology can be of great help to them in learning the course for the completion of their undergraduate program. In a previous study involving information technology students on the acceptance of mobile compilers in learning computer programming, results revealed that such technology was viewed by the students as useful in developing computer programming skills [5]. Thus, the design and development of this kind of technology is advisable and acceptable to the respondents because they are generally familiar and abreast with digital knowledge and technological skills essential for 21st century teaching and learning.

Meanwhile, the perceived ease of use refers to "the degree to which a person believes that using a particular system would be free of effort" [8]. It is a situation where the end-users believe that using the technology does not require complicated tasks and procedures. Hence, it is convenient to use and manipulate. It is necessary for a technology being developed to be easy to use.

In the context of this study, the mobile application should be free from additional complex tasks and should provide straightforward means to present the electronic learning modules to maximize the access time and the effort being exerted by the students. Furthermore, the technology needs to be simple yet efficient in such a way that it contains the necessary information while providing a comfortable and convenient application environment for users. When user experience is one of the priorities when developing applications, providing ease of use is a must. User experience is the experience process that is performed when a user interacts with a product or an application. Perceptions, reactions, behaviors, emotions, and thoughts of users when using an application are some of the experiences considered in user experience. User experience is dynamic as it changes during and after using an application [12].

Meanwhile, the attitude can be either positive or negative feeling. Therefore, the attitude towards using technology can be a positive or a negative feeling or negative behavior, which can impact the overall acceptance of the technology. It is necessary to understand the attitude towards technology of different users in order to address the concerns and suggestions they have before the actual development and deployment of a certain technology for it to be fully accepted.

The result of the assessment on the attitude of the respondents towards the design and development of mobile applications to store their electronic learning modules revealed a positive result. Hence, it can be possibly accepted when the actual technology is implemented. The study of [6] on the use of mobile compilers by IT students revealed that undergraduate students have a positive attitude towards this technology because it can aid them in the improvement of their academic performance. The respondents of this previous study also expressed that using such technology is an alternative to conventional tools in programming. Thus, their attitude towards it was acceptable and positive.

The intention to use a certain technology, on the other hand, refers to the condition that users will use the technology once it is implemented. It is essential to understand the intention of the end-users to use a technology before actual design and development, because the feedback that they can give contributes to the overall improvement and acceptability of the technology.

In the context of this study, respondents generally intend to use the mobile application for their classes once designed, developed, and implemented because they believe it can be of great help to them in improving their flexible access to learning resources, improving their academic performance, and enhancing their skills in the field of information technology.

Understanding the different views of the respondents based on their sex is an important consideration in the overall acceptance of the technology. Based on the results, it was found that when it come to the perceived usefulness of using the application, males and females have no significant difference. This means that the views and perceptions of both sexes do not actually differ from one another. However, in terms of the perceived ease of use, attitude towards, and intention to use, males and females significantly differ from one another. This means that the views of each sex are different from one another. It is actually a good thing to really understand how they differ so that the design and development of the technology can be more gender-responsive to individual differences.

On the other hand, testing the difference between the age brackets of the respondents to the different constructs of the Technology Acceptance Model shows no significant difference. This means that, regardless of their age, their acceptance of technology would not be affected.

These four constructs of the Technology Acceptance Model contribute to the acquisition of valid and necessary information before the actual deployment of a technology because, through assessment, concerns, feedbacks and recommendations from the intended users of the technology can be collected and considered. Thus, in the design and development phase, it can be considered so that a higher quality of user experience, use of technology, and greater impact is achieved. This is the intention of these variables. It aids future development of information technology projects to be improved and generally accepted by the intended end-users.

5. CONCLUSION

The purpose of this study was to determine undergraduate students' acceptance of the use of mobile applications that integrated the contents of electronic learning modules in order to provide a foundation for application developers in the actual design and development of a learning application. It utilized a quantitative research design approach. Results revealed that the respondents agree on their acceptance of a mobile learning application in terms of their perception of its usefulness, ease of use, attitude towards, and intention to use the technology. Results further revealed that in terms of the respondents' sex, their perception of its usefulness has no significant difference. On the other hand, males and females viewed the ease of use, attitude towards, and intention to use the application differently. Thus, a significant difference was found. In relation to their age groups, all of the age groups showed no significant difference.

Based on the findings, it can be concluded that the use of a mobile application is generally accepted by the respondents. The design and development of an actual application can proceed. However, the traits of males and females in terms of their acceptance should be considered.

6. RECOMMENDATIONS

Based on the findings, the following recommendations are made.

1. Application developers may create a mobile application where electronic learning modules are integrated to provide a more flexible means of accessing the lessons;
2. In the development of a mobile application, factors affecting the acceptance of both male and female end-users must be recognized.
3. Future researches may be conducted to expand the scope of the present study.

7. IMPLICATIONS

The implications of the results found in this study is that a mobile application can be develop to provide a more flexible means of accessing instructional learning resources. When instructional materials can be easily access, improvement in the academic performances of the students may be observed.

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