

ASSESSING THE USABILITY FACTORS INFLUENCING STUDENTS' UTILIZATION OF MOBILE DEVICES FOR LEARNING IN FCT-ABUJA

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ABSTRACT

This study assess the usability factors influencing students' utilization of mobile devices for learning in FCT-Abuja. The study adopted a descriptive survey research design. The study was guided by four research questions. The population of this study comprised of all students of the two Colleges of Education in FCT-Abuja. Stratified sampling was used to select School of Sciences, and School of Arts and Social Sciences students. A researcher-designed structured questionnaire was used for data collection and was validated by three experts. The questionnaire was pilot tested and the data obtained were subjected to statistical analysis using Cronbach Alpha Correlation Formula and reliability coefficients from the variable's effectiveness, efficiency, level of engagement, and error tolerance 0.82, 0.78, 0.75, and 0.79 was obtained respectively. Descriptive statistics was use to provide answers to the research questions using Mean and Standard Deviation. Findings of the study revealed students perceived the use of mobile devices for learning to be effective, efficient, engaging, and error tolerance with grand means of 4.14, 3.89, 3.97, and 4.00 respectively. Based on the findings of this study, the following recommendations were made amongst others: learning through mobile devices should be integrated in Colleges of Education students curricular activities; students should be enlightened on the appropriate use of mobile devices for learning.

Keywords: perceived effectiveness, efficiency, perceived level of engagement, error tolerance, and mobile devices

INTRODUCTION

Mobile devices are currently the most widespread and powerful means of social interaction (Croteau *et al.*, 2012). The use of mobile devices in the educational process for delivery of educational materials and learning content is termed mobile learning. The mobile phone has been proposed by several researchers as the most suitable device to promote mobile learning. According to Lieberman (2019), mobile learning implies using portable computing devices such as iPads, laptops, tablet PCs, PDAs and smartphones with wireless networks that enables mobility and mobile variation related to instructional approaches, disciplines, learning goals and technological tools. Mobile learning makes learning possible by various means irrespective of the time and location of the student. Smartphones with the Windows©, LG Android™, or Apple® operating systems, or tablet computers are commonly used mobile devices for learning because they are the most common operating system which makes them readily available

(Megan & Jomayra, 2014). Andreas (2018) offered five criteria that a product must meet to be usable, which are; Effectiveness, Efficiency, Engagement, Error Tolerance and Ease of Learning (5Es).

Effectiveness which is one of the usability factors is concerned with how students are able to complete set goals such as learning a new concept, carrying out a research work and every other educational undertaking, with a high degree of accuracy. According to Adeboye (2016), though technology use in education is increasing, several students and teachers only use technology to make them efficient and not necessarily effective. He also noted that powerful features of the mobile technology should be creatively used to make work and learning effective so as to achieve great result. However, there are three areas where m-Learning's effectiveness is limited: the human dimension, which includes distractions, noise, varying comfort and visibility levels among students and instructors; the design dimension, which includes content and technologies such as small screens, low memory, short battery lives and difficult-to-add applications; and the institutional dimension, which includes network speed and connectivity, content and software applications limitations.

Effectiveness and efficiency though often use interchangeably, are quite different from a usability perspective. According to Andreas (2018), efficiency is all about speed. That is how fast a user can get the job done. One of the many benefits of incorporating technology to our daily lives not just in teaching and learning process, is the fact that it enables and provides the means of getting work done fast. Whether its general information on the internet or its information related to their course, the mobile device helps students achieve it faster (Adeboye, 2016). A student's efficiency in making use of mobile devices for learning can only be possible if the student is actively engaged in the learning process.

Engagement occurs when learners are satisfied and content when utilizing their mobile devices for learning purposes. According to Wardlow (2016), technology as a tool helps teachers create and present content and instruction that is interesting and relevant to students. When learning is relevant to students, then they become engaged, active learners. Active learning requires students to participate, and this can be achieved when students are engaged in the learning process. Wardlow stated further that increased student engagement comes with increased learning.

Increase in learning can be hindered when students constantly encounter error when making use of their mobile devices for learning. The ultimate goal of a product developer is a system

which has no error. But errors are bound to occur due to human factors, therefore, an error tolerant program is designed to prevent errors caused by the user's interaction and to help the user in recovering from any error that do occur. Error Tolerance according to Andreas (2018), means minimizing errors from occurring and ensuring that a user can easily recover from an error and get back to what he/she was doing. Being tolerant to error means to make everything possible to design a product in which it's easy to achieve tasks without letting the users in this case the students get confuse and do the wrong thing (Maricarmen, 2018). When students encounter errors when making use of their mobile devices to learn, they can become frustrated, and probably lose interest in the learning process. Not only should the mobile devices be error tolerance when being used for learning, they should be easy to learn both for first time users and for returning users.

Statement of the Research Problem

Over the years, it has been observed that the use of mobile devices for learning makes learning fun, makes student learn faster and better, arouse the interest of learners to learn, grant students access to vast learning materials, increase participation and engagement among student and also make it possible for learning to occur beyond the classroom, which will thereby lead to increase in the overall academic performance of students. Currently, the use of mobile devices for learning has become an integral part of learning, but there is little research addressing the usability issues of mobile devices, as students learn across a wide range of mobile devices. Many practitioners and researchers are focusing on the implementation and deployment of m-Learning technologies in tertiary education, however, key factors such as usability are usually being overlooked (Ajinkya *et al.*, 2015). Poor usability reduces user and student productivity.

This trend affects students' learning as well as the mobile devices manufacturers and other service providers, who play a key role in mobile learning success. The effective use of mobile devices for learning can be ascertained when usability factors are used to assess the utilization of these devices for learning. Therefore, this study aimed to Assess Usability Factors influencing Students' Utilization of Mobile Devices for Learning in Colleges of Education in FCT-Abuja, Nigeria.

Aim and Objectives of the Study

The aim of this research was to assess the usability factors influencing College of Education students' utilization of mobile devices for learning in FCT-Abuja. The aim was achieved through the following objectives: To examine;

1. The perceived effectiveness of mobile devices for learning by College of Education students.
2. The perception of College of Education student on their efficiency in using mobile devices for learning.
3. College of Education students' perceived level of engagement when using mobile devices for learning.
4. The perception of College of Education students on error tolerance of mobile devices when used for learning.

Research Questions

The study provided answer to the following research questions:

1. Do College of Education students perceive mobile devices to be effective for learning?
2. What is the perception of College of Education students on their efficiency in using mobile devices for learning?
3. How do College of Education student perceive their level of engagement when using mobile devices for learning?
4. What is the perception of College of Education students on the error tolerance of mobile devices when used for learning?

RESEARCH METHODOLOGY

The research design that was adopted for this study was a descriptive survey research design. This is a research design where a group of people or items are examined by collecting and analysing data from their representatives through questionnaires.

The population for this study comprised all 7,514 students of the two Colleges of Education in FCT-Abuja, Nigeria, namely; FCT College of Education Zuba-Abuja with a population of 7,383 and Sam Ale College of Education Kwali, with a population of 131 in 2022/2023 academic session. While the target population for this study comprised of all 1971 NCE II students from the population, this is because they have one year experience of using mobile devices for learning purposes such as doing assignment, preparing for examination and so on and are still using it.

Table 1: Population Distribution of College of Education Students in FCT-Abuja

S/N	Colleges of Education	Population
1.	FCT College of Education Zuba-Abuja	7383
2.	Sam Ale College of Education Kwali	131
	Total	7514

A sample size of 181 was used for this study. Stratified sampling was used to select School of Sciences, and School of Arts and Social Sciences students, this is based on the Science-based and Non-science based characteristics of the population. Krejcie and Morgan (1970) sample size determination table was then used to get the sample size of 181 from the 1017 School of Science and School of Art and Social Science College of Education students.

Table 2: Population Distribution of Science-Based and Non-Science Based Colleges of Education Students in FCT-Abuja

S/N	Colleges	School of Science	School of Art and Social Science
1.	FCT College of Education Zuba-Abuja	422	537
2.	Sam Ale College of Education Kwali	9	49
	Total	431	586

The research instrument used for this study was a questionnaire. The questionnaire was designed by the researcher and it was titled “Questionnaire on Assessing the Usability Factors Influencing Students Utilization of Mobile Devices for Learning (QAUFISUMDL)” on five-points Likert scale of Strongly Agree (SA) 5 points, Agree (A) 4 points, Undecided (UD) 3 points, Disagree (D) 2 points, and Strongly Disagree (SD), 1-point scale. The instrument was validated by two lecturers from Department of Science Education and Department of Educational Technology, Federal University of Technology Minna, and one Guidance and Counsellor from Federal University of Technology Minna. A pilot test was conducted to test the reliability of the instrument. A total of 30 students from other Schools of FCT College of Education Zuba-Abuja, who were not part of the targeted population was selected for the pilot test since they share related characteristics. The administration was done once and a reliability coefficient of from the variable’s effectiveness, efficiency, level of engagement, error tolerance and ease of learning, 0.82, 0.78, 0.75, and 0.79 was obtained respectively using Cronbach Alpha formula.

RESULTS AND DISCUSSION

Research question one: Do College of Education students perceive mobile devices to be effective for learning?

Mean and standard deviation were used to answer research question 1, as presented in Table 3

Table 3: Mean and standard deviation of College of Education students’ perception on effectiveness of using mobile devices for learning

S/N	Items	N	Mean	Std.	Decision
1	My mobile device makes possible personalized access to course contents.	181	4.25	0.82	Agree

2	It provides more flexible method of learning as it can be used anywhere	181	4.08	0.81	Agree
3	It helps me to produce class assignments of higher quality	181	4.03	0.78	Agree
4	It can be used for learning due to good networking	181	4.28	0.80	Agree
5	It helps to enhance course related interaction with my lecturers	181	3.87	1.00	Agree
6	It helps to enhance course related interaction with my fellow students	181	4.28	0.81	Agree
7	It empowers my control over my learning	181	4.28	0.75	Agree
8	It enables me to access scholarly information relevant to my academic activities	181	4.16	0.83	Agree
9	It improves my academic performance	181	4.10	0.89	Agree
10	The electronic information resources that can be accessed motivates me to use my mobile device for learning	181	4.04	0.94	Agree
Grand Mean		181	4.14	0.84	Agree

Decision key: 1.00-2.49 = Low, Average = 2.50-3.49, High = 3.5-5.0

Table 4.1 reveals the mean and standard deviation of College of Education students' perception on effectiveness of using mobile devices for learning. The mean of 3.0 and above was used as the benchmark for 'Agree', and the mean of less than 3.0 is considered 'Disagree'. Consequently, 10 items were listed, the table revealed that item 1 to 10 had mean scores between 3.87 and 4.28 which are above the benchmark of 3.0; this implies that College of Education students perceived using mobile devices for learning to be effective in the ten listed items. The table further revealed that the grand mean score response to the ten items is 4.14, which is above the decision mean of 3.0; this indicates that College of Education students' perceived mobile devices for learning to be effective in FCT- Abuja. The standard deviation of the respondents' perception on effectiveness of using mobile devices for learning is between 0.75 and 1.00, while the grand standard deviation is 0.84; signifying that there is no meaningful deviation of respondents' perception on effectiveness of using mobile devices for learning from each other and the total standard deviation of the group.

Research question two: What is the perception of College of Education students on their efficiency in using mobile devices for learning?

To answer research question two, Mean and standard deviation were used to analyse the data as presented in Table 4.

Table 4: Mean and standard deviation of College of Education students' perception on efficiency of using mobile devices for learning

S/N	Items	N	Mean	Std.	Decision
1	Downloading course content on my mobile device is usually fast	181	3.69	0.84	Positive
2	Opening learning sites on my mobile device is usually fast	181	3.67	0.83	Positive
3	I can quickly access several learning materials with my mobile device	181	3.84	1.06	Positive
4	I can learn more efficiently with the use of my mobile phone	181	3.48	1.20	Positive
5	I can accomplish my learning goals more quickly when using my mobile device	181	4.32	0.82	Positive
6	My search engine provides complete, accurate and relevant results	181	4.02	0.76	Positive
7	Minimal number of clicks are needed to find information	181	3.66	0.86	Positive
8	I can run multiple functions concurrently such as browsing the net, typing, and drawing, without any interference among them	181	3.85	0.88	Positive
9	I can easily and quickly send and receive academic materials from my peers	181	4.14	0.85	Positive
10	There is no delay when it comes to inputting, processing and storing my academic work	181	4.19	0.84	Positive
Grand Mean		181	3.89	0.89	Positive
Decision mean: 3.0					

Table 4 reveals the mean and standard deviation of College of Education students' perception on efficiency of using mobile devices for learning. The mean of 3.0 and above was used as the benchmark for **'Positive'**, and the mean of less than 3.0 is considered **'Negative'**. Consequently, 10 items were listed, the table revealed that item 1 to 10 had mean scores between 3.48 and 4.32 which are above the benchmark of 3.0; this implies that College of Education students have positive perception on efficiency of using mobile devices for learning in the ten listed items. The table further revealed that the grand mean score response to the ten items is 3.89, which is above the decision mean of 3.0; this indicates that College of Education students' perceived mobile devices for learning to be efficient in FCT- Abuja. The standard deviation of the respondents' perception on efficiency of using mobile devices for learning is between 0.76 and 1.20, while the grand standard deviation is 0.89; signifying that there is no

meaningful deviation of respondents' perception on efficiency of using mobile devices for learning from each other and the total standard deviation of the group.

Research question three: How do College of Education student perceive their level of engagement when using mobile devices for learning?

To answer research question three, Mean and standard deviation were used to analyse the data as presented in Table 5

Table 5: Mean and standard deviation on perceive level of engagement of College of Education student when using mobile devices for learning

S/N	Items	N	Mean	Std.	Decision
1	My mobile device offers me various communication modes I can use to achieve my learning goals	181	4.25	0.83	High
2	Great level of discipline is required when using my mobile device for learning	181	3.77	0.96	High
3	I am usually encouraged when using my mobile device for learning because it is fun, entertaining and educative	181	4.11	1.03	High
4	I am less distracted when using my mobile device for learning	181	3.45	1.30	Average
5	Interacting with my mobile device for learning purposes does not requires a lot of mental effort	181	3.89	0.94	High
6	I am less confused when using my mobile device for learning	181	4.38	0.82	High
7	I am usually an active learner when using my mobile device for learning	181	3.92	0.91	High
8	I can relate more with concepts when using my mobile device for learning	181	4.09	1.02	High
9	The audio-visual attribute of learning with my mobile device makes me relate more with the concepts I am studying	181	4.03	0.89	High
10	I prefer using my mobile device for learning because it offers me the opportunity of learning from general to specific	181	3.81	0.94	High
Grand Mean		181	3.97	0.96	High

Decision mean: 3.0

Table 5 reveals the mean and standard deviation on perceive level of engagement of College of Education student when using mobile devices for learning. The Decision Key of 1.00-2.49, 2.50-3.49, and 3.5-5.0 were used for low, average and high respectively. Consequently, 10 items were listed, the table revealed that item 4 had a mean score of 3.45 which falls on the range of average perceived level of engagement when using mobile devices for learning, this implies that College of Education students perceived level of engagement when using mobile

devices for learning to this item (I am less distracted when using my mobile device for learning) was average. However, item 1, 2, 3, 5, 6, 7, 8, 9 and 10 had mean scores between 3.77 and 4.38 which falls on the range of high perceived level of engagement when using mobile devices for learning, this implies that College of Education students perceived level of engagement when using mobile devices for learning to these items was high. The table further revealed that the grand mean score response to the ten items is 3.97, which falls on the range of high perceived level of engagement when using mobile devices for learning, this implies that College of Education students perceived level of engagement when using mobile devices for learning was high in FCT- Abuja. The standard deviation of the respondents' level of engagement when using mobile devices is between 0.82 and 1.30, while the grand standard deviation is 0.96; signifying that there is no meaningful deviation of respondents' level of engagement when using mobile devices from each other and the total standard deviation of the group.

Research question four: What is the perception of college education students on the error tolerance of mobile devices when used for learning?

To answer research question four, Mean and standard deviation were used to analyse the data as presented in Table 6

Table 6: Mean and standard deviation on perception of College of Education student on error tolerance of mobile devices when used for learning

S/N	Items	N	Mean	Std.	Decision
1	I usually receive error messages and clear ways of how to fix the issues when using educational applications	181	4.08	0.91	Agree
2	Whenever I make a mistake, I can undo it easily and quickly	181	4.28	0.73	Agree
3	Whenever I mistakenly delete my assignment, I can easily retrieve it	181	4.10	1.14	Agree
4	I usually receive confirmation message before submitting an assignment and an opportunity to cross-check it before final submission	181	3.73	1.02	Agree
5	My mobile device provides just in-time training and support as and when required when using it for learning	181	3.77	1.13	Agree
6	My mobile device provides simple and short text-based support in rich learning contexts	181	3.59	1.10	Agree

7	My mobile device allows me to easily edit my assignments	181	4.08	0.91	Agree
8	In the case of using educational apps, I can easily monitor my progress	181	4.17	0.83	Agree
9	My mobile device enables me to see grammatical errors when using it to take down notes or do my assignment	181	4.22	0.85	Agree
10	There are alternative ways of navigation i.e., shortcuts when learning with my mobile device compared to other ways of learning	181	4.02	0.96	Agree
Grand Mean		181	4.00	0.96	Agree

Decision mean: 3.0

Table 6 reveals the mean and standard deviation of College of Education students’ perception on error tolerance of mobile devices when used for learning. The mean of 3.0 and above was used as the benchmark for ‘**Agree**’, and the mean of less than 3.0 is considered ‘**Disagree**’. Consequently, 10 items were listed, the table revealed that item 1 to 10 had mean scores between 3.59 and 4.28 which are above the benchmark of 3.0; this implies that College of Education students have positive perception on error tolerance of mobile devices when used for learning in the ten listed items. The table further revealed that the grand mean score response to the ten items is 4.00, which is above the decision mean of 3.0; this indicates that College of Education students’ have positive perception on error tolerance of mobile devices when used for learning in FCT- Abuja. The standard deviation of the respondents’ perception on error tolerance of mobile devices when used for learning is between 0.73 and 1.14, while the grand standard deviation is 0.96; signifying that there is no meaningful deviation of respondents’ perception on error tolerance of mobile devices when used for learning from each other and the total standard deviation of the group.

Summary of Findings

The following are the summary of findings:

- i. College of Education students’ perceived mobile devices for learning to be effective in FCT- Abuja;
- ii. College of Education students’ perceived mobile devices for learning to be efficient in FCT- Abuja;
- iii. College of Education students perceived level of engagement when using mobile devices for learning was high in FCT- Abuja;

- iv. College of Education students' have positive perception on error tolerance of mobile devices when used for learning in FCT- Abuja.

Discussion of Findings

Another finding of this study found out that College of Education students' perceived mobile devices for learning to be effective in FCT- Abuja. This finding agrees with that of Arain *et al.* (2016) finding revealed that the application is user friendly, effective and the users were satisfied. Heflin *et al.* (2017) finding also revealed that students have positive perception towards mobile technology in collaborative learning. In addition, Kumar and Madhu (2018) finding revealed that students' have moderate level perception towards m-learning. In the same vein Abba *et al.* (2019) finding revealed that the use of m-learning as approach and method of teaching has significant effect on students' achievements.

Finding from this study revealed that College of Education students' perceived mobile devices for learning to be efficient in FCT- Abuja, this agrees with the finding of Arain *et al.* (2016) whose finding revealed that the application is user friendly, and efficient and the users were satisfied. Tijani (2017) study also revealed that most participants found the OTELS efficient. Similarly, Ahmad (2020) finding revealed an overall positive student perception toward cell phones usage as a learning tool and integrating cell phones into learning activities. In addition, Guo *et al.* (2020) study revealed that Chinese rural school students believed mobile assisted language learning was very useful.

Finding emanating from the study revealed that College of Education students perceived level of engagement when using mobile devices for learning was high in FCT- Abuja, this finding agrees with that of Tijani (2017) study also revealed that most participants found the OTELS is capable of reducing errors when in use. In the same vein Zhang (2021) study revealed that students in the three different medical majors at the University of Hong Kong perceived mobile devices for learning to be engaged with their mobile devices. Muthuprasad *et al.* (2021) finding also revealed that online classes were engaging participants through frequent, meaningful activities that helps to keep them focused. In addition, Salhab and Daher (2023) finding revealed that most students indicated were likely to be engaged socially, cognitively, emotionally, and behaviourally when using mobile devices to access learning content. However, the finding contradicts that of Ikenyiri and Eresia-Eke (2017) whose finding showed that mobile phones usage in classroom distracts the attention of the students during lectures, affects their note taking classroom behaviour, has adverse effect in students' performance in

examination and aids examination malpractice. In addition Heflin *et al.* (2017) study indicated mobile technology is associated with increased disengagement by students during class.

Discovery from this study revealed that College of Education students' have positive perception on error tolerance of mobile devices when used for learning in FCT- Abuja. This finding agrees with that of Johnson *et al.* (2019) results indicated that students who experienced a higher level of error tolerance showed greater improvement in their mathematical skills compared to those with lower error tolerance. Shah *et al.* (2018) finding also revealed that mobile users tend to make more errors compared to desktop users due to factors such as smaller screen sizes and touch-based input methods. In addition, Harper *et al.* (2018) found that minor errors, such as broken links or missing images, were tolerated to some extent. Chen *et al.* (2019) finding revealed that participants have a high level of error tolerance with the platform. In the same vein, Johnson *et al.* (2019) finding found moderate levels of error tolerance with intelligent tutoring system for programming education.

5.2 Recommendations

Based on the findings of this study, the following recommendations are made:

- i. College of Education students' perceived mobile devices for learning to be efficient and effective, so, learning through mobile devices should be integrated in their curricular activities;
- ii. Colleges of Education students perceived level of engagement when using mobile devices for learning was high, therefore, they should be enlightened on the appropriate use of mobile devices for learning;
- iii. College of Education students' have positive perception on error tolerance of mobile devices when used for learning, hence, they should be encouraged to be focus and not distracted when using mobile devices for learning to reduce errors;
- iv. College of Education students' perceived learning though the use of mobile devices to be easy, therefore, enabling environment with adequate facilities that will enable them acquire adequate knowledge and skills on the use of mobile devices for learning should be provided by the school management.

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