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Development and Validation of Mobile Electronics Response System for Teaching Computer Science Education in Colleges of Education in South-West, Nigeria

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ABSTRACT
This study developed and validated Mobile Electronics Response system for Nigerian colleges of education. Instrumentation and mixed method approach were used to ascertain the ease of development and validation of explaining the Mobile Electronics Response system Package. Waterfall Model was adopted for developing the package. The content was purposively selected from the Nigerian Certificate in Education (NCE) I curriculum. Convenient sampling technique was used in selecting the Mobile Package Developer and educational technology experts to validate the Mobile Package. Four validating instruments were employed in conducting this study: (i) Computer Science content Validation Assessment Report (CVAR); (ii) Educational Technology Experts Validation Assessment Report (ETEVAR); (iii) Computer Science Expert Validation Report (CSEVR): (iv) Computer Science Achievement Test (CSAT): and (v) Mobile Electronics Response System Students Attitude Questionnaire (MERSAQ). The face and content validation of all these instruments were carried out. SVQ was pilot tested and reliability coefficient of 0.80 was obtained using Cronbach's Alpha. CVAR, MADEVAR, ETEVAR were administered on content specialists, Mobile Application Developer experts, and educational technology experts respectively, while MERSQ was administered on 28 NCE I students in Osun State College of Education, Ila- Orangun. The findings revealed that the process of designing and developing of Mobile Electronics Response System. Waterfall Model System Design was successful. Furthermore, reports from the validating team of experts revealed that the Mobile application is valid for learning of Computer Science Education at NCE level in Nigeria. It is therefore recommended that Mobile Electronics Response System (MERS) should be massively develop to teach Computer Science concepts.

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INTRODUCTION

Communication remains a major sustenance of the world existence and to transfer values and skills from one generation to another. Invariably, without good communication the world would be a

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difficult place to live (Raji & Abdulkarim, 2009). Information and Communication Technology (ICT) is a tool for enhancement of teaching and learning and for fostering development and acquisition of skills by teachers and students for economic and self-reliance. Information and communication technology can be viewed as the application of different forms of digital equipment in all areas of teaching and learning (Wushishi & Aniah, 2013). It involves a combination of technologies for collecting, storing, processing, communicating and delivering information related to teaching and learning processes (Johnson, 2007). The National Policy on Information Technology (2010) describes information technology as computer, auxiliary equipment, software and procedures, services and related resources.

ICT in education offers numerous benefits that facilitate and enhance qualitative and quantitative knowledge and skill in higher institution of learning. Nwoke and Akukwe (2012) pointed out that ICT has changed the pattern of how information is disseminated. ICT has contributed immensely to effective teaching and learning through sharing of information, creation of more learner centre environments supporting change and extending existing teaching methods, improving self-learning in subject matter among instructions. It has significantly change the way and technique of teaching and learning in the classroom. This change has been extended to tertiary institution of learning (Achimugu*et al*, 2010). ICT resources are very comprehensive, which consist of Radio, Television, Cellular phones, Digital cameras, Computers, Computer network, Satellite system, Mobile electronics response system among others (Matto, 2015).

Computer science is very important to the success of students in a digital, inter-connected world. Computer science is a discrete academic discipline but is also embedded in virtually every area of academic study, the use of computer technologies, have become essential skills in most disciplines. Additionally, computer technology has become an important tool in creative expression, supporting an exponential growth in the ability of artists, including musicians, gamers and film makers, to self-publish and to collaborate with people from around the world. It is important to provide students access to these tools to support their career and creative aspirations. Due to paradigm shift in education, it is pertinent to embed computer science, related computer science skills and mobile learning to into education curriculum.

Mobile learning or M-learning can be any educational interaction delivered through the use of mobile technology and accessed by students at their convenience from any location (Educause, 2016). There are various software package that are used in mobile learning, some examples of mobile application designed and developed for teaching and learning purposes include Mobile Electronics Response System (MERS), data access, readers, geolocation and maps, among others. Students can have instant mobile access to all aspects of digital educational experience with the use of mobile applications. Medina (2015), identified that M-learning hardware include mobile phones, handheld PC's, Tablets, the Ipad, Mobile electronics response system, Netbooks , Ipod and other devices that are able to run mobile applications. Thus, M-learning utilizes a variety of devices, many of which are routine in the lives of students that foster student engagement, participation, attendance and also make learning integral to daily life.

Furthermore, M-learning has made internet-based learning to grow dramatically over the past decade, primarily because net generation students found it

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efficient and effective means to obtain additional training and education (Wylie, 2015).Sharples (2005) broadly defines mobile learning as learning away from one's normal learning environment or learning involving the use of mobile devices. Another definition of m-learning is provided by the e-Learning Guild as an activity that allows individuals to be more productive when consuming, interacting, or creating information, mediated through a compact digital portable device that the individual carries on a regular basis and has reliable connectivity and fits in a pocket or purse. M-learning has the same advantages as e-learning over traditional lectures, but extends its reach by making use of potable wireless technologies. The integration of M-learning to schools system led to development of Mobile Electronics Response System (MERS) for teaching.

Electronics Response System also called Classroom response systems, electronic student response systems, clickers, personal response system, student response system, or audience response system are interactive remote answering devices that offer instructors a means to gain some simple real-time feedback from the audience.A lecturer poses a multiple-choice question to his or her students via an overhead or computer projector, perhaps using PowerPoint to do so.Each student submits his or her answer to the question using a handheld transmitter (often called a "clicker") that beams an infrared or radio-frequency signal to a receiver attached to the lecturer's computer. Software on the lecturer's computer collects the students' answers and produces a histogram showing how many students chose each of the answer choices (Derek & Vanderbilt, 2008).Typically, a lecturer may ask students to vote in order to engage them later in discussion.

Mobile Electronics Response System (MERS) is a web based system, where multiple choice questions are developed and students are at liberty to choose different options using their mobile devices as clickers and the result is will received immediately by the lecturer and the student. Mobile Electronic Response System can also be used for computer-based test, continuous assessments, reduce distraction due to hand raising in the class and to monitor students' attendance. The impacts of Mobile Electronics Response System for teaching-learning process make learning interactive, enhance positive attitude of students, promote active participation, promote retention and help to save teaching time. Inspite of the potentials of Mobile Electronics Response System (MERS), this device is not common in Nigerian classrooms because it is very expensive, hence there is need to improvise by developing a package for purposes in Nigeria.

Development of mobile electronic response system involves some stages which involves design and development of a website with the use of Bring Your Own Device (BOYD) which serve as clicker. A Mobile Electronics Response System (MERS) consist of a mobile device which serves as transmitter and clickers that student use to send responses. The receiver which collects inputs from transmitter and computer software interprets and aggregates the responses in real time. The lecturer using MERS has a choice to make either publicly or anonymous. The students input signals are collected by activating transmitter to present respondent input anonymously or identify respondent using name, matriculation number and other variables. .

Mobile Electronics Response System is used to send questions assess students understanding of topics or concepts been discussed from the lecture. It can reveal misunderstanding of topics cover

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during the lecture, determine the future directions and, evaluate student understanding of the previous class. In addition, it can be used to access student ability to apply class material to a newsituations and also allow student to access their own level of understanding at the end of the class. Lecturers will send multiple choice questions, students therefore respond to it and the answer will be displayed to express if the concept is understood or not.

Attitude can be referred to an expression of favour or disfavour toward something, place or event and person. It can be positive or negative and influences the way and manner a person respond to another person or activities. Attitudes are influenced by the analysis of the information regarding the result of an action and by the positive or negative evaluation of these results (Ajzen & Fishbeing, 1980, Yusuf & Balogun, 2011). Several researchers have link teachers' attitude and their use of ICT. More positive attitude toward the computer were associated with higher level of computer experience (Teo, 2008). Students believe and response to use of ICT can be explained through the attitude of the lecturers toward use of ICT device.

The importance of appropriate responses to the trainees feeling about ICT as one of the critical factors to its success (Yusuf *et al,* 2011). David (2013) found that negative attitude is a barrier towards integration of ICT in teaching and learning, but David (2013) observed that positive attitude toward ICT use are widely recognized as a necessary condition for effective use in teaching and learning process. Behavioural belief stand to be the strongest determinant of pre-service teachers' behavioural intention and that attitude is an important factor when integrating or using ICT for teaching.

Mobile device allows student the opportunity to collaborative learning, discuss course contents with classmates and instructors, and create new meaning and understanding (Joanne &Michael, 2013). Kubiatko (2010), study on Czech University Student revealed that the participant University student had a positive attitude toward use of ICT in science teaching while Chenng (2015), found that students generally show positive attitude towards use of mobile devices for learning and its effectiveness in language learning. Mobile Electronics Response System was device allows for cooperative learning and interaction in the classroom. According to Reay*et al* (2005) student ranked use of MERS an important part of classroom discussion. However, student are allowed to make a choice between individual 'voting' and group choice, student preferred to use MERS in individual mode.

Based on the above literature**,** the study was designed, developed and validated mobile electronics response system for teaching Computer Science Education in Nigeria Colleges of Education.

Statement of the Research Problem

Research have shown that students perform poorly in Computer Science courses in colleges of Education in Nigeria and major reason is students inability to recall what has been taught, since concepts and facts are taught are memorized and regurgitated. Students find Computer Science as too abstract course to comprehend and easily understood, thereby resorting to memorization or rote learning. In addition, overpopulation and lack of active participation of students during teaching is one of the major factors responsible for the poor performance. In attempt to solve this problem, several instructional materials and Mobile Applications were designed and developed

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by instructional designers yet the problem persist.

The causes of lack of active participation could be due to poor teaching methods used in our Colleges of Education and low integration of information and communication technology into teaching and learning process. Conventional method (lecture) are commonly used in teaching in Nigeria college of Education where students are passive throughout the lecture period. This problem can be overcome by adopting students centered approach, where learning is participatory and integration of technology such mobile electronics response system, e-learning, hybrid learning, web-based instruction among others. Integration of mobile electronics response system for teaching Computer Science will improve the student performance in Colleges of Education. The National Policy of Education recommend the use of innovative teaching techniques in schools to enhance the teaching and learning process (FRN, 2013). Such innovative teaching techniques include mobile devices, mobile electronics response system, mobile App among others as a medium of make learning participatory and monitoring students activities in the classrooms. Therefore, there is need to develop and validate a mobile electronics response system for Colleges of Education students in South-West, Nigeria.

Mobile electronics response system is a student centered approach yet to be integrated into teaching and learning in Colleges of Education. Few studies were recorded on audio response system, use of clickers.In spite of the increased popularity and adoption presence of mobile learning platforms, there is a limited study on development and validation of mobile electronics response system in Nigeria. However, in order to promote active engagement of the learners and delivery of meaningful learning, it is necessary to develop and validate a mobile electronics response system for teaching computer science at college of education level in Nigeria.

Aim and Objectives

The aim of this study was to develop and validate a mobile electronics response system for colleges of education computer science education students in Nigeria.

The specific objectives of this study were to:

i. Determine the steps involved in developing of mobile electronics response system for colleges of education students in Nigeria
ii. Find out how the developed mobile electronics response system for colleges of education students in Nigeria can be validated.

Research Questions

The following research questions were raised to guide the study:

i. What are the steps involved in the development of mobile application for colleges of education students in Nigeria?
ii. How can the developed mobile application for colleges of education students in Nigeria be validated?
iii. What are impacts of the developed mobile electronic response system for teaching computer science among college of education students?
iv. What are the college of education students' attitudes towards using mobile electronics response system for learning computer science?

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METHODOLOGY

The research design adopted for this study is Waterfall Model. The ***Waterfall Model*** was the first Process Model to be introduced. It is very simple to understand and use. In a *Waterfall* model, each phase must be completed before the next phase can begin and there is no overlapping in the phases. *The waterfall* model is the earliest SDLCapproach that was used for software development.

Waterfall" approach, the whole process of *software development* is divided into separate phases. The outcome of one phase acts as the input for the next phase sequentially. This means that any phase in the development process begins only if the previous phase is complete. The waterfall model is a sequential design process in which progress is seen as flowing steadily downwards (like a waterfall) through the phases of ***Conception, Initiation, Analysis, Design,***

The following instruments were developed and were used in this study for data collection.

i. Development of Web- based Mobile Electronics Response System. (WMERS).
ii. Computer Science Achievement Test (CSAT),
iii. Mobile Electronics Response System Attitude Questionnaire (MERSAQ).

To determine the reliability of the Computer Science Achievement Test (CSAT), a pilot test was conducted on 28 NCE I students (12 males and 16 female) of Osun- state College of Education, Ila-Orangun, .The College was part of the research population, but not part of the selected Colleges for the main study. CSAT was administered on the students at once. The data was split into two using the split-half method. The scores obtained and correlated using Pearson Product Moment Correlation (PPMC) revealed the reliability of 0.802.

To determine the reliability coefficient of MERSQ, MERSQ administered on 28 NCE I students of Osun –State College of Education, Ila-Orangun which is within the population of the study but outside the sample size for the study. A reliability test using the Cronbach alpha method of Attitudinal Questionnaire was use to analyze data yielded a value of 0.857 for Students Attitude Towards Electronics Response System Attitude Questionnaire (MERSAQ), The result showed the instrument was reliable for the study see .

To determine the reliability of Mobile Electronics Response System (MERS), the package was trial tested on 28 NCE I Computer Science Students in Osun State College of Education, Ila- Orangun which are not part of the research population and will not be take part in the actual study. They were allowed to work with the Mobile Electronics Response System (MERS) in order to ensure the functionality of the software. Field trial validation form was given to the students after exposing them to MERS to express their experience of functionality of MERS. Cronbach's Alpha was used to analyse the data collected from the field trial and a reliability coefficient of 0.832 was obtained. The results showed that the instrument was reliable for this study

The researcher collected an introduction letter from the Head of Department Educational Technology, Federal University of Technology, Minna and the letters were taken to the six selected College of Education in the South-West, Nigeria. The researcher with the help of research assistants visited the colleges to determine the availability of needed facilities. The researcher exposed the Computer Science Lecturer in charge of the course mode of operandi of Mobile Electronics Response System and also make

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arrangements with the lecturers in the colleges when the learning activities would be carried out. The activities was be moderated by the researcher and assisted by their Computer Science lecturer who was be trained as research assistants through a day training on how to use Mobile Electronics Response System (MERS) to support Instruction in classroom; the researcher briefed the Computer Science lecturer on the objectives and modalities of the experiment. The researcher ensured that all required facilities such android phones, laptops, smartphones, internet facilities and source of power (electricity) are in good working conditions.

The analysis and interpretation of data collected through the questionnaire was analyzed using inferential and descriptive statistics. The frequencies were converted to mean, standard deviation and simple percentage to answer research questions. The questionnaire items were ranked 4 as Strongly Agree, 3 as Agree, 2 as Disagree and 1 as Strongly Disagree for questionnaire items that were positively expressed and vice versa for the negatively expressed items.

RESULTS

Research Question 1: What are the steps involved in the development of mobile application for colleges of education students in Nigeria?

Development of Mobile Electronics Response System (MERS)

This Mobile Electronics Response System for computer science undergraduate university students is a design-based approach. It is a form of Mobile Learning - Application Instructional Package developed by the researcher using Waterfall model instructional system design. The stages of Waterfall model is shown in figure 1.

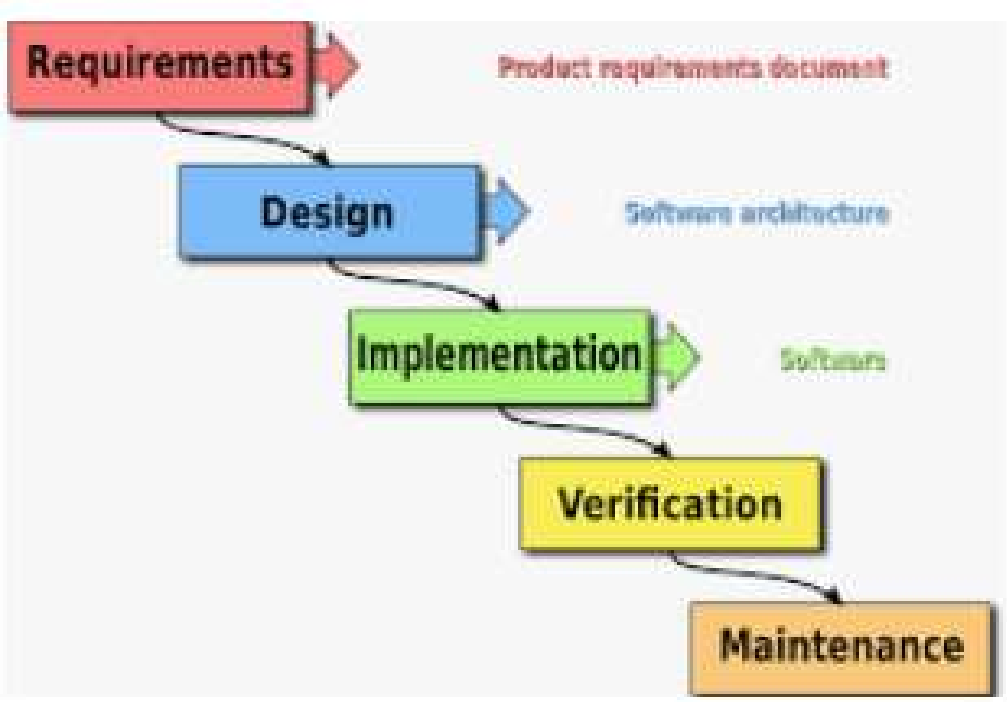

Figure 1: The stages of Waterfall Model Instructional Design used for designing and developing the response system. Available: en.wikipedia.org

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The stages of Waterfall include: Requirement, Design, Implementation, Verification and Maintenance were sequentially followed in the development of this MERS:

As the ***Waterfall Model*** illustrates the software development process in a linear sequential flow; hence it is also referred to as a ***Linear-Sequential Life Cycle Model***.

STAGES OF THE WATERFALL MODEL

Requirements Definition: *The first phase involves understanding what needs to design and what is its function, purpose, etc. Here, the specifications of the input and output or the final product are studied and marked.*

System and Soft Design: *The requirement specifications from the first phase are studied in this phase and system design is prepared. System Design helps in specifying hardware and system requirements and also helps in defining overall system architecture. The software code to be written in the next stage is created now.*

Implementation and Unit Testing: *With inputs from system design, the system is first developed in small programs called units, which are integrated into the next phase. Each unit is developed and tested for its functionality which is referred to as Unit Testing.*

Integration and System Testing: *All the units developed in the implementation phase are integrated into a system after testing of each unit. The software designed, needs to go through constant* ***software testing*** *to find out if there are any* ***flaws or errors****. Testing is done so that the client does not face any problem during the installation of the software.*

i. ***Deployment of System:*** *Once the functional and non-functional testing is done, the product is deployed in the customer environment or released into the market.*

ii. ***Maintenance:*** *This step occurs after installation, and involves making modifications to the system or an individual component to alter attributes or improve performance. These modifications arise either due to change requests initiated by the customer, or defects uncovered during live use of the system. The client is provided with regular maintenance and support for the developed software.*

All these phases are cascaded to each other in which progress is seen as flowing steadily downwards (like a waterfall) through the phases. The next phase is started only after the defined set of goals is achieved for the previous phase and it is signed off, so the name "*Waterfall Model*".

Research Question 2: How can the developed mobile application for colleges of education students in Nigeria be validated?

The validation of instruments was done in four stages: (i) experts validation (computer programmers and educational technology specialist); (ii) content validation (computer science specialists); and (iii) Field trial validation (learners Validation).

Research Question Three: What are impacts of the developed mobile electronic response system for teaching computer science among college of education students?

The following tables captured the impacts of the developed mobile app package for teaching computer science among undergraduate students.

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Table 1: Content in the Package

S/No	STATEMENT	RESPONSE			
		SA	**A**	**D**	**SD**
1	The messages in the package are easy to understand	19(67.9)	8(28.6)	1(3.6)	0(0)
2	The content of the package has been well organized (arranged in order)	16(67.9)	7(25.0)	2(7.1)	0(0)
3	The diagrams/illustrations in the package are very clear to me.	17(60.7)	10(35.7)	1(3.6)	0(0)
4	The examples used in the various sections of the lessons in the package are relevant.	18(64.3)	9(32.1)	1(3.6)	0(0)
5	It was easy to understand the lesson because information was presented from simple to more difficult one.	24(85.7)	4(14.3)	0(0)	0(0)
Total		**69.3**	**27.14**	**3.58**	**0**

From Table 1, 69.30% of the students strongly agreed while 27.14% agreed that the content of the package was suitable for learning computer science course. Students liked the content of the package because it is well organized and easy to understand. Therefore, none of the student disagrees with the statement items on the contents of the package.

Table 2: Interactivity of the Package

S/No	STATEMENT	RESPONSE			
		SA	A	D	SD
1	It is easy to operate the package with your device keys and icons.	20(71.4)	8(28.6)	0(0)	0(0)
2	This package permits me to repeat the section, enlarge animation, and exit the lesson at any time.	17(60.7)	9(32.1)	2(7.1)	0(0)
3	The frequent display of questions to the learners does not interrupt the learning process.	22(78.6)	5(17.9)	1(3.6)	0(0)
4	This package enables me to apply what I have learnt rather than memorize it.	22(78.6)	4(14.3)	1(3.6)	1(3.6)
5	This package allows me to discover information through active learning.	20(71.4)	6(21.4)	2(7.1)	0(0)
Total		**72.14**	**22.86**	**4.28**	**0.72**

From Table 2, 72.14% of the students strongly agreed while 22.86% agreed that the package was interactive for learning of computer science course. Students liked the package because it enables them to apply what was learnt rather than memorize it. 4.28% disagree and 0.72% strong disagree that the package is interactive.

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Table 3: Navigation of the Package

S/No	STATEMENT	RESPONSE			
		SA	A	D	SD
1	From the main menu, learners are allowed to register his/her name.	16(57.1)	8(28.6)	2(7.1)	2(7.1)
2	The EXIT key enables me to exit from the lesson /program	21(75.0)	7(25.0)	0(0)	0(0)
3	The PREVIOUS key enables me to revisit the previous section(s) of the lesson.	17(60.7)	9(32.1)	2(7.1)	0(0)
4	The OPTION keys allow me to select the correct option.	24(85.7)	4(14.3)	0(0)	0(0)
Total		**55.7**	**20.0**	**2.84**	**1.42**

From Table 3, 55.7% of the students strongly agreed that the package option keys allow them to select the correct option while 20.0% agreed. Furthermore, 2.84% of the students disagree and 1.42% strongly disagree with the statement items on the navigation of the package.

Table 4: Feedback from the Package

S/No	STATEMENT	RESPONSE			
		SA	A	D	SD
1	This package provides immediate feedback after selecting the option.	17(60.7)	11(39.3)	0(0)	0(0)
2	This package displays the correct or wrong answer chosen with some sound.	8(28.6)	18(64.3)	1(3.6)	1(3.6)
3	This package allows me to proceed to the next lesson only if the chosen answer is correct.	19(67.9)	5(17.9)	2(7.1)	2(7.1)
4	This package terminates my activities if after three attempts I got the answer wrong.	16(57.1)	12(42.9)	0(0)	0(0)
Total		**42.86**	**32.88**	**2.14**	**2.14**

From Table 4, a total of 42.86% of the students strongly agreed while 32.88% agreed that the package displays the correct or wrong answer chosen with some sound which allows feedback from the package. Furthermore, 2.14% of the students disagree, meanwhile 2.14% of the students strongly disagree with any of the statement items on the feedback of the package.

Table 5: Screen Design of the Package

S/No	STATEMENT	RESPONSE			
		SA	A	D	SD
1	The presentations of the information in the package attract my attention.	17(60.7)	6(21.4)	3(10.7)	2(7.1)
2	The use of proper lettering (fonts) in terms of style and size make the information legible.	14(50.0)	11(39.3)	2(7.1)	1(3.6)
3	The colours used for the various presentations are quite appealing.	11(39.1)	17(60.7)	0(0)	0(0)

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S/No	STATEMENT	RESPONSE			
		SA	A	D	SD
4	The quality of the text, images, graphics and video are interesting.	11(39.3)	15(42.9)	4(14.3)	1(3.6)
Total		**37.82**	**32.86**	**6.42**	**2.86**

Results from table 5 shows that 37.82% of students strongly agreed on the nature of the screen design of the package while 32.86% agreed. They also agreed that the presentation of information is attractive. Meanwhile only 6.42% of the respondents had a negative view on the statement items concerning the screen design of the package.

Research Question Four: What are the college of education students' attitudes towards using mobile electronics response system for learning computer science?

Table 6: Students' Attitude towards Mobile Application Instructional Package

S/NO	Item	Mean	SD	Decision
1.	Having access to Mobile equipment (laptops, Mobile Phone, Android etc) is a yardstick to integrating Mobile Electronics Response System.	4.64	0.44	Agree
2.	I am used to other mobile technologies during learning process.	4.79	0.48	Agree
3.	I can setup new learning platforms on my own.	4.75	0.62	Agree
4.	I have used mobile technology equipment on my own.	4.86	0.62	Agree
5.	I have used Mobile Electronics Response supported-instruction before in learning process.	4.86	0.73	Agree
6.	I became more optimistic academically through the use of Mobile Electronics Response system Learning Package than I do from only traditional method.	4.86	0.58	Agree
7.	Mobile Assisted Learning Application increases my reflectivity while learning Number base concept.	4.86	0.59	Agree
8.	Mobile supported –instructions Learning package makes computer science lecture more interactive.	4.71	0.66	Agree
9.	Mobile Electronics Response integration to learning makes it participatory.	4.71	0.59	Agree
10.	Mobile electronics Response system improve my punctuality to lectures	4.79	0.51	Agree
11.	Mobile Electronics Response system has increased my retention Level.	4.75	1.06	Disagree
12.	Mobile Supported –instruction learning package increases my readiness for Computer Science lectures.	4.75	0.85	Disagree
13.	I can ask questions or clear misconception on topics taught without hand raising.	4.75	0.95	Agree
14.	I can answer questions using different methods.	4.89	0.69	Agree
15.	Mobile Electronics Response system inspires me to achieve better educational learning outcome.	4.71	0.69	Agree
16.	Mobile Electronics Response Systems supported –	4.79	1.37	Agree

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S/NO	Item	Mean	SD	Decision
	instructions discourages me from active learning.			
17.	Mobile Assisted Learning Package distracts me from the real lesson.	4.86	0.66	Agree
18.	Operation of mobile phone discourages me from using Mobile Assisted Learning Application during Computer Science lectures	4.79	0.48	Agree
19.	Multiple question are appropriate for the course contents.	4.82	0.69	Agree
20.	I become more pessimistic academically through the use of Mobile Electronics Response System.	4.79	0.55	Agree
21.	Operation of mobile phone encourages me to use Mobile Assisted Learning Package during Computer lectures.	4.82	0.69	Agree
22.	I won't be able to cope with Mobile Electronics Response System in my academic activities.	4.86	0.58	Agree
23.	The use of my android Phones, Laptops and tablets as a clicker during the first lecture changed my attitude positively towards mobile learning.	4.71	0.44	Agree
24.	Computer Science should be taught with Mobile Electronics Response System because it is a worthwhile experience.	4.82	0.77	Agree
25.	I find it difficult concentrating using Mobile Electronics Response System to learning Computer Science.	4.89	0.77	Disagree
26.	The use of Mobile Electronics Response System technology is a waste of productive learning time.	4.79	0.51	Disagree
27.	Mobile Electronics Response System provides audio- visual instruction which appeal to more sense organs during lectures.	4.89	1.2	Disagree
28.	I have phobia integrating ICT equipment to learning process.	4.89	0.99	Agree
28.	With exposure to Mobile Electronics Response system I was able to learn actively in a Think-Pair-Share collaborative setting.	4.79	0.99	Agree
30.	With exposure to Mobile Electronics Response system I was able to learn actively in a Think-Aloud-Pair problem solving collaborative setting,	4.64	0.44	Agree
31.	Mobile Electronics Response system has improved my attentiveness in the Computer Science Lectures.	4.61	0.59	Agree
32.	Mobile Electronics Response System is useful in other subject area for learning.	4.71	1.29	Agree
33.	Mobile Electronics Response System can be used to control a large class.	4.71	0.51	Agree
34.	Mobile Electronics Response System is suitable for Computer Science lectures.	4.79	0.48	Agree
35.	I learn haphazardly using Mobile Electronics Response system.	4.86	0.73	Agree
36.	Electricity and Internet Connectivity available in your school.	4.86	0.62	Disagree
	Grand Mean	**5.06**	**0.74**	Agree

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Table 7 shows the responses of colleges of education students on their reaction towards the use of Mobile Application Instructional Package. The Grand Mean Score of 5.06 from the above table indicates that the undergraduates' students have positive reaction (attitude) towards Mobile Electronic Response System via Mobile Devices as a medium.

DISCUSSION OF FINDINGS

In this study, the researcher developed and validated Mobile Electronics Response System (MERS) using waterfall model for teaching computer science students via handheld electronic mobile devices. . Most students at the colleges of education normally use computers located in the computer centres to access the online learning materials (courseware) of their blended learning courses. But mobile technology also allowed the students flexible (irrespective of time and location) access to social networks such as Facebook (Mayisela, 2013).There are different types of handheld mobile devices technology roaming around the educational segment today. The researcher sought to find out the procedures for developing mobile apps package, its impacts and effectiveness on student's performance, validation process mobile apps, student's attitudes and other strategies skills needed to be known and used in teaching computer science courses. The researcher adopted the used of waterfall model because it has been considered by many researchers to be one of the most commonly effective model presently adopted and used by many researchers across the globe such as (Scotcher, 2016; Van et al., 2017). However, the new introduced environment will benefit both educators and students in terms of insight into informal, tacit learning processes (Myisela, 2013).

The validation of this MERS was done by computer programmer experts, educational technology specialist, computer science specialists and computer science students for individual field trial validation. Their comments, suggestions and observations revealed that the content of MAI package covered the concepts of computer networking which is based on undergraduates' computer science curriculum. They also agreed that the MERS questionnaire items covered different levels of educational objectives (i.e. Knowledge of facts, application of knowledge, and interpretation of concepts). Both the lecturers and their participating students strongly agreed that the topics and sub-topics treated in the package were sequentially arranged according to the curriculum. It is believed that learning should start from simple to complex; therefore, this sequential arrangement of the sub-topics is considered to be vital to ease the use of the package for teaching and learning process. The content specialist validation was to ensure that the content of the package was carefully prepared and it meets the international standard. The MERS interactive package was developed using Java and built in Android Studio.

The research revealed that the undergraduate's students have positive reaction towards mobile application instructional package taught computer science using mobile devices. The result also shows that the students taught computer science using MERS had positive reaction on their academic impact and performance than those taught using conventional/traditional method.

This result is in line with the work of David (2013) observed that positive attitude toward ICT use are widely recognized as a necessary condition for effective use in teaching and learning process. The discovery is also supported by Shittuet al (2015) revealed that behavioural belief stand to be the strongest determinant of pre-service teachers

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behavioural intention and that attitude is an important factor when integrating or using ICT for teaching.The finding is also supported by Kubiatko (2010) who study on Czech University Student revealed that the participant University student had a positive attitude toward use of ICT in science teaching and also Chenng (2015) who found that students generally show positive attitude towards use of mobile devices for learning and its effectiveness in language learning.

CONCLUSION

From the findings of this research, the following conclusions were made.

i. The used of mobile electronic response system using handheld mobile devices are effective for teaching computer science students.
ii. The mobile learning application is better than the conventional or traditional method as medium of instructions.
iii. (iii) Interactive mobile electronic response system can enhance the education system by providing ease of access to education anywhere, anytime especially for distance learning students.
iv. Mobile learning package improved students' reactions and attitudes towards learning engagement and willingness more than other instructional delivery media such as conventional mode.

RECOMMENDATIONS

Presently, indigenous mobile electronic response system for teaching science and other related courses are not readily available in Nigeria. This is due to the fact that the country is still undergoing a process of technological development in the area of innovative adoption, integration and acceptance in the education sector. Consequently, the production of mobile electronic response system and their corresponding utilization for instruction in our educational system is not common. As a result of this, research into the design, development and validation of mobile learning packages, and their deployment for classroom instruction should be encouraged. This could be achieved if all education stakeholders concerned such as:

The government should provide good standard policies for mobile learning adoption, integration, acceptance and corroboration to support the classroom instructional process.

The Parents should support and provide for their children good handheld Mobile devices that would mainly be used for learning process.

Educators should be trained and encouraged to adapt and adopt the use of mobile learning as means and medium of instructions to enhance teaching and learning processes within and outside the classrooms.

Students should be encouraged to use mobile technology devices as learning tools to enhance their learning performance which is better than conventional method.

The government, NGOs and companies should provide available funds for schools to design, develop, deploy and utilize mobile application packages to all science subjects since students' academic achievement and retention could be enhanced through this medium of instruction.

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