

Effectiveness of Chemistry Learning-App for Nigerian Undergraduates in a Blended Learning Environment

BY

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Abstract

Learning application are applications developed for learning purpose using mobile technologies to enhance students learning. However, in spite of the rapid use of mobile devices among undergraduates in Nigerian Universities, many students use mobile devices for unproductive activities. Hence, this study therefore, focused on the effectiveness of Chemistry Learning-App for Nigerian Undergraduates in a Blended Learning Environment. The objectives of this study was to (i) determined experts' rating of the developed Chemistry Learning-App;(ii) examined the effectiveness of the Chemistry Learning-App on undergraduates' academic performance in a blended learning environment and those taught with conventional lecture method; (iii) examined the influence of gender on academic performance of undergraduates exposed to Chemistry Learning-App in blended learning environment. The research instruments used were; Chemistry Learning-App, Students' Academic Performance Test and Experts Rating of the Chemistry Learning-App with the reliability value of .71. This study used quasi pretest posttest of non-equivalent experimental design. A total of 60 undergraduates were sampled for the study. The study concluded that undergraduates exposed to Chemistry Learning-App performed better than their counterpart taught using conventional lecture method. The implication is that Chemistry academic performance of undergraduates would improve if students are exposed to the developed Learning-App. It was recommended among others that undergraduates should complement instruction with the use of the developed Learning-App.

Keywords: Effectiveness, Learning-App, Undergraduates, Blended learning and Learning environment.

Introduction

The relevance of Information and Communication Technology (ICT) in educational system cannot be overemphasized. ICT motivates both teachers and students. This implies that ICT should be incorporated into the school system to make teachers and students more effective. Ogunlade (2014) submitted that ICT provides teachers and students the opportunities to produce, keep, manipulate, retrieve information and encourage individuals for accumulating knowledge such as in distance learning, motivating teachers and students to keep acquiring knowledge, even after school hours, plan and prepare lessons and design materials such as course content delivery and facilitate sharing of resources, expertise and advice. One of the current ICTs versatile tools used in teaching and learning process is mobile learning application; this is because of its effectiveness (Hartnell-Young & Heym, 2008).

Mobile learning applications has become increasingly pervasive, as many higher institutions of learning have initiated a number of mobile learning initiatives to support their traditional method of teaching and learning (Khanghah & Halili, 2015). Mobile Learning-Apps have been developed and adopted globally due to its effectiveness in teaching and learning process; as teachers and students are being introduced to mobile learning applications in this 21st century. These Learning-Apps can be used anywhere, anytime and at convenience (Sharples, 2006). Mobile Learning-Apps have revitalized learning process by making learning to more effective and efficient. Mobile learning-app is a versatile tool that has the ability of engaging students in instructional activities, to increase their learning, and help them to solve complex problems and also to enhance their cognitive skills (Jones, Scanlon, & Clough, 2013).

The development of mobile learning-apps must follow good instructional design principles aimed at the achievement of specific learning outcomes. The design and development of mobile learning application is complex process which requires standard proficiency in software programming and knowledge in graphic, instructional design and content localizing (Khanghah & Halili, 2015). When all these skills are combined and utilized appropriately, it determines the quality of the mobile Learning-App. This implies that there is need for software developers who want to design and develop mobile learning application for students learning to be adequately equipped with the aforementioned programming skills required for developing such application.

Learning-Apps have been developed and adopted globally due to its significance and effectiveness in teaching and learning process, because Learning-Apps have revitalized learning process by making learning to be more interesting, interactive, stimulating, motivating, effective and efficient. Academic performance of students can be improved when learning-app is used to support learners learning activities. Results of several previous experimental studies that have been conducted on mobile learning-app revealed that the use of learning-apps has been found to improve students' academic performance in selected subjects at all levels of education (Mohammad, 2015; Elfeky & Masadeh, 2016).

Enhancing student teachers learning experiences has become more important in higher institutions in recent time due to increased students' enrollment and diversification. Educational approaches that represent a shift in instructional strategy are often described as blended learning

and virtual reality learning environments often considered as educational environments for blended learning. Blended learning is about effectively integrating ICTs or its components into course design to enhance the teaching and learning experiences for teachers and students by enabling them to engage in ways that would not normally be available or effective in their usual environment, whether it is primarily face-to-face or distance mode. In many cases the act of “blending” achieves better student experiences and outcomes, and more efficient teaching and course management practices. It can involve a mix of delivery modes, teaching approaches and learning styles (Bonk & Graham, 2006).

The role of science in national development cannot be overemphasized, especially in a developing nation like Nigeria. Science reaches out for new ideas and facts, which contribute to the ever-growing stock of knowledge. Chemistry is an important science subject that occupies a prominent place in the school science curriculum. Chemistry is a subject that is used to explain most natural phenomena including the food individual eat and how they are processed in the body.

Statement of the Problem

The 21st century proliferation of digital technology creates difficulty for the digital native students to continue instruction with the conventional ‘chalk and talk’ method due to large population during classroom activities which causes setbacks in their level of engagement in learning activities and inferably affects their academic performance. Gongden, Gongden and Lohdip (2011) submitted that most of the few students who choose to offer science subjects in secondary schools are noted for having problems in learning science subjects especially chemistry, right from their secondary educational level, which later affects their academic performance at the higher institution level. These problems are caused by many factors such as teachers’ and students’ characteristics, inability to operate computer effectively, inadequate coverage of the syllabus, examination patterns and laboratory equipment’s in recent past had led to low turnout in the integration of mobile technologies into teaching and learning process.

Therefore, leading to students’ poor performance in science subjects particularly chemistry. This point to the fact that students have difficulty in learning and grasping the content and applying these when they are under examination conditions. Aina (2013) observed that students found it difficult to appreciate the chemistry of atom if not supported using current ICTs versatile tool. The study further enumerates areas of chemistry that were difficult to teach and learn if not supported by ICTs components, these topics are; quantum theory, radioactivity, chemical reaction, chemical kinetic, ionization, electrochemistry, chemical equilibrium, and atomic theory and nature of atom, and many more. This revealed the relevance of this study for improved academic performance of undergraduates in chemistry in Nigerian universities.

Purpose of the Study

The main purpose of this study was to examine the effectiveness of Chemistry Learning-App for Nigerian Undergraduates in a Blended Learning Environment. Specifically, the study:

1. determined experts’ rating of the developed Chemistry Learning-App (Chemistry Expert, Software Developer and Educational Technology Experts);

2. examined the effectiveness of the Chemistry Learning-App on undergraduates' academic performance in a blended learning environment and those taught with conventional lecture method; and
3. examined the influence of gender on academic performance of undergraduates exposed to Chemistry Learning-App in blended learning environment.

Research Questions

1. How do experts rated the developed Chemistry Learning-App (Chemistry Expert, Software Developer Expert and Educational Technology Experts)?
2. What is the difference in the Chemistry academic performance of undergraduates exposed to the Chemistry Learning-App and those taught with conventional lecture method?
3. What is the influence of gender on Chemistry academic performance of undergraduates exposed to Chemistry Learning-App in blended learning environment?

Methodology

This study adopted an experimental research design-based approach. This study made use of quasi pretest posttest of non-equivalent experimental design. The population for the study comprised all undergraduates of Universities in Osun and Oyo State. The target population for the study was all 100 level undergraduates in Obafemi Awolowo University Ile-Ife and University of Ibadan, Ibadan offering Chemistry Education. Also, a sample of 30 undergraduates of Chemistry Education from Obafemi Awolowo University Ile-Ife was purposively selected to make the experimental group (using the developed chemistry learning-app alongside with the conventional lecture method). This selection was drawn from undergraduates having a functional Android device or tablet phone from the department of Chemistry. While 30 undergraduates of the department of Chemistry Education from University of Ibadan, Ibadan, for the control group (using the conventional lecture method). Statistical Products and Services Solutions (SPSS) version 20.0 software was used to perform descriptive and inferential statistical analysis of all data collected. Mean was used to analyze research questions.

Results

Analysis of data collected for the study are represented on presentation tables and subsequently interpreted. The distribution of sample for the study in which data were collected and analyzed includes; the experimental and control group based on gender, which are presented on the table below:

Table 1: Distribution of Sample for the Study

Sample	Gender		Total
	Male	Female	
Experimental group	13	17	30
Control group	14	16	30
Total	27	33	60

Table 1 shows the distribution of sample for the study. From the above table, the two groups comprised of a total of 60 undergraduates that were selected as samples for this study. Out of which 30 were exposed to the Chemistry Learning-App (Experimental group) while 30 of the respondents were taught with the conventional lecture method (Control group).

Research Question One: How do experts rated the developed Chemistry Learning-App (Chemistry Expert, Software Developer Expert and Educational Technology Experts)?

Table 2: Experts Rating on the Developed Chemistry Learning-App

S/N	ITEMS	Mean
1	There is adequate text –to-background contrast	4.21
2	Space/font size is easy to read	3.24
3	Main navigation is easily identifiable	3.54
4	Screen is designed in a clear and understandable manner	4.00
5	Icons in the Chemistry Learning-App are to be integrated	4.10
6	The quality of the text, graphics and diagrams are good	4.32
7	The colour of the text follow the principle of readability	4.00
8	The content has durability overtime	3.23
9	The content is structured in a clear and understanding manner	3.43
10	The learning-App create rooms for individualized learning	3.43
11	The students can interact with the learning-App at anytime	4.20
12	Learning is accessible anywhere via learning-App	3.60
	Grand	3.92

Table 2 showed a grand mean of 3.92 for the chemistry Learning-App which is above the average mean of 2.5. This indicated a positive reaction to the chemistry Learning-App on the part of the Educational Technology Experts, Computer Expert and Subject Expert, which confirmed that the Chemistry Learning-App was rated suitable for learning.

Research Question Two: What is the difference in the Chemistry academics performance of undergraduates exposed to the Chemistry Learning-App and those taught with conventional lecture method?

Table 3: Mean differences in the chemistry academic performance of undergraduates exposed to the chemistry Learning-App and those taught with conventional lecture method

Group	Mean	Std. Deviation
Experimental	3.24	1.023
Control	3.12	1.012

Table 3 revealed that undergraduates exposed to chemistry Learning-App had the highest mean score of 3.24 and their control group counterparts had a mean score of 3.12. This indicated that undergraduate's exposed to chemistry Learning-App performed better than those who were taught with conventional lecture method. Hence, the results of the analysis in table 3 revealed that there is difference in the Chemistry academic performance of undergraduates exposed to

chemistry Learning-App and those taught with conventional lecture method. In favour of experimental group.

Research Question Three: What is the influence of gender on Chemistry academic performance of undergraduates exposed to Chemistry Learning-App in blended learning environment?

Table 4: Gender influence on the chemistry academic performance of undergraduates exposed to Chemistry Learning-App

		N	Mean	Mean	Gain Score
Chemistry Learning-App	Male	13	10.47	17.87	7.40
	Female	17	15.80	18.13	2.50

Table 4, indicates that both male and female undergraduates exposed to Chemistry Learning-App had mean gain scores of 7.40 and 2.50 respectively. This indicated that the treatment improved the chemistry academic performance of the undergraduates exposed to the Chemistry Learning-App irrespective of gender. However, male had higher mean gain score than their female counterpart.

Discussions

Findings of research question one indicated a positive reaction to the chemistry learning-App on the part of the experts which confirmed that the Chemistry Learning-App was rated suitable for learning. This finding agrees with the earlier findings of Koledafe (2016) which revealed the experts rating of learning application and it was found appropriate for learning. This was to testify to the fact that using Chemistry Learning-App is a better approach for teaching Chemistry concepts for undergraduates in Nigeria. However, as effective as Chemistry Learning-App is, it should not be adopted to replace the conventional lecture method because of the missing real life teachings which students enjoy in conventional method.

Findings of research question two revealed the analysis of chemistry academic performance scores of undergraduates. The result of the mean analysis indicated that there was significant difference between the academic performance of undergraduates exposed to Chemistry Learning-App and those that were taught with the conventional lecture method. Also, the experimental group performed significantly different from their contemporaries in the control group. This finding agrees with the earlier findings of (Hartnell-Young & Heym, 2008) which revealed that the use of mobile learning application has improved students' academic performance in many subjects at all level of education. This finding also agrees with the earlier finding of Mohammad (2015) which revealed that the students' perceived performance and satisfaction has a positive relationship with the mobile learning application and improved students' academic performance. From the above findings, it can be deduced that chemistry Learning-App produced more positive effect on students' academic performance. The excellent performance of the students exposed to Chemistry Learning-App over those taught with conventional lecture method. Hence, Chemistry Learning-App should only be used to complement conventional lecture method.

Findings of research question three established that there was significant difference between male and female undergraduates' academic performance exposed to Chemistry Learning-App in a blended learning environment. Furthermore, analysis also indicated that gender had influence on the performance of students in chemistry concepts when they were exposed to the chemistry Learning-App. This implies that the treatment improved the academic performance of the male students while exposed to Chemistry Learning-App as the mean score revealed that the mean gain of male students is better than female students. The result agreed with the earlier findings of (UNESCO, 2000) which revealed that Gender differences exist in the use of mobile learning application.

Conclusion

The result obtained from the data gathered and analyzed in this study indicated that the Chemistry Learning-App covered four selected chemistry concepts. The Chemistry Learning-App was used and found effective for learning the selected Chemistry concepts. The students exposed to Chemistry Learning-App performed better than their counterpart taught using conventional lecture method. Gender inequality performance was also recorded because both the male and female students that were exposed to Chemistry Learning-App vary in their academic performance. This implies that there was gender influence or difference in undergraduates' academic performance. The findings in the research established that undergraduates have positive reaction towards the use of the Chemistry Learning-App. Based on the result in this study; Chemistry Learning-App is a valuable online learning technological tool that can be incorporated into Universities curriculum for the study of some selected Chemistry concepts. It pleased the students because they could learn at anywhere, any place, anytime and their own convenience.

Recommendations

Based on the findings and conclusions made in this study, the following recommendations were made:

1. Experts rated the chemistry learning-app suitable for learning, This indicated a positive response towards the chemistry learning-App on the part of experts (Educational Technology Experts, Computer Expert and Subject Expert)
2. Chemistry Learning-App improved the academic performance of undergraduates exposed to Chemistry Learning-App in a blended learning environment than those who were taught with conventional lecture method. Therefore, university authorities should make effort to integrate blended learning method into Nigerian Universities. This will assist students to learn anytime, anywhere and at their own convenience.
3. Chemistry Learning-App is gender friendly because it enhanced the Chemistry academic performance of both male and female undergraduates alike, both gender are employ to make use of Chemistry Learning-App continuously to improve students' academic performance

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