# EFFECTS OF INSTRUCTIONAL MOBILE TECHNOLOGY PACKAGES ON STUDENTS' ACADEMIC PERFORMANCE IN INTRODUCTION TO COMPUTER SCIENCE IN COLLEGES OF EDUCATION IN OSUN STATE, NIGERIA

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## Abstract

*This study investigated the effects of instructional mobile technology packages on students' academic performance in introduction to computer science in colleges of education in Osun State. Quasi-experimental design was employed and the sample for the study consisted of 240 purposively selected first year Nigeria Certificate in Education (NCE) students from three colleges of education in the State. Computer Science Achievement Test (CSAT) consisting of 40 multiple choice items was used as instrument for data collection. Test retest method was used to ascertain the reliability of the instrument and a reliability coefficient of 0.57 was obtained. The data collected were analysed using Analysis of Covariance (ANCOVA) statistics. Findings revealed that students taught introduction to computer science using instructional mobile technology packages performed academically better than those that were taught using traditional lecture method. Also, there was significant difference in the academic performance of students that were taught using different modes of the package. The study concluded that the use of instructional mobile technology packages can serve as viable alternative or supplement to traditional lecture method of teaching. The packages were therefore recommended to be used by lecturers teaching computer science to supplement traditional lecture method in the teaching and learning of introduction to computer science with a view to improving students' academic performance.*

**Keywords:** Introduction to Computer Science, Mobile Technology, Academic Performance.

## Introduction

The introduction of computer education programme into teacher education curriculum in Nigeria by the National Commission for Colleges of Education (NCCE) is a means of preparing the teaming population for international communications, relations and commerce. Computer education will also expose teachers to both personal and professional improvement opportunities. Knowledge and skills gained from learning computer will enhance teachers' confidence as well as their abilities in teaching and learning. The needed improvisation of instructional materials and application of computer in instruction are easily made when teachers are groomed in computer education.

In spite of all these and many other importance of computer education, there are some factors that affect the implementation of the policy that established its introduction into the NCCE curriculum in Nigeria. Nwaboku (2003) and Jegede and Owolabi (2003) identified inadequate facilities, erratic electricity power supply, financial limitations, increased enrolment, poor maintenance culture and poor policy implementation as some of the factors directly or indirectly affecting computer education at all level of education in the country.

One of the major outcomes of the above factors is observed in academic performance which represents the observed and measurable knowledge gained by a learner. The academic performance of students in a general computer education course (Introduction to Computer Science) in the two leading colleges of education in Osun state Nigeria has not been satisfactory. Analysis of data collected from the Osun State College of Education, Ilesa, showed that a greater number of students performed below average. Record showed that about 80.4% of students from some subject combinations in the school of arts and social sciences who registered for the course during the 2010/2011 session obtained grades that are below average C grade while only 14.5% of the students obtained grades C and above, and 5.1% failed the course. The record obtained for the 2011/2012 session for students that registered for the course in the

same School revealed that 65.6% scored below the average C grade while only 34.1% obtained grades C and above, and 0.3% failed.

Also, record obtained from Osun State College of Education, Ila-Orangun was not different. It was revealed that 56.4% of the students from primary education studies combinations in the school of education who registered for the course during 2011/2012 session obtained grades that are below average C grade while only 43.6% of the students obtained grades C and above. During the 2012/2013 session, record obtained for students that registered for the course in the same school revealed that 32.5% scored below the average C grade while only 21.1% obtained grades C and above. A large percentage (46.4%) of the students, however failed. These students usually complain about inability to get access to the computer laboratory for practical sessions, ill-equipped computer laboratory where access was granted, and poor electricity power supply among others. The resultant effect was their nonchalant attitude towards computer education.

In the present Information and Communication Technology age, mobile technologies (especially the smartphone) with their increasing capabilities and wide adoption could be utilized to enhance students' academic performance in practical oriented courses. Several studies have established the effectiveness of mobile learning in and outside Africa (Al-Fahad, 2009; Choi, 2012; Kajumbula, 2006; Moura & Carvalho, 2012). Instructional mobile technology package will provide learning contents directly for students' usage on their smartphones. It will also offer students the opportunities embedded in mobile technologies such as providing increase access to education, giving support to teachers, and strengthening teaching and learning in and outside the traditional school settings (Trucano, Liu & Iglesias, 2012).

The use of mobile technologies for instruction in colleges of education in Nigeria has the backing of the National Policy on Information Technology (IT) which called for the integration of information and communication technology (ICT) in the Nigerian school system when it stated in its mission statement that its mission is to, first and foremost, "Use IT" for education (Federal Republic of Nigeria, 2001). The instructional mobile technology packages that were used in this study were encoded in video, audio and text formats that are generally compatible with most mobile phones.

## Statement of the Problem

In Nigeria, several factors have been identified as militating against computer education Jegede and Owolabi (2003). These factors include inadequate facilities/equipment, unstable electricity supply and poor maintenance culture. The resultant effect of these as observed in colleges of education was students' poor attitude towards computer science in general and low academic performance in Introduction to Computer Science as a course. Recently, mobile technologies have become versatile tools for learning due to their increased capabilities. However, it was not known whether instructional mobile technology packages will enhance students' academic performance in Introduction to Computer Science in colleges of education in Osun State. Hence the study.

## Purpose of the Study

The purpose of this study was to determine the effects of instructional mobile technology packages on students' academic performance in introduction to computer science in colleges of education. Also, the study examined the comparative effects of the packages on students' academic performance.

## Research Questions

The study was guided by the following research questions:

1.  What will be the effects of instructional mobile technology packages on students' academic performance in introduction to computer science in colleges of education?

2.  Which of the instructional mobile technology packages will be most effective on students' academic performance in introduction to computer science in colleges of education?

**Research Hypotheses**

H₀ 1:   There is no significant difference in the academic performance of students that were taught Introduction to Computer Science using Instructional Mobile Technology  Packages (IMTP) and those that were taught using traditional method.

H₀ 2:   There is no significant difference in the academic performance of students exposed to different modes of Instructional Mobile Technology Packages.

**Methodology**

The study employed quasi-experimental design using pre-test, post-test control group. The population consisted of all 6,542 100 level Nigeria Certificate in Education students in three purposively selected colleges of education in Osun State. Sample comprised 240 purposively selected students from the three colleges of education with sufficient number of student population namely Osun State College of Education, Ilesa; Osun State College of Education, Ila-Orangun; and Foreign Links College of Education, Moro. Other criteria for selection include; possession of a mobile device with Bluetooth compatibility and free memory space of up to 100 megabytes. In each of the three colleges, 40 students each was assigned into one experimental and one control group using simple random sampling technique.

The stimulus material was the Instructional Mobile Technology Packages (IMTP) that was locally developed following a production script in three different modes of video, audio and text. The video was produced using Windows Movie Maker 2012, while Microsoft Sound Recorder 6.2 and Audacity 1.3 computer application software were used for the audio production. Microsoft Word 2013 was used for text production and saved as .txt format. Both video and audio modes of IMTP were converted to 3GP and MP3 formats respectively. These formats are generally acceptable to most mobile phones for easy usage by students in the experimental groups.

The only instrument that was used for data collection was Computer Science Achievement Test (CSAT) which comprised forty (40) multiple choice test items that were based on the selected topics from introduction to computer science. CSAT was subjected to face and content validity by experts in the field of computer science education, instructional technology and test and measurement. A test retest method was used to determine the reliability of the instrument and a reliability coefficient of 0.57 was obtained using Pearson Product Moment Correlation. The instrument was administered as pre and post-tests.

The research was conducted within six weeks, during which the following topics were treated: basic concepts in Computer Science, historical overview of the computer, and classification of computers. Each of the three experimental groups was exposed to only one mode of IMTP that was transferred to their mobile phone via Bluetooth wireless technology. The control groups were taught using the traditional lecture method. Data collected were analysed using Analysis of Covariance (ANCOVA) and post hoc (LSD) statistics.

**Results**

H₀ 1:  There is no significant difference in the academic performance of students that were taught Introduction to Computer Science using Instructional Mobile Technology Packages (IMTP) and those that were taught using traditional method.

The ANCOVA table (Table 1) reveals that the covariate (CSAT pre-test) did not significantly predict the groups' academic performance at the post-test, p (0.943) > 0.05. Therefore, the students' academic performance after treatment was not influenced by their previous academic performance. Also, there was a significant effect of the instructional mobile technology packages on students' academic performance, $F_{(1, 237)} = 42.434$, $p < 0.05$.  This means that the academic performance of students in the experimental groups was significantly better than that of the students in the control groups. Hypothesis one (H₀ 1), which states that there is no significant difference in the academic performance of students that were taught Introduction to Computer Science using Instructional Mobile Technology Packages (IMTP) and those that were taught using traditional method, was therefore rejected.

H$_o$ 2: There is no significant difference in the academic performance of students exposed to different modes of Instructional Mobile Technology Packages.

Result shown in Table 2 indicates that there was a significant difference in the effect of the different modes of instructional mobile technology packages on students' academic performance in introduction to computer science, $F_{(2, 116)} = 16.507$, $p < 0.05$. This means that the academic performance of students in one of the experimental groups was significantly better than the others. Hypothesis two (H$_o$ 2), which states that there is no significant difference in the academic performance of students exposed to different modes of instructional mobile technology packages, was therefore rejected.

Table 3 shows a post hoc multiple comparisons carried out in order to further test for hypothesis two. The table shows that there was a significant difference between the video group and both the audio group (p = 0.000) and text group (p = 0.000) in respect of their academic performance. There is however no significant difference between the audio group and the text group (p = 0.051). This implies that the academic performance of students that were exposed to the video mode of instructional mobile technology package was significantly better than those of the students that were exposed to either audio mode or text mode.

**Table 1: ANCOVA result of the academic performance of the experimental and control groups in introduction to computer science.**

Dependent Variable: CSAT Post-test

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 3646.934[a] | 2 | 1823.467 | 21.217 | .000 |
| Intercept | 9486.972 | 1 | 9486.972 | 110.385 | .000 |
| CSAT Pre-test (covariate) | .433 | 1 | .433 | .005 | .943 |
| Group | 3646.933 | 1 | 3646.933 | 42.434 | .000 |
| Error | 20368.884 | 237 | 85.945 | | |
| Total | 105141.469 | 240 | | | |
| Corrected Total | 24015.818 | 239 | | | |

a. R Squared = .152 (Adjusted R Squared = .145)

**Table 2: ANCOVA result of the academic performance of students taught introduction to computer science using different modes of instructional mobile technology packages.**

Dependent Variable: CSAT Post-test

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 2939.088[a] | 3 | 979.696 | 11.095 | .000 |
| Intercept | 4823.051 | 1 | 4823.051 | 54.622 | .000 |
| CSAT Pre-test (covariate) | 48.477 | 1 | 48.477 | .549 | .460 |
| Group | 2915.017 | 2 | 1457.509 | 16.507 | .000 |
| Error | 10242.685 | 116 | 88.299 | | |
| Total | 72767.406 | 120 | | | |
| Corrected Total | 13181.773 | 119 | | | |

a. R Squared = .223 (Adjusted R Squared = .203)

**Table 3: Pairwise comparisons of the effect of different modes of instructional mobile technology packages on students' academic performance in introduction to computer science.**

Dependent Variable: CSAT Post-test

| (I) Group | (J) Group | Mean Difference (I-J) | Std. Error | Sig.[b] | 95% Confidence Interval for Difference[b] | |
|-----------|-----------|------------------------|------------|---------|------------------|------------------|
| | | | | | Lower Bound | Upper Bound |
| Video | Audio | 11.903[*] | 2.104 | .000 | 7.736 | 16.071 |
| | Text | 7.743[*] | 2.103 | .000 | 3.579 | 11.908 |
| Audio | Video | -11.903[*] | 2.104 | .000 | -16.071 | -7.736 |
| | Text | -4.160 | 2.110 | .051 | -8.338 | .019 |
| Text | Video | -7.743[*] | 2.103 | .000 | -11.908 | -3.579 |
| | Audio | 4.160 | 2.110 | .051 | -.019 | 8.338 |

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

**Discussion**

The best academic performance was recorded by students in the instructional mobile technology packages groups, which supports the notion that technology supports and better enhances learning (Yusuf, 2007). This correlates with findings of Forest (2009), Al-Fahad (2009), Shih et al. (2010), Hashim et al. (2011), Choi (2012) and Moura and Carvalho (2012) who discovered that students who engaged in learning through mobile technologies had better learning and enhanced academic performance.

Findings showed that each of the three modes of instructional mobile technology packages improved the academic performance of students better than the traditional lecture method of teaching. Furthermore, comparison of the achievement scores of the experimental groups showed that students exposed to the video mode of IMTP performed significantly better than the others (Table 3). These findings can be attributed to inherent features of the video mode such as combination of audio and visual effects which appeal to both auditory and visual senses thus allowing for communication via two channels. This according to Paivio (1986) allows for better learning and retention of contents in the long-term memory. Also, going by Dale's (1969) organization of learning experiences, the video mode of IMTP will better present learning in more concrete form than either the audio or text mode of IMTP since the degree of abstraction of the later is higher in Dale's "cone of experience".

The text mode which followed the video mode in effectiveness on academic performance possesses the highest degree of abstraction in the "cone of experience" by Dale (1969) but has no significantly different effect when compared with the audio mode of IMTP. This finding is closely related to findings by Merkt, Weigand, Heier, and Schwan (2011) that illustrated textbook improved knowledge acquisition. The better achievement test scores recorded by the text mode of IMTP over the audio mode can be attributed to students' close familiarity with reading texts for learning than listening to audio instruction.

The least academic performance recorded by the audio mode when compared with the video and text modes of IMTP can be attributed to two major factors. One is the assertion made by Spencer (1996) that for the potential of teaching via audio mode to be fully exploited, essential graphic information, usually in the form of printed materials, must be provided. Lack of supportive printed graphic materials for students in the audio group might have been responsible for the least academic performance by this group. The second factor can be said to be the lack of familiarity of students with the audio mode for individualised instruction. Though they are motivated by the fact that the instruction was via their mobile phones, yet it seems this was not enough to sufficiently boost their commitment to repeatedly listen to the instructions for better understanding and learning. Chen and Denoyelles (2013) had earlier found that music is the only audio which students are most familiar with on mobile devices. The result, therefore, emphasises the superiority of video mode of instruction over audio, text and the traditional modes of instruction. This agrees with finding of Bada (2006), Isiaka (2007) and Akerele and Afolabi (2012), who found that students that were taught using video instruction performed better than those that were taught using the traditional method. The result, however, differs from findings of

Merkt et al. (2011) which showed that there was no significant difference in the performance of students exposed to educational videos and those exposed to the illustrated textbook.

**Conclusion**

The result of this study provides empirical evidence that students' academic performance in introduction to computer science was enhanced using instructional mobile technology packages. Also, the video mode of instructional mobile technology packages better improved students' academic performance in introduction to computer science in colleges of education than both audio and text modes of the package.

**Recommendations**

1. Computer science teachers in colleges of education are encouraged to use instructional mobile technology packages to teach introduction to computer science in order to enhance students' academic performance in the course.
2. The video mode of instructional mobile technology package should be utilized in teaching aspects of introduction to computer science in colleges of education where necessary facilities/equipment is lacking or inadequate.
3. Authorities in colleges of education should make mobile technology compatible learning contents available in the library/learning resource centres so as to encourage the use of mobile technologies, most especially mobile phones, which are in students' possession as learning tools.

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