Effect of Three Modes of Mobile Instructional Package on Retention and Gender of Mathematics Students in Colleges of Education in North-Central Nigeria

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Abstract

This study investigated the effect of three modes of mobile instructional package on retention and gender of mathematics students in colleges of education, in North-Central Nigeria. The study adopted pre-test post-test and retention-test randomized experimental design. The target population for the study was all the NCE one mathematics students in North-Central Nigeria. Multi-stage sampling was used to sample the schools and students for the study. A random sample of 120 students (75 male and 45 female) were randomly selected from three randomly selected colleges of education, in North-Central Nigeria. Three schools were assigned to experimental group one, two and three respectively. The research was guided by three research question and three null hypotheses and tested at 0.05 level of significant. The researchers developed mathematics mobile instructional package MMIP on mathematical concepts on trigonometry, which was used as treatment for experimental groups. A pilot study was carried out to test the research instrument. A reliability coefficient of 0.85 was obtained using the split-half method. Thirty (30) multiple choice item multiple choice questions were administered to both groups before and after the treatment as post-test and retention-test. The data collected from the administration of the research instrument (TRAT) were analysed using SPSS version 20.0. The mean and standard deviation were used to answer the research questions while analysis of covariance (ANCOVA) was used to test the research hypotheses. The findings of the study revealed that there was no significant difference in the retention and gender of mathematics student taught using Video Only, Audio+Text and Text Only. Based on the finding, the study recommends that mathematics mobile instructional package (MMIP) should be encouraged in schools for teaching and learning of mathematics.

Key Words: Mathematics mobile instructional package, video only, audio with text, text only, achievement, instructional package, mathematics students.

1. Introduction

Mathematics is a science of numbers and there are several different branches of mathematics including algebra, geometry and trigonometry. Many students dislike mathematics in general and trigonometry in particular, this explain why students have usually high failure rate in public

examinations (Akinsola, 2002). This has been considered as a big clog in the wheel of progress and advancement in educational system. Trigonometry aspect of mathematics is a compulsory course offering by 100 level mathematics students in first semester in NCE, it is known by its code as MAT 112, and students have been finding this concept difficult, because most of the students studying mathematics at NCE level do not offer further mathematics at secondary school level, which will help them to have solid foundation in trigonometry. The trigonometry aspect of general mathematics is not detail enough in secondary schools syllabus, therefore there is need to bridge the gap that exists in the students' background in trigonometry aspect of mathematics through research.

Failure in mathematics is a barrier to students' ambition to study science and engineering courses (Iwendi, 2007). Many researchers have attempted finding out the causes of students' poor performance in mathematics. Some of the problems identified include: poor teaching methods; inadequate instructional materials and student's misconception of mathematics as a difficult subject (Yusuf, 2004). Matazu (2010) added that mathematics teacher's attitude towards teaching the subject, poor teaching skills and lack of active participation by the students among others, could also be responsible for students' poor performance in the subject.

To address these challenges, there is need for an instructional system that is supported by technology for meaningful learning. In this 21st century, a motivating and captivating approach should be encouraged to help students learn better, understand, and retain mathematical concepts and promote their future involvement. One of the promising approaches, according to Lam and Lam and Duan (2012) is the use of mobile devices such as ipad, android among others for learning. There are multiple advantages with respect to the use of mobile devices such as ipad, android among others, with incorporation of mathematics mobile instructional modes such as video only, audio with text and text only in the learning process and also including stimulus, motivation, ease of use, availability. The devices are becoming highly valuable tools in the educational process because of their attractive features, mobile devices are portable, more affordable, in relation to desktop computers, they offer the opportunity for learning without local restrictions, use the possibilities offered by the wireless mobile technologies for easy access to information, promote the development of digital literacy, provide opportunities for independent learning, facilitate people with disabilities (Shuler, 2009).

In order to ascertain whether knowledge acquired in mobile instructional package is retain by mathematics students of colleges of education, students' retention test need to be carry out. Retention is the ability to reproduce the learnt concept when the need arise. Retention takes place when learning is coded into memory, and appropriate coding of incoming information provides the index that may be consulted so that retention takes place without an elaborate search in the memory lane (Achor, Otor, & Umoru, 2013). Anything that aids learning improves retention while things that lead to confusion or interference among learned materials decrease the speed and efficiency of learning and accelerates forgetting. Choi and Johnson (2007) reported that the

simultaneous processing of both auditory and visual information increase learner comprehension and retention. Shaibu, Mike, Solomon, and Jarkko (2016) carried out investigation on impact of mobile devices for learning in higher education institutions: Nigerian universities case study. The study found out that there was no significant difference in the students' use of mobile devices based on gender.

Achor, Otor and Umoru (2013) carried out findings on do teaching strategies matter in students' retention in biology at secondary school level? It was revealed that significant difference existed in students taught using CBI and those taught using conventional method. Khalid (2011) investigated a research titled SMS: Tool for L 2 vocabulary retention and reading comprehension ability. The study found out that there was significantly better retention level in SMS group than those in control group, when taught new words through conventional board and paper technique for the same period. Oludipe (2012) Investigated gender difference in Nigerian junior secondary students' academic achievement in basic science. Result revealed that there was no significant difference in academic achievement of male and female students at the pretest, post-test a delayed post test levels respectively. Gambari, Falode and Adegbenro (2014) carried out study on effectiveness of computer animation and geometrical instructional model on mathematics achievement and retention among junior secondary school students. Results suggested that students taught geometry using computer animation performed significantly better in posttest and retention test than their counterparts taught geometry using instructional model and conventional method respectively.

1.1 Objectives of the Study

The aim of this research is to investigate the effects of three modes of mobile instructional package on retention and gender of mathematics students in colleges of education, in North-Central Nigeria

1.1 Research Questions

The following research questions were raised to guide the study:
1. What is the mean retention score of male and female students taught mathematics with mathematics mobile instructional package with (Video Only)?
2. What is the mean retention score of male and female students taught mathematics with mathematics mobile instructional package with (Audio + Text)?
3. What is the mean retention score of male and female students taught mathematics with mathematics mobile instructional package with (Text Only)?

1.2 Research Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance:

H_{01} There is no significant difference in the mean retention score of male and female students taught mathematics with mathematics mobile instructional package with (Video   only).

H_{02} There is no significant difference in the mean retention score of male and female students taught mathematics with mathematics mobile instructional package with audio with (Text only).

H_{03} There is no significant difference in the mean retention score of male and female students taught mathematics with mathematics mobile instructional package with (Text   Only).

2.   Methodology

The research adopted the pre-test–post-tests randomize design. The population of the study comprises all NCE mathematics students in North Central Nigeria and target population was NCE one mathematics student. 120 students were randomly selected from three colleges of education in North Central Nigeria for the study. The Instruments for the study is Trigonometry Achievement Test (TRAT) and treatment material is Mathematics Mobile Instructional Package (MMIP). The TRAT comprises of 30 multiple choice objective questions and Mathematics Mobile Instructional Package comprises of Video Only, Audio+Text and Text Only Mathematics Instructional Package. The Trigonometry Achievement Test (TRAT) and Mathematics Mobile Instructional Package (MMIP) was validated by three experts in mathematics education, education technology and computer scientist in both university and college of education, because research was carried out in colleges of education. All the experimental groups were given Pretest before the treatment and after treatment posttest were administered on them. Experimental group one was exposed to the use of Video Only Mathematics Mobile Instructional Package '(VOMMIP)'; experimental group two was exposed to Audio+Text Mathematics Mobile Instructional Package '(A+TMMIP)'; while experimental group three was exposed to Text only Mathematics Mobile Instructional Package '(TOMMIP). The retention test was administered on the groups after two weeks of posttest. ANCOVA was used for method of data analysis. Conclusion it was established that there was no significant difference in the male and female retention of NCE one mathematics student taught using video only, Audio+Text and Text Only Mathematics Mobile Instructional Package.

3. Results
3.1 Students Taught Mathematics Mobile Instructional Package with Video Only

The study sought to determine the mean retention score of male and female students taught mathematics mobile instructional package with video only. Table 1 shows the distribution of the respondents respectively

Table1

Students Taught with Video Only

Group	N	Posttest		Retention		Mean Gain
		$\bar{X}$	SD	$\bar{X}$	SD	
Male	25	78.50	12.30	82.07	8.18	3.57
Female	15	75.28	15.84	76.64	13.13	1.36

From table 1, the result, it can be seen that mean score of the posttest and retention test score of the male are $\bar{X}$ = 78.50, SD = 12.30 and $\bar{X}$ = 82.07, SD 8.18. The mean gain is 3.57 in favour of the male retention test score. Similarly, the mean and standard deviation of posttest and retention test score of female are $\bar{X}$ = 75.28, SD = 15.84 and $\bar{X}$ = 76.64, SD = 13.13, the mean gain is 1.36 in favor of the female retention test score. Also the result reveals the difference of 2.21 between the retention mean gains score of male and female in favor of the male.

3.2 Students Taught Mathematics Mobile Instructional Package with Audio + Text

The study also sought to determine the mean retention scores of male and female students taught mathematics mobile instructional package with Audio + Text. Their distribution was recorded in table 2 below.

Table 2

Students Taught with Audio + Text

Group	N	Posttest		Retention		Mean Gain
		$\bar{X}$	SD	$\bar{X}$	SD	
Male	25	67.19	13.11	70.51	11.02	3.32
Female	15	69.75	11.68	71.73	9.08	1.98

As shown in table 2, it can be seen that mean score of the posttest and retention test score of the male are $\bar{X}$ = 67.19, SD = 13.11and $\bar{X}$ = 70.51, SD 11.02. The mean gain is 3.32 in favor of the male retention test score. Similarly, the mean and standard deviation of posttest and retention test score of female are $\bar{X}$ = 69.75, SD = 11.68 and $\bar{X}$ = 71.73, SD = 9.08, the mean gain is 1.36 in favour of the female retention test score. Also the result reveals the difference of 1.34 between the retention test mean gains score of male and female in favor of the male.

3.2 Students Taught Mathematics Mobile Instructional Package with Text Only

The study sought to determine the mean retention score of male and female students taught mathematics mobile instructional package with text only. Table 3 shows the distribution of the respondents respectively

Table 3

Students Taught with Text Only

Group	N	Posttest		Retention		Mean Gain
		$\bar{X}$	SD	$\bar{X}$	SD	
Male	25	59.06	8.89	65.86	10.64	6.80
Female	15	60.66	7.58	65.10	8.89	4.44

From table 3, it can be seen that mean score of the posttest and retention test score of the male are $\bar{X}$ = 59.06, SD = 8.89 and $\bar{X}$ = 65.86, SD 10.64. The mean gain is 6.80 in favor of the male retention test score. Similarly, the mean and standard deviation of posttest and retention test score of female are $\bar{X}$ = 60.66, SD = 7.58 and $\bar{X}$ = 65.10, SD = 8.89, the mean gain is 2.36 in favour of the female retention test score. Also the result reveals the difference of 2.36 between the retention test mean gains score of male and female in favor of the male.

Hypothesis One

H0₁: There is no significant difference in the mean retention score of male and female students taught mathematics mobile instructional package with Video only.

Table 4

ANCOVA Analysis of Retention of Male and Female Students Taught Mathematics Using Video Only Mathematics Mobile Instructional package (VOMMIP)

Sources	Sum of Squares	df.	Mean Square	F	Sig.
Corrected Model	3059.122[a]	2	1529.561	45.561	.000
Intercept	1154.643	1	1154.643	34.393	.000
Covariate	2781.967	1	2781.967	82.866	.000
Treatment	108.787	1	108.787	3.240	.080
Error	1242.165	37	33.572		
Total	260546.145	40			
Corrected Total	4301.287	39			

*: Significant at 0.05

Table 4: shows the result of the hypothesis six. The hypothesis was tested using the pre-test mean scores of male and female students taught using Video Only MMIP as covariate for the analysis of Covariance. The F value of 3.240 was not significant at 0.05 alpha level that is F (1, 37) = 3.240, p > 0.05. The result shows that there was no significant difference in the retention of male and female students taught using Video Only Mathematics Mobile Instructional Package. On this basis, the hypothesis six is accepted. This shows that there is no statistical difference in the retention of male and female students taught with Video Only Mathematics Mobile Instructional package.

Hypothesis two

H_{02}: There is no difference in the mean retention score of male and female students taught mathematics mobile instructional package with Audio with Text.

Table 5

ANCOVA Analysis of Retention of Male and Female Students Taught Mathematics Using (Audio with Text MMIP)

Sources	Sum of Squares	df.	Mean Square	F	Sig.
Corrected Model	1893.578	2	946.789	15.992	.000
Intercept	1348.213	1	1348.213	22.772 .	.000
Covariate	1879.755	1	1879.755	31.750	.000
Treatment	.415	1	.415	.007	.934
Error	2190.569	37	59.205		
Total	205563.719	40			
Corrected Total	4084.147	39			

*: Significant at 0.05

Table 5: Shows the result of the hypothesis eight. The hypothesis was tested using the pre-test mean scores of male and female students taught using Video Only MMIP as covariate for the analysis of Covariance. The F value of .007 was not significant at 0.05 alpha level that is F (1, 37) = .007, p> 0.05. The result shows that there was no significant difference in the mean retention score of male and female students taught mathematics using (Audio with Text) MMIP package. On this basis, the hypothesis eight is accepted. This shows that there is no statistical difference in the retention of male and female students taught with (Audio with Text) MMIP package.

Hypothesis Three

H_{03}: There is no significant difference in the mean retention score of male and female students taught mathematics mobile instructional package with Text only.

Table 6

ANCOVA Analysis of Retention of Male and Female Students Score Taught Mathematics Using Text Only Mathematics Mobile Instructional package (Text Only MMIP)

Sources	Sum of Squares	df.	Mean Square	F	Sig.
Corrected Model	1648.080	2	824.040	13.971	.000
Intercept	262.418	1	262.418	4.449	.042
Covariate	1642.733	1	1642.733	27.851	.000
Treatment	37.253	1	37.253	.632	.432
Error	2182.354	37	58.983		
Total	175859.890	40			
Corrected Total	3830.434	39			

*: Significant at 0.05

Table 6: shows ANCOVA analysis of retention score of Text Only Mathematics Mobile Instructional Package (TOMMIP), An examination of Table 4.11 with $F (1, 37)$ .632, $p = 0.432$, The result shows that there was no significant difference in the retention of male and female students taught using Text Only Mathematics Mobile Instructional Package. On this basis, the hypothesis eight is accepted. This shows that there is no statistical difference in the retention of male and female students taught with Text Only MMIP package.

4. Discussion

The findings on the influence of gender (male and female) on students retention when taught mathematics using mathematics mobile instructional package **(video only)** as sought by research question four indicated that male students had minimally higher mean retention score (82.07) than their female counterparts (76.64). This implies that there was little difference in the mean retention scores of male and female students exposed to video only mathematics mobile instructional package. The result of testing research hypothesis four on ANCOVA Table 4 proved there was no statistical significant difference between mean retention scores of male and female participants in the experimental group using video only. Therefore, hypothesis four was upheld. Hence, there was no significant difference in the retention scores of male and female students taught mathematics using mathematics mobile instructional package. The recall effect of

mathematics mobile instructional package (video only) on the retention scores of both male and female students could be explained from the point of view that package (video only) is very effective and gender friendly. This is in support of Shaibu, Mike, Solomon, and Jarkko (2016) that found out that there was no significant difference in the students' use of mobile devices based on gender, also in contrary to the work of Achor, Otor and Umoru (2013) which says significant difference existed in students taught using CBI and those taught using conventional method.

The findings on the influence of gender (male and female) on students retention when taught mathematics using mathematics mobile instructional package **(Audio+Text)** as sought by research question six indicated that female students had minimally higher mean retention score (71.73) than their male counterparts (70.51) this implies that there was no much difference in the mean retention scores of male and female students exposed to audio with text mathematics mobile instructional package. The result of testing research hypothesis six on ANCOVA Table 5 proved there was no significant difference between the mean retention scores of the male and female participants in the experimental group. Therefore, hypothesis six was upheld. Hence, there was no significant difference in the retention scores of male and female students taught mathematics using mathematics mobile instructional package (Audio with text) The retain effect of mathematics mobile instructional package (Audio with text) on the retention scores of both male and female students could be explained from the point of view that package (Audio with text) is very effective and gender friendly. This is in agreement with Khalid (2011) who found out that there was significantly better retention level in SMS group than those in control group, when taught new words through conventional board and paper technique for the same period.

The findings on the influence of gender (male and female) on students retention when taught mathematics using mathematics mobile instructional package **(Text only)** as sought by research question eight indicated that male students had minimally higher mean retention score (65.86) than their female counterparts (65.10) this implies that there was no much difference in the mean retention scores of male and female students exposed to mathematics mobile instructional package (Text only). The result of testing research hypothesis eight on ANCOVA Table 6 proved that there was no significant difference between the mean retention scores of male and female participants in the experimental group (Text only). Therefore, hypothesis eight was not rejected. Hence, there was no significant difference in the mean retention scores of male and female students taught mathematics using mathematics mobile instructional package (Text only) The retention effect of mathematics mobile instructional package (Text only) on the retention scores of both male and female students could be explained from the point of view that package (TO) is very effective and gender friendly. This is in support of Oludipe (2012) who investigated gender difference in Nigerian junior secondary students' academic achievement in basic science and revealed that there was no significant difference in academic achievement of male and female students at the pretest, post-test a delayed post test levels respectively**.** Also it is in

agreement with Gambari, Falode and Adegbenro (2014) who suggested that students taught geometry using computer animation performed significantly better in posttest and retention test than their counterparts taught geometry using instructional model and conventional method respectively.

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