IMPACT OF MOODLE-BASED CO AND SELF-REGULATED LEARNING STRATEGIES ON THE ACHIEVEMENT OF BASIC TECHNOLOGY STUDENTS IN MINNA, NIGERIA

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Abstract

Student's performances in basic technology over the years have been declining. The reasons for this have been attributed to lack of basic teaching and learning equipment and inefficient instructional media. The use of technology in education has been adjudged as a veritable tool in returning the lost glory. This study assesses the use of MOODLE- based Co and Self-regulated learning strategies on the achievement and retention of basic science and technology (BST) among secondary school's students in Minna Metropolis. Three secondary schools were purposively selected for the study, the quasi-experimental design which include a pretest, Posttest, non-randomized, non-equivalent and control groups was used for the study. 123 students were used from intact class were used for the study which consisted of 52 male and 71 female. The Basic Science and Technology Achievement Test (BSTAT) was used for pretest, post-test and retention test. The results of the study revealed that there is no significant difference in the achievement of students' in Co and self-regulated learning. Also, the study revealed that male and female BST students taught using CRL benefited from the treatment irrespective of their gender. The study therefore recommends that MOODLE individualize learning strategy should be used for classroom instruction in the day – to- day teaching of BST and BST students should be exposed to the use of individualized learning strategies in order to improve their achievement.

Keywords: MOODLE platform, Co-and-Self regulated learning, Achievement, Basic Technology.

Introduction

The world is developing scientifically and technologically in every sphere of human endeavour therefore; Nigeria should thrive to join this technological train. Despite all the efforts made by the government to promote technology education in Nigeria, the problems of teaching and learning basic technology still persist. Odu (2013) identified factors responsible for this to include; lack of good and well equipped laboratories, well trained BST teachers, and non-compliance with the norms of the teaching of the subjects. Offorma and Obiefuna, (2016) stated that lack of finance to execute projects, shortage of manpower, lack of facilities and lack of policy itself contribute to poor performance in Basic Technology in secondary schools. Basic science and technology which was previously known as introductory technology and which was later change to basic technology is a core subject offered at the basic level in Nigerian educational systems. Adeyemi and Adeyegbe (1993) stated that even though a number of introductory technology curriculum reforms were inquiry-based and problem – solving in style, research findings have continued to show that teaching and learning in basic technology remain problematic. Although the government took a giant step by establishing Scientific Equipment Development Institutes, such institutes have been underfunded. Also, inadequate or poorly prepared BST teachers and their non-scientific approach to BST teaching are among militating factors against basic technology development in Nigerian schools. To improve teaching and learning amidst all these problems, there is, therefore, the need to change the current approach to learning through the use of emerging technologies such as web-based learning, mobile learning, podcasting, and MOODLE platform.

The Modular Object-Oriented Dynamic Learning Environment (MOODLE) is a free and open-source software which allows a developer to make modification based on their needs. It is a type of learning management system written in Hypertext Preprocessor (PHP). It is a widely used open-source general-purpose scripting language that is suited for web development and can be embedded in Hypertext Mark-up Language (HTML) and distributed under the General Public License (Goyal & Tambe, 2015). It affords the instructor the opportunity to present the lessons in a concise form and gives the learners the opportunity to understand what was being presented without ambiguities. MOODLE is used for blended learning, distance education, flipped classroom and other e-learning projects in Schools, workplaces and other sectors. With customizable management features, it is used to create private websites with online courses for educators and trainers to achieve learning goals (Naddabi, 2007). In this context, MOODLEs effectiveness would be tested as an independent variable in a different collaborative setting.

Collaborative learning involves groups of students grouped in two or more and teachers engaging in an educational setting. A study conducted by Lee and Yang (2014) showed that there was no significant difference in the achievement of students in Co and Self- regulated learning strategies. The collaborative learning strategies such as think pair share, demonstration methods, jig-saw methods project-based learning co and self- regulated learning when properly harnessed might improve the teaching and learning of BST. For effective use of MOODLE Technology, Mohd- Kosnin, (2007) suggested the use of self-regulated learning strategies.

In Self-regulated learning (SRL) the learners set goals for their learning and then monitor, regulate, and control their cognition, motivation, and behaviour as well as the contextual features of the learning environment. The self- regulated learning strategies perform excellently well when it is Co-regulated (Volet, *et. al.,* 2009). Due to the fact that two or more students and teachers engaging in aspects of planning, monitoring, evaluating and reflecting on the learners' cognition, motivation, behaviour, and context as they work towards investigating a problem.

Yidizli and Saban (2016) examined the effect of self-regulated learning on sixth-grade Turkish students' achievements and motivational beliefs. The study revealed a significant difference in favor of the experimental group with regard to achievements and motivational beliefs while the interviews and document analysis further revealed that students started to have fun with learning, build more self-confidence, set specific targets for themselves, and monitor their learning process. Zimmerman (2004) revealed that self-regulated learners performed better than Co-regulated learners. Rosario (2013), and Malberg, (2015) also revealed that self-regulated learners performed better than the control group. Lee and Bonk (2019), reported that students learning ability increased rapidly in a self regulated classroom than in conventional pre-service teacher education classes and that the team achievement was enhance through the students' individual readiness to work. Zeng and Goh (2018), Investigated self-regulated learning approach to extensive listening and its impact on listening achievement and metacognitive awareness. The findings revealed substantial differences in the two groups' metacognitive engagement in three SRL phases; they also argued that the achievements of the respective learners in listening development were affected by these differences. Pedagogical implications of a self-regulated learning approach in extensive listening for L2 listening development Wehrli (2013), found that CRL facilitates the exchange of ideas and awareness of mutual concerns which might invariably have effect on their achievement. Gambari, et. al., (2013), thereafter linked the achievement of students to their

attitude which further enhances their retention level. Uchechi (2013) submitted that the level of retention of the students is linked with the teaching methods, therefore the need for MOODLE technology.

Considering gender, Babajide (2010) opined that science subjects are given masculine outlook by education practitioners while Longe and Adedeji (2003) were of the opinion that science and technology are male-dominated subjects and that female tends to shy away from scientific and technological fields. Boys, therefore appear to have a naturally positive attitude toward technical and science subjects and technology while girls show a negative attitude. Al-Ani (2013) and Oludipe (2012) revealed that there is no significant difference in the achievement of male and female students in Co-regulated learning Strategies

This study, therefore, focuses on examining the impact of MOODLE Based Co- and Self-Regulated Learning Strategies on Secondary School Students' Achievement and Retention in Basic Science and Technology in Minna Metropolis, Nigeria.

Research Questions
Answers were sought to the following research questions

(i) What are the impact of Moodle-based Co, Self-regulated and individualized learning strategies on students' achievement in Basic technology?

(ii) What is the difference in the mean achievement scores of male and female students taught Basic Technology using Moodle-based Co-regulated learning strategy?

(iii) What is the difference in the mean achievement scores of male and female students taught Basic Technology using Moodle-based Self-regulated learning strategy?

(iv) What is the difference in the mean achievement scores of male and female students taught Basic Technology using Moodle-based Individualized learning strategy?

Research Hypotheses
H_{o1}: There is no significant difference in the mean achievement scores of students taught BST using Moodle-based Co, Self-regulated and individualized learning strategies.

H_{o2}: There is no significant difference in the mean achievement scores of male and female students taught Basic Technology using Moodle-based Co-regulated learning strategy.

H_{o3}: There is no significant difference in the mean achievement scores of male and female students taught Basic Technology using Moodle-based Self-regulated learning strategy.

H_{o4}: There is no significant difference in the mean achievement scores of male and female students taught Basic Technology using Moodle-based Individualized learning strategy.

Methodology
The study adopted a quasi-experimental design; that is a pretest, Posttest, non-randomized, non-equivalent and control groups. Hence, a 3x2 factorial design was employed to allow for the study of the interaction between the treatment variables and the moderating variables. The treatment variables had three levels of independent variable (two experimental and a control), while the moderating variables had two levels of gender (male and female). The dependent variable (cognitive learning outcomes) had the achievement and retention scores.

A total of 123 students out of 2931private JSS II secondary school students in Minna

Metropolis were used for this study (Planning, Research and Statistics(PRS), Niger State Ministry of Education. Three schools were purposively selected based on the availability of ICT equipment. The criteria used for the selection of schools are availability of computer laboratory facilities and manpower; school type (private schools), gender composition (co-educational schools), and Candidates' enrolment (enrolling students for JSSCE Basic Technology for a minimum of five years). The schools are Galaxy schools (co-regulated learning strategy) experimental Group I which consists of 43 students (15 male and 28 female); Mypa Schools (self-regulated learning) which consists of 44 Students (16 male and 28 female) experimental group II and Ideal Royal School (individualize learning) which is the control group consists of 36 students (21 male and 15 female. The simple random sampling technique was used to assign the three selected schools into groups for the study.

The research instrument used was Basic Technology Achievement Test (BTAT) which was be used for pretest and post-test and retention test. The treatment material that was employed was the MOODLE platform used in a Co, self-regulated learning and individualized learning strategies. The test instrument (BTAT) consist of two sections namely A and B. Section A contains Biodata and Section B consist of fifty multiple choice Questions with four options (A-D). The instrument was validated by three experts in Metalwork (because the content is on metal work), three Basic Technology senior teachers in Minna and a test and measurement expert in Metalwork from NECO. To determine the reliability of the BTAT, a pilot test was conducted on thirty JSS II Students who were randomly selected from Fema Secondary School who were part of the research population, but not part of the selected schools for the real study and a reliability coefficient of 0.79 was obtained using Pearson Product Moment Correlation (PPMC). Hence the instrument was considered valid and reliable.

Students in all the groups (experimental and control) were given pretest before the treatment using the BSTAT. The post test was administered to the students in all the groups after four weeks treatment and retention was given after three weeks. Mean and standard deviation was used in analyzing the research questions whie ANCOVA was used to analyze the null hypotheses. Where there was significant difference, Sidak-post hoc was used to spot the direction of the difference. The significant difference was ascertained at 0.05 alpha level.

Results

Research Question One: What are the impact of Moodle-based Co, Self-regulated and individualized learning strategies on students' achievement in Basic technology?

In answering research question one, mean scores of the male and female students in the three groups were analysed using mean and standard deviation as shown on Table 1.

Table 1: Mean and Standard Deviation of pretest and posttest Scores of Students Taught Basic Technology Using (CRL, SRL and IND)

Group	N	Pretest Mean	SD	Posttest Mean	SD	Mean gain
CR	43	24.30	8.68	61.95	8.68	37.65
SR	44	18.14	6.65	60.48	9.02	42.34
IND	36	20.89	5.11	63.64	9.17	42.75

The results in Table 1, implied that all the groups benefited from the treatment as shown in the Mean and Standard Deviation of pretest, posttest and retention test scores of students Taught Basic Technology Using CRL, SRL, and IND. From the result, it can be deduced that mean and SD score of the pretest and posttest scores of CRL are X =24.30, SD=8.68, X=61.95, SD =8.68, with the mean gain of 37.65. Similarly, the mean and SD scores of the pretest and posttest of SRL are X=18.14, SD= 6.65, X=60.48, SD= 9.02 with the mean gain of 42.34. Finally, the mean and SD scores of the pretest and posttest of IND are X=20.89, SD=5.11, X=63.64, SD= 9.17, with the mean gain of 42.75 respectively. From the Table, the Individualized group has the highest mean gain of 42.75 than other groups. The graphical representation of the student performances is illustrated in Figure 1.
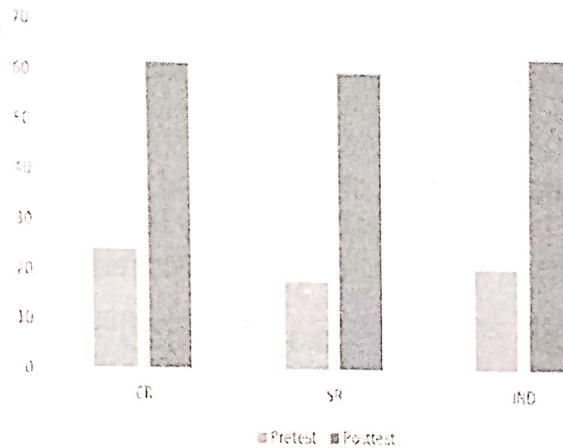
Figure 1: Performance of Basic Technology Students taught using MCR, MSR and IND.

Hypothesis One: There is no significant difference in the mean achievement scores of students taught Basic technology using Moodle-based Co, Self-regulated and individualized learning strategies.

In testing hypothesis one, the achievement scores of students exposed to flipped classroom in RPT, TPS and those taught with traditional flipped classroom were analysed using ANCOVA as shown on Table 2.

Table 2: ANCOVA Result of Students Achievement Scores in MCR, MSR, and IND Settings

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	2123.555[a]	3	707.852	10.971	.000
Intercept	30279.037	1	30279.037	469.312	.000
Pre	1925.557	1	1925.557	29.845	.000
Treatment	248.613	2	124.307	1.927	.150 [ns]
Error	7677.632	119	64.518		
Total	481374.000	123			
Corrected Total	9801.187	122			

ns: Not Significant at $p < 0.05$

Table 2 shows the ANCOVA result of the achievement scores of the group taught using the Moodle-based Co, Self-regulated and Individualized settings. From the Table, the F (2,119) = 1.927, p > 0.05. This indicates that there is no significant difference among the achievement scores of the students in MCR, MSR, and IND. Hence, hypotheses one is not rejected. This implies that the groups benefited from Moodle platform irrespective of learning strategies employed.
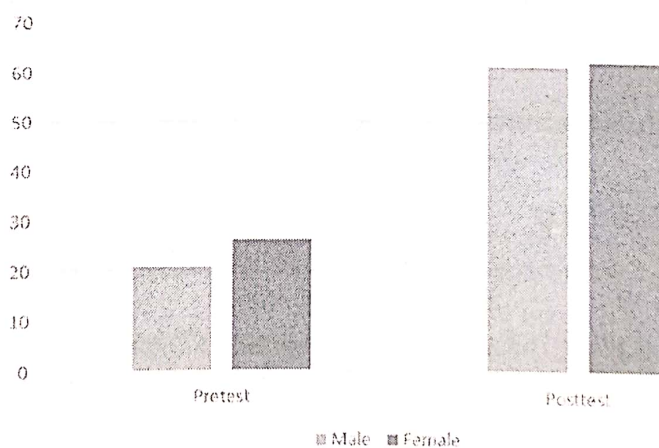
Research Question Two: What is the difference between the mean achievement scores of male and female students taught Basic Technology using Moodle-based Co-regulated learning strategy?

In answering research question two, the mean scores of male and female students in the Moodle-based Co-regulated (MCR) group were analysed using mean and standard deviation as shown on Table 3.

Table 3: Mean and Standard Deviation of pretest and posttest Scores of male and Female Students Taught Basic Technology Using MCR

Gender	N	Pretest	SD	Posttest	SD	Mean Gain
Male	15	20.80	8.31	61.33	8.84	40.53
Female	28	26.18	8.42	62.29	8.74	36.12

Table 3 revealed the Mean and Standard Deviation of pretest and post test scores of male and female students taught Basic Technology using CRL. From the Table, it was observed that the Mean and SD of the pretest and posttest scores of male students are X=20.80, SD=8.31, X=61.33, SD= 8.84 with mean gain of 40.53. Similarly, the Mean and SD of the pretest and posttest scores of female students are X=26.18, SD=8.42, X= 62.29, SD= 8.74 with mean gain of 36.12 respectively. Male students in Moodle-based Co-regulated learning has higher Mean Gain than their female counterparts. This implied that male and female taught Basic Technology using CRL benefited from the treatment irrespective of their gender. The graphical representation of the student performances is illustrated in Figure 2

■ Male ■ Female

Figure 2: Performance of Basic Technology Male and Female students taught using MCR

Hypothesis Two

There is no significant difference in the mean achievement scores of male and female students taught Basic Technology using Moodle-based Co-regulated learning strategy.

In testing hypothesis two, the mean achievement scores of male and female students taught Basic Technology using Moodle-based Co-regulated (MCR) were analysed using ANCOVA as shown in Table 4.

Table 4: ANCOVA Results of the Mean Achievement Scores of Male and Female Students taught Using MCR

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	1217.560[a]	2	608.780	12.511	.000
Intercept	10006.426	1	10006.426	205.645	.000
PRE	1208.701	1	1208.701	24.840	.000
GENDER	56.962	1	56.962	1.171	.286[ns]
Error	1946.347	40	48.659		
Total	168208.000	43			
Corrected Total	3163.907	42			

ns: Significant at $p < 0.05$

Table 4 shows the ANCOVA results of the mean achievement scores of male and female students taught Basic Technology using Moodle-based Co-regulated instructional strategy. From the table, there is no significant difference in the mean achievement scores of the male and female students at 0.05 level of significance, $F(1,40) = 1.171$, $p > 0.05$. The results of the analysis indicate that this hypothesis two should not be rejected on the basis that the univariate effect of gender was not statistically significant on the posttest mean score of male and female students taught Basic Technology using Moodle-based Co-regulated instructional strategy. On this basis, hypothesis two is therefore not rejected. This implies that male and female students performed equally well when Moodle-based Co-regulated strategy was used.
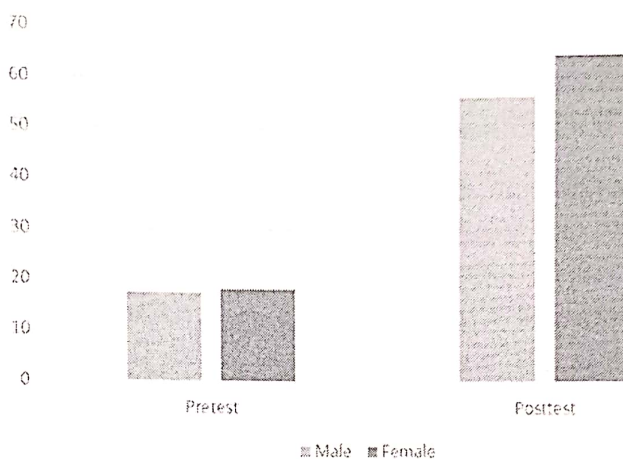
Research Question Three: What is the difference in the mean achievement scores of male and female students taught Basic Technology using Moodle-based Self-regulated learning strategy?

In answering research question two, the mean scores of male and female students in the Moodle-based Self-regulated (MSR) group were analysed using mean and standard deviation as shown on Table 5.

Table 5: Mean and Standard Deviation of pretest and posttest Scores of male and Female Students Taught Basic Technology Using MSR

Gender	N	Pretest	SD	Posttest	SD	Mean Gain
Male	15	17.65	7.15	55.59	5.47	37.94
Female	28	18.44	6.43	63.56	9.52	45.11

Table 5 revealed the Mean and Standard Deviation of pretest and posttest scores of male and female students taught Basic Technology using MSR. From the result, it can be deduced that Mean and SD of the pretest and posttest scores of male are X=17.65, SD=7.15, X=55.59, SD= 5.47, with mean gain of 37.94. Similarly, the Mean and SD of the pretest and posttest scores of female students are X=18.44, SD=6.43, X= 63.56, SD= 9.52, with Mean Gain of 45.11 respectively. Female students have the higher mean gain than their male counterparts in MSR group. This implies that male and female students taught Basic Technology using SRL benefited from the treatment irrespective of their gender. The graphical representation of male and female students' performances in MSR is illustrated in Figure 3.

Figure 3: Performances of Male and Female Students taught Basic Technology Students taught using MSR

Hypothesis Three

There is no significant difference in the mean achievement scores of male and female students taught Basic Technology using Moodle-based Co-regulated learning strategy.

In testing hypothesis three, the mean achievement scores of male and female students taught Basic Technology using Moodle-based Self-regulated (MSR) strategy were analysed using ANCOVA as shown in Table 6.

Table 6: ANCOVA Results of the Mean Achievement Scores of Male and Female Students taught Basic Technology using MSR

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	831.982[a]	2	415.991	6.405	.004
Intercept	14966.974	1	14966.974	230.434	.000
Pretest	169.789	1	169.789	2.614	.114
Gender	620.911	1	620.911	9.560	.004*
Error	2662.996	41	64.951		
Total	164425.000	44			
Corrected Total	3494.977	43			

*: Significant at $p < 0.05$

Table 6 shows the ANCOVA results of the mean achievement scores of male and female students taught Basic Technology using Moodle-based Self-regulated strategy. From the table, there is a significant difference between the mean achievement scores of the male and female students at 0.05 level of significance $F_{(1,41)} = 9560$, $p < 0.05$. The results of the analysis indicate that this hypothesis should be rejected on the basis that the univariate effect of gender was not statistically significant on the posttest mean score of male and female students taught Basic Technology using Moodle-based Self-regulated strategy. On this basis, hypothesis three is therefore rejected. This implies that female students performed better than their male counterparts.
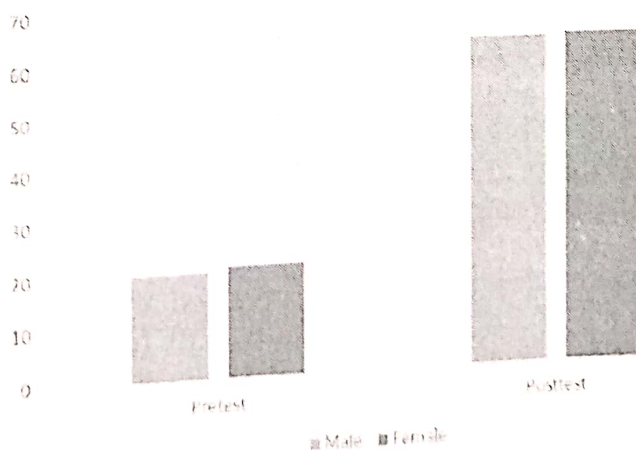
Research Question Four: What is the difference in the mean achievement scores of male and female students taught Basic Technology using Moodle-based Individualized learning strategy?

In answering research question four, mean scores of the male and female students in the Individualized setting (MIS) group were analysed using mean and standard deviation as shown on Table 7.

Table 7: Pretest and Posttest Mean Scores and Standard Deviation of Male and Female Students Taught Moodle-based Individualized Setting (MIS)

Group	N	Pretest		Posttest		Mean Gain
		Mean	SD	Mean	SD	
Male	15	20.27	4.39	63.40	8.91	43.13
Female	21	21.33	5.63	63.81	9.57	42.48

Table 7 revealed the Mean and Standard Deviation of pretest and posttest scores of male and female students taught Basic Technology using MIS. From the result, it can be deduced that Mean and SD of the pretest and posttest scores of male are X=20.27, SD=4.39, X=63.40, SD= 8.91, with mean gain of 43.13. Similarly, the Mean and SD of the pretest and posttest scores of female students are X=21.33, SD=5.63, X= 63.81, SD= 9.57, with Mean Gain of 42.48 respectively. Male students have the higher mean gain than their female counterparts in MSR group. This implies that female and male students taught Basic Technology using Moodle-based Individualized setting benefited from the treatment irrespective of their gender. The graphical representation of male and female students' performances in MIS is illustrated in Figure 4.

Figure 4: Performance of Male and Female Students taught Basic Technology Using Moodle-based Individualized Setting

Hypothesis Four: There is no significant difference in the mean achievement scores of male and female students taught Basic Technology using Moodle-based Co-regulated learning strategy.

In testing hypothesis four, the mean achievement scores of male and female students taught Basic Technology using Moodle-based Individualized Setting (MIS) groups were analysed using ANCOVA as shown in Table 8.

Table 8: ANCOVA Results of the Mean Achievement Scores of Male and Female Students taught Basic Technology using MIS

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	780.125[a]	2	390.062	5.948	.006
Intercept	3879.145	1	3879.145	59.150	.000
Pretest	778.657	1	778.657	11.873	.002
Gender	2.907	1	2.907	.044	.835[ns]
Error	2164.181	33	65.581		
Total	148741.000	36			
Corrected Total	2944.306	35			

ns: Not Significant at $p < 0.05$

Table 8 shows the ANCOVA results of the mean achievement scores of male and female students taught Basic Technology using Moodle-based Individualized Setting. From the table, there is no significant difference in the mean achievement scores of the male and female students at 0.05 level of significance, $F(1,33) = .044$, $p > 0.05$. The results of the analysis indicate that this hypothesis two should not be rejected on the basis that the univariate effect of gender was not statistically significant on the posttest mean score of male and female students taught Basic Technology using Moodle-based Co-regulated instructional strategy. On this basis, hypothesis two is therefore not rejected. This implies that male and female students performed equally well when Moodle-based Individualized setting was used.

Discussion

The findings that emanated from this study revealed that there is no significant difference in the achievement of student's Co, Self-regulated learning and Individualized setting. This corroborated the findings of Lee and Yang (2014) who reported that there is no statistical significance between the achievement of Co and Self-regulated learners. This is contrary to the study of Zimmerman (2003) and Zheng et al (2018) which reported that self-regulated Learners performed better than Co-regulated learners.

Another finding that emanated from this study revealed that there was no significant difference in the achievement of students exposed to co- regulated irrespective of their gender. This implies that both the male and female students achieved at the same rate. This corroborate the findings of Oludipe, (2012) and Al-Ani, (2013) which stated that there was no significance difference in the achievement of students exposed to collaborative learning strategy based on gender. This implies that male and female students paid attention while using MOODLE co-regulated learning strategy.

Conclusion

Based on the findings of this study, it can be concluded that the use of different Strategies of MOODLE platform for classroom is effective for teaching and learning and welcomed by the Basic Technology Students. The study revealed that Co-regulated learning self-regulated learning and individualized learning strategies achieved at the same rate. Also the study has shown that individualized learning strategies retained better than their counterparts, however the strategies and Platform does not have a long term effect on student memory.

Also, the study revealed that male and female Basic Technology students taught using MCR and MIS benefited from the treatment irrespective of their gender. However, female students performed better than their male counterparts when taught Basic Technology using Moodle-based Self-regulated learning strategy. This indicates that the Basic Technology contents taught using MCR and MIS were well achieved by the students irrespective of their gender.

Recommendations

The study therefore recommends that MOODLE-based Co, Self-regulated and individualized learning settings should be used to for classroom instruction in the day – to- day teaching of Basic Technology. The students should be encouraged to use the Moodle platform repeatedly to eliminate the problem of poor achievement among Junior Secondary School students. Also, Collaborative learning strategies should be used for teaching and learning of Basic Technology since it brings about improvement in learning for both male and female students, since the Strategy is gender friendly.

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