

Effect of Mastery Learning Strategy on Male And Female Students' Academic Achievement In Basic Technology In Edo State, Nigeria

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Abstract: Unsatisfactory gender differences in science based subjects and the need to enhance their academic achievement prompted this study. It focused on the effect of mastery learning strategy on academic achievement of Male and Female students' in Basic Technology (BTE). The study has five purposes, five research questions guided the study and four null hypotheses formulated were tested at 0.05 level of significance. Quasi-Experimental design was adopted. The population was 3,170 (1,675 male & 1,495 female) JSS II students. A sample size of 78 (43 male, 35 female) JSS11 students from two selected schools participated in this study. Simple random sampling technique was used to select which of the schools will be experimental or control group. A 50-item multiple choice Basic Technology Achievement Test (BTEAT) was used. The instrument was face and content validated before administration. Test – retest method was used to establish the reliability of the instrument. Pearson product moment correlation coefficient was used to correlate the two results and a reliability index of 0.85 was obtained. Both the experimental and control groups received pre-test and posttest. Data collected were analyzed with descriptive and inferential statistics (mean, mean difference, t-test and Analysis of Covariance (ANCOVA). It was found out that female students taught BTE with MLS performed relatively higher in their post-test academic achievement than the male students. Furthermore, there was a not significant interaction effect between gender and instructional strategy (MLS), on students' academic achievement in BTE. However, the findings revealed that both male and female taught with MLS performed significantly higher in their posttest academic achievement in BTE than those taught with Direct Instruction Strategy (DIS). Based on the findings, it was concluded that MLS is an effective instructional strategy that significantly enhances gender academic achievement in BTE. Therefore, the use of MLS is recommended, for curbing gender disparity in academic achievement in science based subjects.

Date of Submission: 26-05-2018

Date of acceptance: 09-06-2018

I. BACKGROUND TO THE STUDY

Technology is a practical application of scientific knowledge in transforming natural resources to solve human problems. It involves all human activities engaged in to enhance his environment for standard living. Technology development is based on individual ability to visualize and create things, put them into pictures and designs. It involves all productive activities, improvisation and the processes human beings use to change the world and adapt to the dynamic nature of technology itself. According to Okwor, (2011) technology simply means processes and products that make life easy and stress free for mankind.

Basic technology is an integrated subject designed to prepare and encourage pupils to develop positive attitude towards work and productivity to better the environment (Onoele, 2014). The subject is offered at the Junior Secondary School Level. It is designed to provide basic technological literacy for everyday living and as well stimulates creativity amongst learners. It is designed to ensure that the students are properly taught the basic skills in science and technology that will enable them learn effectively within the global community (Mankilikl, & Dawal, 2015). Furthermore, basic technology is an aspect of technology which is geared towards helping to develop students' interest in learning science and technology in the secondary school and beyond, thereby producing scientists and technologist for the nation (Okwor, 2011).

Gender, as a concept, has captured the interest of science and technology educators in Nigeria. Students' gender has been subject of discussion in the domain of educational research. Some findings report that males do better in competitive learning while female do better in cooperative learning settings leading to single-sex schooling advocacies due to perceived male domination and potential and by extension affirming gender differences effect on students' achievement in science subjects (Ogunkola & Garner-O'Neale, 2013). Studies on

gender differences and students' achievement, revealed gender disparity in science in favour of males' students, others reported females' superiority and others zero disparity (Udo & Udofia, 2006; Udo, 2011). Thus, a study on gender differences in academic achievement in science based subjects like in basic technology is very relevance and need to be examined. Students' gender and instructional strategy among many other factors are strong determining factors for high academic achievement. This makes it imperative to seek for appropriate instructional strategies that could help all or a large number of students to learn excellently well in basic technology. Many innovative learning strategies this day has proved helpful, among which is mastery learning strategy.

Mastery Learning Strategy (MLS) is an instructional strategy, in which students are allowed unlimited opportunities to demonstrate mastery of unit content taught. Mastery learning strategy involves breaking down learning content into units, each with its own objectives (Udo & Udofia, 2014). MLS is an effective method of instruction which enhances student learning, achievement, attitude, and expectations. It divides subject into units that have predetermined objectives or unit expectations. Students, alone or in groups, work through each unit in an organized fashion (Lamidi, Oyelekan & Olorundare, 2015). MLS is a very simplistic way of teaching and learning in the sense that the instructors assume all students can learn the same material and individually can reach success and that the only difference among students is the amount of time needed to learn the material (Mitee & Obaitan, 2015).

According to Mankilikl and Dawal (2015), MLS is an effective teaching and learning strategy designed to advance an individual's potential for learning, both boys and girls are expected to master the learning objectives in a unit before proceeding to the next unit. Additional time for learning is prescribed for those requiring remediation and students continue the cycle of studying and testing until mastery is achieved after which they can proceed to more advanced learning tasks (Adeyemo & Babajide, 2014). Achufusi and Mgbemena (2012), experiment on effect of using mastery learning approach on academic achievement of senior secondary school II physics students and found that the female students achieved slightly higher than their male counterparts but the difference was not significant at $P=0.05$. Also, a non-significant different of gender on academic achievement in science based subjects was reported by (Abubakar & Oguguo, 2011).

II. STATEMENT OF THE PROBLEM

Gender differences in academic achievements in Basic Technology (BTE) have been a challenge to educators and government for years. This may be attributed to students' gender differences in their learning styles and use of inappropriate instructional strategies, amongst other factors. These factors are militating against the objectives for which BTE was introduced into JSS curriculum. Use of appropriate instructional strategy is a vital tool to students' comprehension and assimilation of lesson taught. Also a proper understanding of subject content could assist in improving students' academic achievement (Olorundare, 2014). On this platform, this study was conceived to ascertain whether the use of MLS in teaching male and female BTE students would yield appreciable result in their academic achievement. Nations are noting appreciable improvements in the academic achievement of male and female students in science based subjects with the use of MLS. The question therefore is; would the use of mastery learning strategy enhance male and female students' academic achievement in BTE?

Purpose of the Study: The purpose of this study was to determine the effect of mastery learning strategy on academic achievement of male and female students in Basic Technology in Edo State. Specifically, the study determined;

1. The pre-test and post-test academic achievement mean scores of male and female students taught Basic Technology (BTE) using Direct Instruction Strategy (DIS) and those taught using Mastery Learning Strategy (MLS)
2. The difference in the post-test academic achievement mean score of male students taught BTE using DIS and those taught with MLS.
3. The difference in the post-test academic achievement mean scores of female students taught BTE with MLS and those taught with DIS.
4. The difference in the post-test academic achievement mean scores of male and female students taught BTE with MLS.
5. The interaction effect of students' gender and instructional strategy (MLS) on academic achievement in BTE.

III. SIGNIFICANCE OF THE STUDY

Findings of this study would benefit Basic Technology teachers, students, and government and future researchers.

This study when published would be used to guide teachers on the need for using appropriate instructional strategies in teaching BTE. When teachers use MLS in teaching it would make their job easier and interesting with the use of immediate feedback and formative assessments.

When the findings of this study are put to practice in schools, it would be of benefit to students in developing their interest on self learning, unity, and creative habits. When formative and corrective feedback is practice, students' would have a detailed prescription of what more is needed to master learning objectives.

The findings of this study when implemented would benefit government in that allowing individual to participate actively in teaching and learning process would positively influence their attitude towards technology and learning generally. Finally, findings of this study would also encourage future researchers by providing relevant literature for related studies.

Scope of the Study

This study was delimited to the effect of mastery learning strategy on academic achievement of male and female students in Basic Technology in Edo State. The study also determined the interaction effects of gender and instructional strategy (MLS) on students' academic achievement in BTE.

Research Questions

The following research questions guided the study:

1. What are the pre-test and post-test academic achievement mean scores of Male and female students taught Basic Technology (BTE) with Direct Instruction Strategy (DIS)?
2. What are the pre-test and post-test academic achievement mean scores of Male and female students taught Basic Technology (BTE) with Mastery Learning Strategy (MLS)?
3. What are the differences between post-test academic achievements mean scores of male students taught BTE with DIS and those taught with MLS?
4. What is the difference between the post-test academic achievement mean scores of female students taught BTE with MLS and those taught with DIS?
5. What is the difference between the post-test academic achievement mean scores of male and female students taught BTE with MLS?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance

1. There is no significant difference between the post-test academic achievement mean scores of Male students taught BTE with Direct Instruction Strategy and those taught with MLS
2. There is no significant difference between the post-test academic achievement mean scores of female students taught BTE with MLS and those taught with DIS.
3. There is no significant difference between the post-test academic achievement mean scores of male and female students taught Basic Technology (BTE) with MLS.
4. Students' gender and instructional strategy (MLS) do not have significant interaction effects on academic achievement in BTE

IV. METHODS

Research Design

This research study adopted Quasi-Experimental design.

Area of the Study

Edo Central was used for this study. Edo Central is made up of 5 local government areas, namely; Esan Central, Esan North East, Esan South East, Esan West and Igueben.

Population for the Study

The population for the study was 3,170 (1,675 males & 1,495 females) JSS II students from 25 public junior secondary schools offering Basic Technology in their curriculum in Edo Central in the 2015/2016 academic session.

Sample and Sampling Techniques

Sample size for the study was 78 (43 males & 35 females) JSS11 students from two mixed schools. A simple random technique was used to select which schools will be experimental or control groups. Since school authority would not allow reconstitution of classes for experiment, intact classes were used. In order not to disrupt normal school programme during the experiment the respective class teachers were used.

Instrument for Data Collection

Instrument for data collection was a 50-item Basic Technology Achievement Test (BTEAT). The instrument was a multiple choice objective test and the items covered selected topics and components of the subject. The Basic Technology Achievement Test (BTEAT) was used for both the pre-test and post-test except that the items were reshuffled before it was administered as post- test.

Validation of the Instrument

The instrument used for this study was subjected to face and content validation. It was given along side with the research topic, purpose, research questions and hypotheses to four experts in technology education who were requested to carefully scrutinize the items in order to establish its validity.

Reliability of the Instrument

Test–retest method was used to establish the reliability of the instrument whereby it was administered to the same level of students (trial group of an intact class of 40 students) in another local government area in Edo State. Pearson product moment correlation coefficient was used to correlate the two results and a reliability co-efficient index of 0.85 was obtained. This high correlation index indicates that the instrument was reliable for the study. In accordance with Uzoagulu (2011), 0.7 or above is an acceptable reliability value.

V. PRESENTATION AND ANALYSIS OF DATA

Data collected based on the research questions and hypotheses formulated are hereby presented.

Research Question 1

What are the pre-test and post-test academic achievement mean scores of male and female students taught Basic Technology (BTE) with Direct Instruction Strategy (DIS)?

The data related to this research question are presented in Table 1

Table 1: Pre-Test and Post-Test Academic Achievement Mean Scores of male and Female Students taught Basic Technology with Direct Instruction Strategy (DIS)

| Gender/Instr. strategy | N | Pre-Test | Post-Test |
|------------------------|----|------------|------------|
| | | Mean score | Mean score |
| Male (DIS) | 23 | 50.71 | 52.73 |
| Female (DIS) | 17 | 48.23 | 50.13 |

Data in Table1 showed that the pre-test and post test academic achievement mean scores of the male students in control group were 50.71 and 52.73 respectively. For the female students academic achievement mean scores were 48.23 and 50.13 respectively. Results showed that post test academic achievement mean scores were higher than the pre-test academic achievement mean scores.

Research Questions 2

What are the pre-test and post-test academic achievement mean scores of male and female students taught Basic Technology (BTE) with Mastery Learning Strategy (MLS)?

Table 2: Pre-Test and Post-Test Academic Achievement Mean Scores of male and Female Students taught Basic Technology with Mastery Learning Strategy (MLS)

| Gender/Instr. strategy | N | Pre-Test | Post-Test |
|------------------------|----|------------|-------------|
| | | Mean score | Mean scores |
| Male (MLS) | 20 | 48.79 | 64.81 |
| Female (MLS) | 18 | 54 | 67.49 |

Data in Table 2 showed that the pre-test and post test academic achievement mean scores of the male students in experimental (MLS) group were 48.79 and 64.81 respectively. For the female students academic achievement mean scores were 54 and 67.49 respectively. Results showed that post test academic achievement mean scores were higher than the pre-test academic achievement mean scores.

Research Questions 3

What are the differences between post-test academic achievements mean scores of male students taught BTE with DIS and those taught with MLS?

Table 3: Mean difference between the Post-test Academic Achievements Mean Scores of Male Students Taught BTE with DIS and those taught with MLS

| Group/Sex | Post-test score | Mean | SD | Mean score Diff. |
|------------------|-----------------|------|------|------------------|
| Expt. male(MLS) | 64.81 | | 9.82 | 12.08 |
| Contr. male(DIS) | 52.73 | | 8.66 | |

Table 3 shows the post-test score for male students taught BTE using DIS to be 52.73 while those taught with MLS was 64.81. The mean difference of 12.08 indicates that male students taught with MLS performed higher in their post-test than those taught with DIS.

Research Questions 4

What is the mean difference between the post-test academic achievement mean scores of female students taught BTE with MLS and those taught with DIS?

Table 4: Mean difference between the Post-test Academic Achievements Mean Scores of Female Students Taught BTE with MLS and those taught with DIS

| Group/Sex | Post-test score | Mean | SD | Mean score Diff. |
|-------------------|-----------------|------|-------|------------------|
| Expt.Female(MLS) | 67.49 | | 10.03 | 17.36 |
| Contr.Female(DIS) | 50.13 | | 8.25 | |

Results in Table 4 revealed that female students taught BTE with MLS performed higher than those taught with DIS in their posted mean scores. The difference in their academic achievement mean scores was 17.36, it suggests higher efficacy of MLS in enhancing gender academic achievement in Basic Technology.

Research Questions 5

What is the mean difference between the post-test academic achievement mean scores of male and female students taught BTE with MLS?

Table 5: Mean difference between the Post-test Academic Achievements Mean Scores of Male and Female Students Taught BTE with MLS

| Gender/ Instruct. Strategy | Post-test Mean score | SD | Mean score Diff. |
|----------------------------|----------------------|-------|------------------|
| Female(MLS) | 67.49 | 10.03 | 2.68 |
| Male(MLS) | 64.81 | 9.82 | |

Data in Table 5 revealed that both the male and female students taught BTE with mastery learning strategy performed higher in their post-test academic achievement mean scores. The female performed relatively higher than the male student with a mean score difference of 2.68. This further indicates the effectiveness of mastery learning strategy in enhancing students' academic achievements

Statistical Results of Test of Null Hypotheses

This section presents the analysis of results of the three null hypotheses formulated for the study. Analysis of covariance (ANCOVA) and t-test statistic were used for analyzing data relating to the four hypotheses and were tested at 0.05 at level of significance.

HO₁

There is no significant difference between the post-test academic achievement mean scores of Male students taught Basic Technology (BTE) with Direct Instruction Strategy and those taught with MLS.

t-test was used to analyzed the above hypothesis, and the results is presented in

Table6: Test of significant difference between the Post-test Academic Achievements Mean Scores of Male Students Taught BTE with DIS (t-test)

| groups | Sex | Post-test Scores | | | T _{cal.} value | Decision |
|-------------------|------|------------------|------|------------|-------------------------|-------------|
| | | Mean | SD | Difference | | |
| Experimental(MLS) | Male | 64.81 | 9.82 | 12.08 | 8.64 | significant |

| | | | | | | |
|--------------|------|-------|------|--|--|--|
| Control(DIS) | Male | 52.73 | 8.66 | | | |
|--------------|------|-------|------|--|--|--|

Critical t value at 5% = 1.96

Results in Table 6 showed that male students taught BTE with mastery learning strategy performed significantly higher in their post test assessment than those taught with DIS at 0.05 level of significance, t-test result ($t_{cal} = 8.64$; $df = 2$; $P > 0.05$) was significant. Therefore, the null hypothesis was rejected. It thus implies that MLS as a teaching strategy have a significant effect on male students' academic achievement in basic technology.

HO₂

There is no significant difference between the post-test academic achievements mean scores of Female students taught BTE with DIS and those taught with MLS.

t-test was used to analyzed the above hypothesis, and the results is presented in

Table7: Test of significant difference between the Post-test Academic Achievements Mean Scores of Female Students Taught BTE with DIS (t-test)

| groups | Sex | Post-test Scores | | | T _{cal.} value | Decision |
|-------------------|--------|------------------|-------|------------|-------------------------|-------------|
| | | Mean | SD | Difference | | |
| Experimental(MLS) | Female | 67.49 | 10.03 | 17.36 | 11.52 | significant |
| Control(DIS) | Female | 50.13 | 8.25 | | | |

Critical t value at 5% = 1.96

Results in Table 7 revealed that female students taught BTE with mastery learning strategy performed significantly higher in their post test academic achievement than those taught with DIS at 0.05 level of significance, t-test result ($t_{cal} = 11.52$; $df = 2$; $P > 0.05$) was significant. Therefore, the null hypothesis which state was rejected. It thus implies that MLS as a teaching strategy have a significant effect on male students' academic achievement in basic technology.

HO₃

There is no significant difference between the post-test academic achievement mean scores of male and female students taught Basic Technology (BTE) with MLS.

t-test was used to analyzed the above hypothesis, and the results is presented in Table 6

Table 8: Statistical Test of difference between the Post-test Academic Achievements Mean Scores of Male and Female Students Taught BTE Using MLS (t-test)

| Experimental groups | Sex | Post-test Scores | | | T _{cal.} value | Decision |
|---------------------|--------|------------------|-------|------------|-------------------------|-----------------|
| | | Mean | SD | Difference | | |
| MLS | Female | 67.49 | 10.63 | 2.68 | 1.64 | Not Significant |
| | Male | 64.81 | 9.82 | | | |

***Critical t value at 5% = 1.96**

Data in Table 8 indicates that the female students performed better in their BTE assessment than their male counterpart. However, at the 5% level of significance, the t-test result ($t = 1.64$; $df = 2$; $P > 0.050$) is not significant. This means the difference in the BTE post-test academic achievement scores of both the male and female students was not significant, implying that MLS, as a teaching strategy, does not have a significant effect on students' gender academic achievement in basic technology.

HO₄

Gender and Instructional Strategy (MLS) do not have Significant Interaction Effects on Students' Academic Achievement Mean Scores in Basic Technology

ANCOVA was used to analyze the above hypothesis, and the results are presented in Table 7.

Table 9: Summary of Gender and Instructional Strategy (MLS) Interaction on Students' Academic Achievement Scores in BTE (ANCOVA)

Dependent Variable: Post-Test

| Source | Type III Squares | Sum of Squares | df | Mean Square | F | Prob. level | Decision |
|---|------------------|----------------|----|-------------|---------|-------------|-----------------|
| Instructional strategy | 7754.585 | | 1 | 7754.585 | 173.922 | .000 | Significant |
| Gender* Instructional strategy | 80.949 | | 1 | 80.949 | 1.816 | .180 | Not significant |
| a. R Squared = .719 (Adjusted R Squared = .711) | | | | | | | |

The ANCOVA results on the interaction effect between the students' gender and instructional strategy (MLS) revealed a non-significant interaction effect ($F = 1.816$; $df = 1$; $P > 0.05$). This implies that instructional strategy (MLS) does not have significant interaction effect on male and female post-test academic achievement in BTE. Hence, the null hypothesis was not rejected.

VI. DISCUSSION OF RESULTS

The discussions of the results are based on the research questions that guided the study and null hypotheses formulated and tested at 0.05 level of significance.

Gender, Mastery Learning Strategy and Students Academic Achievement in Basic Technology

Analysis of results in revealed that the females' students performed relatively higher than the males students in their post-test achievement in BTE with a mean score difference of 2.68 using MLS. Results in Table 6 and 7 showed that male and female students taught BTE with mastery learning strategy performed significantly higher in their post test assessment than those taught with DIS at 0.05 level of significance, t-test result ($t_{cal} = 8.64$; $df = 2$; $P > 0.05$) for male students and ($t_{cal} = 11.52$; $df = 2$; $P > 0.05$) for female students were significant. Therefore, the null hypotheses were rejected. It thus implies that MLS as a teaching strategy have a significant effect on both male and female students' academic achievement in basic technology over direction instruction strategy. ANCOVA results on instructional strategy at 0.05 level of significance ($F = 173.92$; $df = 1$; $P < 0.05$) revealed that MLS has a significant effect on both male and female students academic achievement in BTE. However, interaction effect between the students' gender and instructional strategy (MLS) revealed a not significant effect with ($F = 1.816$; $df = 1$; $P > 0.05$). Therefore, the null hypothesis that gender and instructional strategy do not have significant interaction effects on academic achievement in Basic Technology was accepted. This implies that instructional strategy (MLS) has no significant effect on gender academic achievement and that both the male and female students performed equally well when taught using MLS. These results agreed with the findings of Nwoke, Uzoma, Akukwe, (2014); Achufusi and Mgbemena (2012), who reported that in certain instances, female students performed relatively higher in academic achievement than their male counterpart with the used of MLS. Similarly, a not significance result has been reported by Lamidi, Oyelekan and Olorundare (2015), who noted that gender, had no significant effect on the achievement of the students, taught using the Mastery Learning Strategy. However, the findings of this study disagreed with that of Udo and Udofia (2014), who found that gender, had a significant influence on students' performance with the males performing better than their female counterparts and Ogunkola and Garner-O'Neale,(2013) findings that males do better in competitive learning while female do better in cooperative learning settings. Furthermore, this study also agreed with Achufusi and Mgbemena (2012), who found out that the experimental group achieved significantly higher than the control group. Also that the female students achieved slightly higher than their male counterparts and that the difference was not significant at $P=0.05$.

VII. CONCLUSION

Based on the findings of this study, the following conclusions were reached;

There was a significant difference in the post-test academic achievement of BTE male and female students taught using MLS over those taught using direct instruction strategy (DIS). There was no significant difference between the post-test academic achievement mean scores of male and female students taught Basic Technology (BTE) with MLS. Students' gender and instructional strategy (MLS) have no significant interaction effects on academic achievement in Basic Technology (BTE)

Implications of the study

Mastery learning is based on the belief that all students are potential academic achievers when given the opportunity that suite their learning style. It therefore, implies that time and instructional variation to some extent would help all students learn well and improve in their academic achievement. The implication of this is that if teachers would incorporate Mastery Learning Strategy in teaching and learning process, it would in turn improve students' motivation and interest to learn Basic Technology. Furthermore, careful implementation of these major elements of mastery learning would assist educators in helping children manage their learning difficulties and learn excellently well. The study revealed that the use of MLS improved students' academic achievements in Basic Technology irrespective of gender. It would minimize the gender disparities experienced in students' performance in science and technology based subjects in secondary schools. Nevertheless, it should be noted that mastery learning strategy will not solve all the complex challenges facing educators in meeting learners needs, but would allows educators at all levels to make great improvement in their efforts.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations are suggested:

1. Education authorities in Nigeria should encourage Basic Technology teachers to vary instructional

strategy in their teaching process.

2. Teachers' education institutions should make MLS part of their teacher training curriculum content.
3. There should be deliberate plans by both government and school administrators to develop secondary school teachers' capacity to utilize MLS as a teaching strategy.

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IOSR Journal Of Humanities And Social Science (IOSR-JHSS) is UGC approved Journal with Sl. No. 5070, Journal no. 49323.

Dr. Iserameiya.' Effect of Mastery Learning Strategy on Male And Female Students' Academic Achievement In Basic Technology In Edo State, Nigeria." IOSR Journal Of Humanities And Social Science (IOSR-JHSS). vol. 23 no. 06, 2018, pp. 74-81.