International Journal of Advanced Scientific Research
ISSN: 2456-0421
Impact Factor: RJIF 5.32
www.allscientificjournal.com
Volume 3; Issue 5; September 2018; Page No. 87-91

Effects of gender and mastery learning strategy on senior secondary school science students' academic achievement in Nasarawa state

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Abstract
This study investigated the effect of gender on academic achievement in Science using Mastery Learning Strategy and Conventional Method on Senior Secondary School Students in Nasarawa West Senatorial Zone of Nasarawa State, Nigeria. The quasi-experimental non-randomized pre-test, post-test control group design was used. The study also employed random sampling technique to select 200 (120 male and 80 female) senior secondary school two (SS III) students offering Science from four intact classes. A 53-item Science Achievement Test (SAT) constructed by the researchers and validated by experts in Science education was used to obtain data. After pilot testing the instrument using 80 students from three intact classes, the data obtained were analyzed using Pearson Product Moment Correlation Coefficient statistic where a reliability index of 0.78 was obtained. Data collected were analyzed using descriptive statistics of mean, independent t-test and Analysis of Covariance (ANCOVA). The study revealed that students exposed to learning Science through Mastery Learning Strategy performed better.

Keywords: academic achievement, conventional method, gender, mastery learning strategy, science

Introduction

In Nigeria, education has been emphasized both as a basic right and as a major enabling factor for the developmental processes. The launching of the Universal Basic Education (UBE) in 2016 and the Education for All (EFA, 2014) have emphasized the importance of education for all, irrespective of gender. It is still common even among the educated ones that women education should end in their husbands' homes where they bear children.

Researches in achievement test have shown that boys and girls in the early ages perform equally in all subjects including English Language, but as they grow older, girls become more interested in Language Arts, while boys sway towards Sciences and Social Sciences, (Nnamani and Oyibe (2016) [14]. This has resulted in a situation where there are more boys than girls offering Social Sciences. Despite this, gender and students' academic achievement have remained controversial and inconclusive. From the going, it is easy to assert that no evidence is clear as to whether differences exist between males and females in academic achievement. In another effort, Nnamani and Oyibe (2016) [14] pointed out that generalization on specific intellectual abilities or specific subject areas are porous and susceptible to considerable problems.

Numerous causes have been attributed for students' success or failure in schools. These causes include the role of the students, teachers, parents, school environment, society and government. Notable works on students' achievement in schools include students' study habits, school environment, parent's economic status, continuous assessment and educational funding by Najimi, Sharifirad, Amini and Meftagh (2013) [13]; Umar and Samuel (2018) [17]. Gender has considerable effect on students' academic performances especially in science subjects. It is the biological, mental and behavioural identities differentiating between female and male individuals. The importance of examining performance in relation to gender is therefore, based primarily on the socio-cultural differences.

Some careers have been designated as men's domain such as engineering, medicine, technology and agriculture, while others as women's domain such as catering, typing and nursing. It is common for parents to assign tasks like car washing, grass cutting, climbing ladders to fix or remove things to their male children. On the other hand, chores like dishes washing, cooking, cleaning and baby caring are assigned to female children (Filgona & Sababa, 2017) [6]. As a result of this stereotyping or socialisation the society has tended to see female children as weak. Invariably, in Nigerian children transfer these traits to school with their stereotypes. As a result, boys dominate Science classes while girls prevail in Languages and Arts. Umar (2018) [17] reported that in Nigeria as in many African societies, there is gender bias, a situation in which favours male children over female children. This is evidenced in political elective positions contestable by men and women. People always see women as not fit to govern or rule since men are involved. The idea that female should be under and submissive to men have created negative influences in the lives of women folk. Explaining further, Umar and Samuel (2018) [17] are of the view that the socio-cultural practices of Nigerians have placed men on the leading edge, which gives them superior influence over women. In a related study, Nnamani and Oyibe (2016) [14] argued that because of various human biological differences of creation, people assume that one sex may have a learning edge over the other sex. The fact that men are regarded as the dominant and

even superior sex does not mean that they are holistically better than women.

Gender differences in intellectual abilities can be as a result of gender role stereotyping. Gender differences in academic achievement cannot therefore, be assumed to be due to inherent biological differences between the genders alone, even if they exist. The theory of innate gender differences in ability that might be used to account for gender differences in academic achievement has weak evidence. According to Joseph, John, Eric, Yusuf and Oludunmi (2015) [12] and Amosun (2011) in many psychological areas, it is virtually impossible to separate completely the innate from the acquired. Gender therefore, is a strong predictor of human conduct and many differences have been documented on attitude and behaviour that affect academic achievement in between male and female individuals, (Agbaje & Alake, 2014).

Academic achievement therefore, differs between boys and girls in basic subjects like Social Studies both in primary and secondary levels. Ezenwafor (2016) [4] explained that, the influence of gender and differences in academic achievement is a complex task, thus many studies appear to be contradictory. A tremendous amount of work has been done in an attempt to find out potential causes of differences between girls' and boys' academic achievement which has clearly demonstrated that male students are superior to their female counterparts in qualitative courses.

So many factors such as campaign for understanding and implementation of gender equality contribute to the findings of the aforementioned studies hence, giving way to the various implementation of gender equality from one place to another. For instance, the various research findings on gender equality have global touch regarding students' achievement in Science and they have been undertaken in many parts of the world though, some have found that there are no significant differences in male-female Science performance at any level, most have identified gender differences (Joseph, John, Eric, Yusuf, & Olubunmi, 2015) [12].

Science and Gender

Gender differences have been observed in terms of perceptions where girls have more negative attitudes than boys toward arithmetic, mathematics, and science, (Graham & Lauren, 2012) [10]. There is therefore, a very strong correlation between education and future participation in the labor market, and studies have shown higher incomes among sciences graduates than among humanities graduates. The gender disparity in higher education could be attributable to girls disliking Science subjects and performing worse than boys or perhaps there may be factors other than performance leading to the disparity. As the production of scientific knowledge has historically been the task of men, this scientific knowledge can in itself be seen as male domain at work in the organization of academic content in school subjects. George and Barnabas (2015) [9] have shown that while the internet is a new media platform, it has the effect of disseminating old gender stereotypes which, rely on the influence of family members, significant others and the media underlie the negative relationship of girls and Science subjects. Girls' passive attitudes towards Science subjects are also progressively formed by their day-to-day interactions with teachers and with other students. The obstacles in advancing to higher education in the sciences are much greater for girls than for boys.

Statement of the Problem

A study conducted by Umar and Samuel (2018) [17] has indicated that Science is gender sensitive. Inputs from girls during Science classes in secondary schools of were observed to be considerably lower. While boys are likely to ask more questions and engage the teacher during lesson delivery, girls will rather choose to remain quiet, even when they know. The enrolment of girls in senior secondary school Science classes was also observed to be at its low. The teaching methods adopted by the teachers could interact with gender to influence students' academic achievement (Samuel, 2017) [15]. Observations have indicated that most Science teachers rely primarily on the traditional method for imparting knowledge, while the manner of presentation is supposed to be activity based (Samuel, 2017) [15]. This does not give students the opportunity to contribute to the teaching learning process. Therefore, there is the need to adopt newer and innovative learner-friendly teaching approach that could bridge the achievement gaps between male and female students' in Science. Mastery Learning Strategy is one of such innovative learner-friendly teaching strategies that may enhance the achievement of both male and female students offering Science in secondary schools.

Purpose of the Study

This study sought to find out the effect of gender on Senior Secondary school students academic achievement in Science using Mastery Learning Strategy. The specific objective of the study was to: determine the effect of Gender on Science students' academic achievement taught using Mastery Learning Strategy

Research Question

The study was guided by the following question:

What is the academic achievement of male and female students taught Science using Mastery Learning Strategy and Conventional Method?

Hypotheses

The following hypothesis was formulated and tested at 0.05 alpha level:

H_{O1}: There is no significant difference between male and female students taught Science using Mastery Learning Strategy and Conventional Method.

Methods

The study adopted the quasi-experimental design of pre-test, post-test, control group design to verify the relative effectiveness of gender on academic achievement of students taught Science using Mastery Learning Strategy. This research design is used because secondary schools exist in intact classes. The pre- test, post-test suggest that measurements are taken before and after the introduction of the intervention. The pre-test helped in examining the differences between the experimental and the control groups' entry behaviour and to

establish a baseline for the effect of the treatment. The sample for this study consisted of 200 (120 Male and 80 Female) Senior Secondary School two (SS III) students offering Science in three intact classes from four selected public secondary schools Nasarawa West Senatorial Zone of Nasarawa State, Nigeria. Random sampling technique using the balloting technique was employed. The four selected schools were randomly assigned into the experimental and control groups. The schools were co-educational schools located in both urban and rural areas of Nasarawa West Senatorial Zone of Nasarawa State. Two schools comprised of 103 (67 male and 41 female) students formed the experimental group taught Science through Mastery Learning Strategy, while the other two schools with 97 (59 male and 38 female) students constituted the control group exposed to learning of concepts in Science through the Conventional Teaching Method.

Research Instrument

The instrument used for data collection was Science Achievement Test (SAT), which consisted of 35 structured multiple choice questions and 5 essay items drawn from West African Certificate Examination (WAEC) and National Examinational Council (NECO) past questions. The SAT was used as a pre-test to ascertain equivalent ability of students as well as a post-test after treatment to determine the effect of the intervention on academic achievement. The instrument was given to two experts in the Faculty of Education, Nasarawa State University, Keffi, Nigeria for face and content validation. To further strengthen the validity of the SAT, the items were trial-tested on 80 students offering Science from two intact classes. The test-re-test method was used to generate two sets of scores for the students. The data obtained were used to determine the reliability, difficulty and discrimination indices of the items. In order to determine the reliability of the instrument, the two sets of scores were subjected to correlation using the Pearson Product Moment Correlation Coefficient statistic. The reliability coefficient was found to be 0.78, which showed that the instrument was reliable and capable of measuring the intended objectives of the study with consistency.

Method of data collection

Five Research Assistants with a minimum of Nigeria Certificate of Education (NCE) were given one week's training on data collection under the supervision of the researchers. This was followed by the administration of the SAT as a pre-test to the students in the experimental and control groups to ascertain the equivalence in ability of the students in Science. In the second phase, the treatments were introduced to the experimental and control groups. Students in experimental group were taught using the Mastery Learning Strategy, while the control group were taught using the Conventional Lecture approach. The teaching was closely monitored and supervised by the researchers after which a reshuffled version of SAT was re-administered as post-test to both the experimental and control groups. The pre-test and post-test of students were scored over 100 to generate quantitative data for further statistical analysis.

Method of Data Analysis

The data collected were analyzed using descriptive statistics of mean, independent samples t-test and Analysis of Covariance (ANCOVA). Descriptive statistics of mean was used to answer the research question. The t-test was used to test hypothesis one because of its superior power to detect differences between two means (male and female students' post-test scores in the experimental group). Hypothesis two was tested using Analysis of Covariance (ANCOVA), where the post-test scores of the students were the dependent variables, treatment and gender were the independent variables while pre-test scores were the covariates. Significance level of 0.05 was used to test the null hypotheses.

Results

The results of the analysis of pre-test scores in the SAT for the experimental and the control groups taught Science were analyzed and the results presented in Table 1**.**

Table 1: u-test of pre-test results of students in the mastery Learning Strategy (MLS) and Conventional Methods (CM)

Variable	N	Mean	SD	U	Asym. sig (2-tail)
MLS	120	58.46	24.50	4838.00	.223
CM	80	65.86	24.74		
Total	200	62.16	24.62		

Not significant, $p > 0.05$

Table 1 shows that the difference in students' pre-test scores in Science at the start of the study is not significant ($U = 4838.00$, $p = 0.223$). This implies that students in the experimental and control groups had equivalent entry behaviour before treatment.

Research Question

What is the academic achievement of Male and Female students taught Science using Mastery Learning Strategy and Conventional Method? Descriptive statistics of students' mean achievement scores taught Science using Mastery Learning Strategy and Conventional Method by gender was used to answer this question as in Table 2.

Table 2: Students' Academic Achievement in MLS and CM by Gender

Source	Gender	N	Mean	SD
MLS	Male	54	27.95	1.63
	Female	40	36.75	1.23
CM	Male	57	21.76	1.06
	Female	43	19.07	1.59

The result shows that the female students in Mastery Learning Strategy group had the highest mean score in Science ($M = 36.75$) compared to their male counterparts ($M = 227.95$). On the other hand, male students' academic achievement ($M = 21.76$) in Conventional Method group was slightly higher than the academic achievement of their female counterparts ($M = 19.07$). The Table suggests that male and female students exposed to Science using Mastery Learning Strategy obtained higher academic achievement scores than their counterparts in the control group.

Hypothesis One

There is no significant difference between male and female students taught Science using Mastery Learning Strategy and Conventional Method.

This hypothesis was tested using ANCOVA. The post-test scores of the students were the dependent variables, treatment and gender, while the independent variables of pre-test scores were the covariates as shown in Table 3.

Table 3: Analysis of Covariance of the Male and Female Students' Achievement in Science Using SAT

Source of variation	Sum of squares	Df	Mean square	F	Sig.
Corrected Model	7853.742	2	62832.406	7.687	.001
Intercept	125664.810	1	125664.810	249.556	.000
Pre-test	1298.952	1	1298.952	2.429	.120
Gender	6643.342	1	6643.342	12.631	.000
Error	106110.221	197	518.534		
Total	532178.000	199			
Corrected total	108421.786	200			

Sig; $p < 0.05$

Table 3 shows a significant interaction effect of treatment and gender on students' achievement in Science ($F = 12.631$, $p = 0.000$). This implies that students' gender is sensitive to the treatments administered.

Discussion

Gender has been advanced as one of the predictor variables that may affect students' academic achievement. However, findings from substantial body of literatures regarding gender and students' achievement are conflicting and inconclusive. Mastery Learning Strategy approach is effective as it insists on attainment of mastery of unit objective before proceeding to the next topic. It increases student motivation by providing peer support. In this study, the pre-test scores of students in the experimental and control groups taught Science using Mastery Learning Strategy and Conventional Method were compared. The results showed that students in the two groups did not differ significantly in their pre-test scores at the onset of the treatment. This is an indication that the students have attained equivalence in their background knowledge of Science before the study.

Descriptive statistics of research question one shows that male and female students exposed to Science using Mastery Learning Strategy obtained higher academic achievement scores than their counterparts in the control group. This implies that Mastery Learning Strategy was effective in improving students' achievement in Science when compared with the Conventional Lecture Method. This finding tallies with that of Adeyemo and Babajide (2014) [1] and Amiruddin and Zainudin (2015) [2] who found Mastery Learning Strategy to be better in improving students' achievement than the conventional method. Testing hypothesis one reveals that female students exposed to learning Science through Mastery Learning Strategy performed better than their male counterparts in the same group. This finding is in agreement with that of Udo and Udofia (2014) [16] and Furo (2014) [8] which showed that girls perform better than boys in schools. The finding however, disagrees with that of Dania (2014) [3] who found that male students perform better than female students in Science. In respect to hypothesis two, a significant interaction effect of treatment and gender on students' academic achievement in Science was found. This implies that the treatments administered to the experimental and control groups using Mastery Learning Strategy and Conventional Teaching Method to teach Science was sensitive to the students' gender. Findings of this study have disproved the perception held that Science is a male dominated discipline. The reason that could be advanced for the better achievement of female students in the experimental group could lie on the instructional strategy adopted. Even though the girls were observed to interact more during lesson delivery, the use of this strategy gave them the freedom to relate with their peers in and outside the classroom, in an effort to unravel what appears difficult to them.

Conclusion

The findings of the study, among others, have shown that Mastery Learning Strategy, is a way of improving achievement in Science. The present conventional demonstration method employed by teachers should drastically be minimized. The Mastery Learning Strategy was shown to enhance students' achievement in Science, better than the conventional method. However, the strategy favoured female students in Science more than their male counterparts. Similarly, the treatments administered to the two groups did interact significantly with gender to influence students' academic achievement in Science. The implications of these findings are that teaching strategies adopted by Science teachers and students' gender are significant predictors of students' achievement. Consequently, Science teachers should always diversify their teaching strategy and that gender factor should not be overlooked in any teaching-learning situation.

Recommendations

The following recommendations were made based on the findings of the study:

1. Male and female students in Secondary Schools should be given the same level of encouragement irrespective of gender;
2. Mastery Learning Strategy should be used to enhance the teaching and learning of Science. This is because iot is innovative and have the potential to motivate learners towards learning Science;
3. Students should always be encouraged to work together in groups so as to enable them imbibe the culture of working together cooperatively in order to promote their understanding of Science;

4. School managers should organize seminars and workshops to equip teachers to enable them acquire more knowledge and skills of how to use cooperative learning strategies in the teaching and learning of Science.

References

1. Adeyemo SA, Babajide VFT. Effects of mastery learning approach on students' achievement in Physics. International Journal of Science & Engineering Research. 2014; 5(2):910-920.
2. Amiruddin MH, Zainudin L. The effects of a mastery learning strategy on knowledge acquisition among aboriginal students: An experimental approach. International Journal of Vocational Education and Training Research. 2015; 1(2):22-26.
3. Dania PO. Effect of gender on students' achievement in secondary school Social Studies. Journal of Education and Practice. 2014; 5(21):78-84
4. Ezenwafor JI, Obidile IJ. Effect of gender on students' academic performance and retention in Financial Accounting in technical colleges. European Journal of Education Studies. 2016; 2(4):43-54.
5. Federal Ministry of Education (FMoE,). Education for All: A collection of responsibilities. Abuja: NERDC Printers, 2014.
6. Filgona J, Sababa LK. Effect of gender on senior secondary school students' academic achievement in Geography in Ganye Education Zone, Nigeria. European Journal of Education Studies. 2017; 3(4):402-411.
7. Filgona J. Effects of hands-on learning strategies on students' achievement. Germany: Lambert Academic Publishers (LAP), 2016.
8. Furo PT. Effect of mastery learning approach on secondary school students' achievement in chemistry in Rivers State, Nigeria. Chemistry and Materials Research. 2014; 6(9):104-110.
9. George TO, Barnabas S. ICT and the gender question: Prospects and challenges for the knowledge economy in the 21st century. International Conference on African Development Issues: Social and economic Models for Development Track, 2015.
10. Graham SE, Lauren E. Mathematics achievement gaps between suburban students and their rural and urban peers increase over time, 2012. Retrieved from http://www.scholars.unh.edu.
11. Isa N. Gender disparities in academic performance and motivation in STEM Subjects in Japan, 2016. Retrieved from http:www.jil.go.jp.
12. Joseph A, John O, Eric I, Yusuf S, Olubunmi A. Effect of gender on students' academic performance in computer studies in secondary schools in New Bussa, Borgu Local Government on Niger State. Journal of Education and Practice. 2015; 6(33):1-7.
13. Najimi A, Sharifirad G, Amini MM, Meftagh D. Academic failure and students' viewpoint: The influence of individual, internal and external factors. Journal of Education and Health Promotion. 2013; 2(22). Retrieved from http: //www.ncbi.nlm.nih.gov.
14. Nnamani SC, Oyibe OA. Gender and academic achievement of secondary school students in social studies in Abakaliki urban of Ebonyi State. British Journal of Education. 2016; 4(8):72-83.
15. Samuel RI. Assessement of Basic Science teachers' pedagogical practices and students' achievement in Keffi Educational Zone, Nasarawa State, Nigeria. An Unpublished Masters Dissertation, Faculty of Education, Nasarawa State University, Nigeria, 2017.
16. Udo MF, Udofia TM. Effects of mastery learning strategy on students' achievement in symbols, formulae and equations in chemistry. Journal of Educational Research and Reviews. 2014; 2(3):28-35.
17. Umar US, Samuel RI. School location as a correlate of students achievement in basic science. International Journal of Innovative Education Research. 2018; 6(3):14-17.