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INTERACTION EFFECT OF TREATMENT AND GENDER ON THE MOTIVATION AND ACHIEVEMENT OF JUNIOR SECONDARY TWO STUDENTS IN BASIC SCIENCE AND TECHNOLOGY IN JOS-NORTH, PLATEAU STATE, NIGERIA

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ABSTRACT

*The study investigated the effect of treatment and gender on the motivation and achievement of junior secondary school two (JSS II) students in Basic Science and Technology in Jos-North, Plateau State, Nigeria. Two objectives, two research questions, and two hypotheses guided the study. The sample for the study was 72 students, drawn from two schools. One school had 32 students (representing the control group), and the second school had 40 students (used as the experimental group). The instruments for data collection were the Basic Science and Technology Motivation Questionnaire (BSTMQ) and Basic Science and Technology Achievement Test (BSTAT)**.** Mean and standard deviation were used to analyze data for answering the research questions. ANCOVA was used to test the hypotheses at 0.05 level of significance. Findings revealed that there was no significant effect of gender on motivation of students towards Basic Science and Technology after exposure to treatment, since the effect size was very small. There was significant main effect for groups, suggesting that the treatment significantly influenced students' motivation. Findings also indicated a significant difference in achievement mean scores between the experimental group and the control group. That is, students in the experimental group achieved significantly better in Basic Science and Technology than those in the control group. However, there was no significant effect of gender on the academic achievement of students in Basic Science and Technology after the treatment. The study recommended among others that although no significant gender differences were found in motivation and achievement, teachers should still consider the slight variation in motivation levels between male and female students, providing additional support where necessary, and educational interventions in Basic Science and Technology should be designed to be gender-neutral, ensuring equal opportunities for both male and female students:*

Key words: Achievement Effect Gender Motivation Treatment

INTRODUCTION

Videos offer a spectrum of content tailored for diverse learning needs, providing supplementary material and engaging visual aids that complement traditional educational methods. Videos serve as effective learning catalysts by providing context and visual representations of concepts (Karppinen, 2015), Nowadays the use of educational videos has become necessary as this provides real-life hands-on learning experiences. Educational video games, for instance, enhance the spatial cognition abilities of players while some games can be used to improve prosocial behaviour (Anderson & Warburton, 2019). It can also be used as a tool for pain management for kids (Craig & Wayne, 2019).

Video clip incorporates multimedia elements like graphics, simulations, and dynamic presentations, thereby enhancing engagement and comprehension. They ensure consistent content delivery, serving as valuable supplements to live sessions and reinforcing

fundamental concepts covered in class. Moreover, educators leverage the time saved through video clip to engage students in discussions, interactive activities, and personalized support, enriching the overall learning experience (Rahm & Reed, 2017). The impact of video clip in education extends beyond geographical boundaries, catering to diverse learning styles and preferences. However, maintaining the quality, accuracy, and relevance of these educational resources remains pivotal to their effectiveness and alignment with educational objectives and student needs (Abid, Mohd, & Rajiv, 2022).

Basic Science and Technology is a core subject in the National Curriculum at the lower and upper basic levels. The Basic Science and Technology curriculum is a broad field curriculum in which subject matter is integrated with the various science subject areas of Biology, Chemistry, Physics, Astronomy, Geology, Environmental Science, and Introductory Technology. All this is synthesized to provide a holistic and unified nature of science (FRN, 2014). Basic Science and Technology is taught at the primary and junior secondary schools so as to help children to develop reflective thinking and good habits which are needed for scientific method and successful future life (Agogo & Ode, 2011).

The use of video clips in teaching Basic Science and Technology motivates students. Motivation in education plays a pivotal role in shaping a learner's engagement and academic success. Motivation serves as a catalyst, driving students to focus on goals and fostering resilience, initiative, and curiosity (Yarborough & Fedesco, 2020). High motivation is associated with sustained attention and is vital for prolonged learning periods, showcasing the ability to navigate the learning journey autonomously. This force, inherent in human behaviour, is multifaceted, encompassing intrinsic and extrinsic motivations. Intrinsic motivations arise from personal satisfaction, while extrinsic motivations emanate from external stimuli like rewards or recognition (Lin, Chai, Jong, Dai, Guo, and Jian-jun, 2021). In education, motivation serves as a fundamental skill, driving learning even in complex subjects where heightened interest is pivotal (Matt, 2020). Matt held that within organisations, motivation acts as a linchpin, mobilising human resources, enhancing productivity, and fostering job satisfaction among employees.

Wide-spread use of digital learning environments has facilitated the integration of a diverse range of video materials into course and programme curriculum, although earlier forms of videos, such as film and television, have been commonly used to enhance and support learning for decades (Yousef, Chatti & Schroeder, 2014). In recent years the higher education sector has witnessed a surge in student access to videos, such expansion has been powered by the relative ease of video production (e.g., voice over PowerPoint) with accessible ready-to use tools, institutionally available recording studios, and streaming media platforms, such as YouTube (Mirriahi & Vigentini, 2017). Further, video is becoming the main method of content delivery in online education (Hansch, Hillers, McConachie, Newman, Schildhauer & Schmidt, 2015).

For Junior Secondary School Two (JSS2) students in Jos-North, Plateau State, it was observed that the achievement of students in BECE was unsatisfactory. Besides, teaching and learning Basic Science and Technology can be challenging due to the abstract nature of certain concepts and the need for visualizations and real-world example. (Hoffler, & Leutner, 2017). Therefore, the unsatisfactory achievement of the students could be attributed to poor motivation of the students, arising from the teacher-centred method of teaching employed by teachers. Consequently, the incorporation of video clips into the teaching of Basic Science and Technology holds great potential for transforming the way

students engage with and understand complex scientific concepts. Basic Science and Technology is a foundational subject that provides students with essential knowledge about the natural world, scientific principles, and critical thinking skills.

The term "gender" deals with the personal sexual identity of a people, notwithstanding their biological and outward sex (Ibitoye, 2018). The term also refers to socially ascribed attributes which distinguish males from females. (Mbonu & Okoli 2019). Studies reveal inconsistencies in academic achievement between male and female students. The study by Alamri (2018) discovered that female students achieved better than their male counterparts. On the other hand, the works of Nwachukwu (2014) and Amedu (2015) found that male students achieved better than female students. However, the study by Kingdom-Aaron, Etokeren and Okwelle (2019) revealed that there was no significant difference in achievement between male and female students. This shows that the discourse on the academic achievement of male and female students has not been finalized. The discourse is still ongoing, hence the need to consider the interaction effect of treatment and gender on the motivation and achievement of junior secondary school two students in Jos-North, Plateau State, Nigeria

OBJECTIVES OF THE STUDY

1. To determine the interaction effect of treatment and gender on the motivation mean score of JSS2 students.
2. To find out the interaction effect of treatment and gender on the achievement mean score of JSS2 students.

RESEARCH QUESTIONS

1. What is the interaction effect of treatment and gender on the motivation mean score of JSS2 students in Jos-North Local Government Area?
2. What is the interaction effect of treatment and gender on the achievement mean score of JSS2 students in Jos-North Local Government Area?

HYPOTHESES

1. There is no significant difference in the interaction effect of treatment and gender on the motivation mean score of JSS2 students in Jos-North Local Government Area.
2. There is no significant difference in the interaction effect of treatment and gender on the achievement mean score of JSS2 students in Jos-North Local Government Area.

METHODOLOGY

The study made use of quasi-experimental research design. Specifically, the non-randomized pre-test post-test non-equivalent control group design was used. The population of the study was 1,648 JSS2 Basic Science and Technology students, drawn from 22 public schools in Jos-North, Plateau State. The sample of the study was 72 students, drawn from two schools. The sample comprised 32 students from Government Secondary School Jos Jarawa (used as the control group) and 40 students from Government Secondary School Jishe (used as the experimental group). The instrument for data collection was the Basic Science and Technology Motivation Questionnaire (BSMQ)**,** which contained 30 items scored on a 4-point scale**.** The reliability coefficient of the instrument was found to be 0.78.

Mean and standard deviation were used to analyze data for answering the research questions. ANCOVA was used to test the hypotheses at 0.05 level of significance.

RESULTS

Research Question One

What is the interaction effect of treatment and gender on the motivation mean score of JSS2 students?

Research question five is answered using the presented Table 1.

Table 1

Mean and Standard Deviation of Interaction Effect of Treatment and Gender on Motivation Mean Score of JSS2 Students in Basic Science and Technology

GROUPS	GENDER	Mean	Std. Deviation	N
EXPGROUP	MALES	74.96	19.086	21
	FEMALES	73.69	19.521	19
	$\overline{x}$G	74.36	19.269	40
CONGROUP	BOYS	56.50	5.341	13
	GIRLS	52.90	7.376	19
	$\overline{x}$G	54.25	6.868	32
Total	MALES	66.10	16.913	34
	FEMALES	64.84	18.621	38
	Total	65.28	17.997	

Table 1 reveals the total mean scores and standard deviation of the interaction effect of treatment and gender on the motivation based on groups, in experimental group the grand motivation mean scores is 74.36 with a standard deviation of 19.26 and control group average motivation mean scores is 54.25 with a standard deviation of 6.89. It indicate that the motivation mean scores difference based on group is 3.61 which implies that there was a difference in the mean scores the Students in experimental group had higher motivation than the Students in control group toward Basic Science and Technology. While, the table reveals the total mean scores and standard deviation of the interaction effect of treatment and groups on the motivation based on gender, the total average motivation mean scores for boys is 66.10 with a standard deviation of 16.91 and the total average motivation mean scores for girls is 64.84 with a standard deviation of 18.62. It indicates that the motivation mean score difference based on gender is 1.26 which implies that there is no difference in the motivation mean scores based on gender toward Basic Science and Technology.

Research Question Two

What is the interaction effect of treatment and gender on the achievement mean score of JSS2 students in Basic Science and Technology?

Research question two is answered by the data in Table 2

Table 2
Mean and Standard Deviation of Interaction Effect of Treatment and Gender on Achievement Mean Score of JSS2 Students in Basic Science and Technology

GENDER	GROUPS	Mean	Std. Deviation	N
BOYS	EXPGROUP	59.85	18.163	21
	CONTGROUP	31.96	11.686	13
	$\overline{x}_G$	46.46	20.748	34
GIRLS	EXPGROUP	58.04	20.807	19
	CONTGROUP	32.38	8.813	19
	$\overline{x}_G$	47.12	21.024	38
Total	EXPGROUP	58.63	19.889	34
	CONTGROUP	32.22	9.899	38
	Total	4	20.859	
		6.89		

Table 2 reveals the total mean scores and standard deviation of the interaction effect of treatment and gender on the achievement based on groups, in experimental group the average achievement mean scores is 58.63 with a standard deviation of 19.88 and control group average achievement mean scores is 32.22 with a standard deviation of 9.89. It indicate that the achievement mean scores difference based on group is 24.41 which implies that there was a difference in the mean scores the students in experimental group had higher achievement mean scores than the students in control group in Basic Science and Technology. While, the table reveals the total mean scores and standard deviation of the interaction effect of treatment and groups on the achievement mean scores based on gender, the total average achievement mean for boys is 46.46 with a standard deviation of 20.74 and the total average achievement mean scores for girls is 47.12 with a standard deviation of 21.02. It indicates that the achievement mean score difference based on gender is 0.66 in favour of girls. This result shows that there is no significant difference in the achievement mean scores based on gender.

Hypothesis One
There is no significant difference in the interaction effect of treatment and gender on the motivation mean score of JSS2 students in Jos-North Local Government Area

Hypothesis five is answered using the data in Table 11.

Table 3: Two-Way Analysis of Interaction Effect of Treatment and Gender on Motivation in Basic Science and Technology

Source	Type II Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	14232.679[a]	3	4744.226	20.703	.000	.307
Intercept	613611.111	1	613611.111	2677.670	.000	.950
GROUP	14137.229	1	14137.229	61.692	.000	.306
GENDER	179.323	1	179.323	.783	.378	.006
GROUPGENDER	43.667	1	43.667	.191	.663	.001
Error	32082.210	140	229.159			
Total	659926.000	144				
Corrected Total	46314.889	143				

R Squared = .307 (Adjusted R Squared = .292)

In Table 3 two-way between -groups analysis of variance was conducted to explore the impact of groups and gender on level of motivation of boys and girls students in Basic Science and Technology after exposure to treatment. A two-way between-groups ANOVA was conducted to examine the effects of group and gender on the motivation levels of boys and girls in Basic Science and Technology after treatment exposure. The results indicate a significant main effect for groups, ($F(1,140) = 61.692$, $p < 0.05$ \), with a small effect size (Partial Eta Squared = .306). This suggests that the treatment significantly influenced student motivation. However, the main effect for gender was not significant, ($F(1,140) = .783$, $p > 0.05$ \), indicating no significant difference in motivation levels between boys and girls, with an extremely small effect size (Partial Eta Squared = .006). Additionally, the interaction effect between group and gender was not significant, \($F(1,140) = .919$, $p > 0.05$ \), implying that the treatment did not differentially impact boys and girls, as evidenced by an almost negligible effect size (Partial Eta Squared = .001). The adjusted R squared value of .292 suggests that 29.2% of the variation in motivation was explained by the group and gender interaction, while the remaining variation was due to other factors. This study concludes that while the treatment is effective in enhancing motivation on the whole, it does not have a differential impact based on gender.

Hypothesis Two: There is no significant difference in interaction effect of treatment and gender on the achievement mean score of JSS2 students in Jos-North Local Government Area.

The data in Table 4 were used to test this hypothesis.

Table 4: Two-Way Analysis of Interaction Effect of Treatment and Gender on Mean Achievement

Source	Type II Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	24852.578[a]	3	8284.193	31.041	.000	.399
Intercept	316593.778	1	316593.778	1186.264	.000	.894
GENDER	19.977	1	19.977	.075	.785	.001
GROUP	24798.422	1	24798.422	92.919	.000	.399
GENDER * GROUP	40.067	1	40.067	.150	.699	.001
Error	37363.644	140	266.883			
Total	378810.000	144				
Corrected Total	62216.222	143				

R Squared = .399 (Adjusted R Squared = .289)

A two-way between -groups analysis of variance is conducted to explore the impact of groups and gender on academic achievement of boys and girls in Basic Science and Technology after exposure to treatment. Table 4 shows that the main effect for gender F (1,140) =.075, p >0.05, since the p-value of .785 is greater than 0.05 level of significance, the null hypothesis was accepted, indicating that there is no significant effect of gender on the academic achievement of students towards Basic Science and Technology after exposure to treatment, the effect size was small (Partial Eta Squared =.001). The main effect for groups F(1,140) = 92.919, p <0.05, since the p-value of .000 is less than 0.05 level of significance, the null hypothesis is rejected, indicating that there was a significant effect of groups on academic achievement of students towards Basic Science and Technology after exposure to treatment, the effect size was small (Partial Eta Squared =.399).

The interaction effect F(1,140) =.150, p >0.05, since the p-value of .699 is greater than 0.05 level of significance, the null hypothesis was accepted, indicating that there was no significant effect of gender and group interaction on academic achievement of JSS2 students in Basic Science and Technology after exposure to treatment, the effect size was very small (Partial Eta Squared =.001). The table further reveals an adjusted R squared value of .292 which means that 29.2% of the variation in the dependent variable which is motivation to Basic Science and Technology is explained by interaction of group and gender, while the remaining is due to other factors not included in this study.

DISCUSSION

The result in Table 1 revealed that there was no significant effect of gender and group interaction on motivation of students towards Basic Science and Technology after exposure to treatment, the effect size was very small (Partial Eta Squared =.001). The result agrees with Ejiogu and Madumelu (2019) who investigated the impact of motivation on junior secondary students' academic performance in Basic Technology, specifically focusing on the interaction with gender in North Central Nigeria. The research design utilized a mixed-method approach, combining quantitative surveys and qualitative interviews. The findings revealed a statistically significant positive relationship between motivation and academic performance in Basic Technology, with gender interacting as a moderating variable.

Hypothesis one tested indicated a significant main effect for groups, suggesting that the treatment significantly influenced student motivation. However, the main effect for

gender was not significant, indicating no significant difference in motivation levels between boys and girls. Additionally, the interaction effect between group and gender was not significant, implying that the treatment did not differentially impact boys and girls. This study concludes that while the treatment was effective in enhancing motivation overall, it did not have a differential impact based on gender. This finding is consistent with the works of Kingdom-Aaron, Etokeren and Okwelle (2019). However, the finding is in contrast to the work of Alamri (2018) discovered that female students were liable to be more motivated to achieve than their male counterparts. It is also in contrast to the works of Nwachukwu (2014) and Amedu (2015) which found that male students were more motivated to achieve than female students.

The results from Table 2 indicate a significant difference in achievement mean scores between the experimental group and the control group. Specifically, the experimental group had an average achievement mean score of 58.63 with a standard deviation of 19.88, while the control group had an average achievement mean score of 32.22 with a standard deviation of 9.89. This difference of 24.41 points implies that students in the experimental group performed significantly better than those in the control group in Basic Science and Technology. These findings are consistent with prior research that emphasizes the positive impact of specific treatments or interventions on academic achievement. Adeyemo (2011) found that instructional strategies tailored to students' needs can significantly enhance their academic performance. Similarly, Yusuf and Afolabi (2010) demonstrated that the use of multimedia instruction improved students' understanding and retention in science subjects.

Null hypothesis two tested indicated that the null hypothesis was accepted, indicating that there was no significant effect of gender on the academic achievement of students in Basic Science and Technology after exposure to treatment, leading to upholding the null hypothesis. In respect of groups, the effect size was small, leading to rejecting the null hypothesis, indicating that there was a significant effect of groups on academic achievement of students in Basic Science and Technology after exposure to treatment.

CONCLUSION AND RECOMMENDATIONS

Based on the findings, the study concluded as follows: There was no significant effect of gender on motivation of students towards Basic Science and Technology after exposure to treatment, since the effect size was very small. There was significant main effect for groups, suggesting that the treatment significantly influenced student motivation There was a significant difference in achievement mean scores between the experimental group and the control group. That is, students in the experimental group achieved significantly better in Basic Science and Technology than those in the control group. However, there was no significant effect of gender on the academic achievement of students in Basic Science and Technology after the treatment. Based on these findings, the following recommendations are made:

1. Educators should adopt video clips as a teaching tool for Basic Science and Technology to improve students' motivation and academic achievement.
2. Although no significant gender differences were found in motivation and achievement, teachers should still consider the slight variation in motivation levels between male and female students, providing additional support where necessary.
3. Educational interventions in Basic Science and Technology should be designed to be gender-neutral, ensuring equal opportunities for both male and female students.

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