

**EFFECT OF GROUP-BASED TEACHING STRATEGY ON THE ACADEMIC
ACHIEVEMENT OF SCIENCE BASED SUBJECTS IN SECONDARY SCHOOLS IN
KHANA LOCAL GOVERNMENT AREA OF RIVERS STATE**

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ABSTRACT

The study examined the effect of the group-based learning strategy on students' performance in Basic Science using a quasi-experimental, randomized control group design in public secondary schools in Khana LGA, Rivers State. The sample comprised 113 JSS II students from two intact classes in two selected schools. The experimental group was taught using the group-based learning method, while the control group received conventional lecture instruction. Data were collected using the validated Basic Science Achievement Test (BSAT), which demonstrated a reliability coefficient of 0.71. Two research questions and corresponding hypotheses guided the study. Descriptive statistics (mean and standard deviation) were used to answer the research questions, and ANCOVA tested the hypotheses at a 0.05 significance level. The results indicated that students taught with the lecture method slightly outperformed those in the group-based learning group, and no significant gender differences were observed. The study concluded that group-based learning was not more effective than traditional lectures in enhancing Basic Science achievement, recommending targeted teacher training for effective implementation.

KEYWORDS: Group-based, Academic achievement, Teaching Strategy, Secondary School.

INTRODUCTION

Science education at the secondary school level is meant to educate learners who are knowledgeable, skilled, and capable of contributing meaningfully to national progress. The fundamental purpose is not only to foster scientific literacy but also to prepare young people with the critical thinking, problem-solving ability, and technological capabilities required for a modern workforce. Numerous studies stress that strong science education systems drive technical advancement, innovation, and economic growth, which in turn boost a nation's overall development (Hess, 2014; Aikenhead, 2020; Han & Yoon, 2023). However, despite rising investments in education, teaching resources, infrastructure, and teacher development, many countries—including Nigeria—continue to have static or deteriorating outcomes in science courses. Researchers suggest that this continuing loss affects national objectives for scientific and

technological competitiveness (Ford & Robinson, 2016; Okebukola, 2021). Recognising the importance of education to national goals, government agencies, policymakers, curriculum planners, and educational stakeholders have shown growing interest in improving teaching methods, learning environments, assessment practices, and teaching resources in recent years (Brown et al., 2021; Onwu & Aina, 2022). This increasing attention is tied to the larger commitment articulated in the Nigerian National Policy on Education, which promotes learner-centered instruction, self-development, and the nurturing of independent and self-directed learners. As part of implementing this goal, the education system increasingly emphasises techniques that enhance student participation, inquiry, creativity, and collaboration. Nevertheless, research continually demonstrates that many schools still rely significantly on traditional, teacher-centered pedagogies, which hinder students' ability to investigate scientific ideas effectively (Ford & Robinson, 2016; Udo & Ekpo, 2022). Even though self-directed and activity-based learning has been encouraged for decades, expository and lecture-based instruction remain prominent in many science classes. The roots of this problem are not new. Since the 1960s, educational scholars and curriculum makers have underlined the relevance of inquiry-based instruction, hands-on learning, and problem-solving approaches for boosting students' knowledge of scientific concepts (Yazici, 2016; Bybee, 2018). Yet, poor performance in Basic Science continues to be observed across junior secondary schools. Numerous studies conducted in Nigeria and worldwide have continuously revealed that students' low academic achievement is significantly linked to the teaching methods adopted by Basic Science teachers (Yazici, 2016; Eze & Osuji, 2021; Nworgu & Otum, 2023). Traditional approaches typically fail to satisfy the different needs, interests, and learning styles of students, pushing researchers to explore alternative models such as collaborative learning, cooperative learning, and group-based teaching tactics. Achieving the objectives of Basic Science demands an educational paradigm that encourages deeper engagement and meaningful learning results. Effective learning goes beyond the transfer of information; it entails influencing learners' attitudes, behaviours, abilities, and values that enable them function in a continually changing society. Group-based learning appears as a potential technique because it allows students to participate actively, discuss scientific concepts, work together to solve issues, and promote each other's learning (Yazici, 2016; Johnson et al., 2017). In this paradigm, teaching begins with carefully organised instruction that attracts students' attention, following which learners engage in group tasks that increase learning and retention. Students that require extra guidance receive focused re-teaching, frequently through diverse instructional modalities such as hands-on activities, peer explanations, or collaborative work. These students are later reviewed to determine mastery. Such a system demands that teachers operate not only as transmitters of information but as facilitators who understand the Basic Science curriculum deeply and can structure content in meaningful ways. Effective feedback systems are also critical in recognising instructional problems and strengthening teaching practice (Streiner, 2014; Darling-Hammond et al., 2020). Research demonstrates that students with less past knowledge in a subject tend to get higher results when taught through group-based learning compared to traditional lecture-based techniques (Johnson et al., 2017; Slavin, 2020). These findings agree with the recurring claims of low performance in Basic Science in internal and external examinations across secondary schools in Rivers State, including Khana Local Government Area. Because Basic Science creates core competencies for further

study in science and technology, bad instruction in this subject affects both individual career routes and national development goals.

Given this relevance, the teacher becomes a prominent role in affecting learning outcomes. Historically, instructors have been regarded the primary source of knowledge in the classroom, and students' achievement is greatly influenced by how well teachers teach (Joseph, 2019; Darling-Hammond et al., 2021). Teachers therefore need to embrace tactics that improve engagement, stimulate active involvement, and make learning relevant. Group-based learning gives such options. It is a student-centered educational style where learners engage in small groups to explore concepts, evaluate material, solve issues, and develop knowledge together. This strategy has proven popular globally since it coincides with recent educational trends and facilitates deeper learning. Group-based learning takes numerous forms, including collaborative problem-solving, group discussions, peer teaching, case studies, and joint projects. It turns the classroom from a teacher-centered atmosphere to a student-centered one, encouraging learners to clarify misconceptions, explain ideas to peers, and challenge one another's thinking. Research by Johnson et al. (2014, 2017) reveals that cooperative learning—a basic component of group-based learning—consistently leads to improved academic performance compared to individual learning. High-achieving students strengthen their understanding by explaining topics to others, whereas lower-achieving students gain from peer assistance. Beyond cognitive improvements, group-based learning promotes communication, leadership, teamwork, and interpersonal skills, all of which are vital in the 21st-century job (Forbes & Nolan, 2018; Avdiu, 2019).

In contemporary education, students are expected to cultivate the 4Cs—critical thinking, communication, creativity, and collaboration—which are crucial for navigating a knowledge-driven world. Group learning fosters these competencies by fostering engagement, co-construction of knowledge, and collaborative inquiry into real-world situations. These qualities are especially crucial in Basic Science since scientific research inherently involves teamwork, experimentation, communication, and collaborative problem-solving. Because today's classrooms are increasingly diverse, collaborative learning approaches assist accommodate variances in background, learning pace, and aptitude (Noslund, 2013; OECD, 2019).

Evidence from empirical studies suggests that group-based learning greatly boosts students' academic performance, motivation, creativity, and classroom engagement (Avdiu, 2019; Forbes & Nolan, 2018; Slavin, 2020). Teachers who apply this strategy claim improved classroom management, less behavioural difficulties, and a more inclusive classroom culture. The teacher's job transforms from a lecturer to a facilitator who structures activities, supervises group interactions, gives support, and ensures that learning objectives are reached. These traits make group-based learning particularly relevant to modern science education, where active participation and critical thinking are key to curricular goals.

Although group-based learning is highly successful, factors such as gender might influence its implementation and consequences. Research reveals that gender composition within groups might alter the dynamics of involvement. In some mixed-gender groups, male students may dominate talks, which can limit the participation of female students (Wang & Sun, 2019). Teachers must therefore be purposeful in arranging groups to guarantee balanced involvement. Studies also reveal that male and female students may display distinct learning preferences: females often prefer

collaborative and supportive situations, while males may be more comfortable with competitive activities (Smith & Anderson, 2020). Understanding these characteristics helps teachers create more inclusive learning environments.

The gender of the teacher can also influence the success of group-based learning. Previous studies revealed that female teachers frequently adopt more collaborative, student-centered techniques, while male teachers may rely more on direct instruction (Eddy et al., 2015;). Students' opinions of teacher gender may also affect how they interact with group work and participate in classroom activities. For these reasons, gender-related variables must be considered while employing group-based learning in Basic Science (Gilmartin et al., 2023). These evidences strongly support the change from traditional teaching approaches to modern, learner-centered strategies such as group-based learning. Studies reveal that when systematically applied, group-based learning boosts mastery, improves retention, stimulates deeper comprehension, and fosters crucial 21st-century abilities. As Nigeria continues to emphasize scientific and technological growth, adopting effective learning methodologies such as group-based learning becomes vital for enhancing students' progress in Basic Science and preparing them for future academic and career pathways.

RESEARCH QUESTIONS

The following are the research questions that guided the study:

1. What is the difference in the mean performance scores of Students taught basic science using Group learning strategy and those taught using Conventional Method?
2. What is the difference in the male and female students taught using Group learning strategy?

Hypotheses

The following Null Hypotheses were formulated and tested at 0.05.level of confidence

HO1: There is no significant difference in the mean achievement scores of students taught using Group- based learning strategy and those taught with discussion method.

HO2: There is no significant difference in the mean achievement scores of male and female students taught using Group- based learning strategy.

METHODOLOGY

The study adopted a pretest-posttest non-randomized quasi-experimental design. This design was suitable because intact classes were used, which prevented disruption of normal lessons and minimized the influence of extraneous variables. The population consisted of all Junior Secondary Two (JSS2) students in the 15 government-owned secondary schools in Khana Local Government Area, totaling 4,592 students as recorded by the Rivers State Universal Basic Education Board for the 2023/2024 academic year. Junior Secondary School class 2 students were chosen because the content required for the study is included in the JSS2 Basic Science scheme of work. A total of 113 students formed the study sample. Simple random sampling technique was used to select two secondary schools from which the intact classes were selected. Two instruments were used: the Basic Science Achievement Test (BSAT) and researcher-prepared lesson notes. The BSAT consisted of 30 multiple-choice items with four options each, developed from Basic Science textbooks based on four curriculum topics on simple machines: gears, wheel and axle, efficiency of machines, and screw threads. These topics were chosen because they align well with the teaching strategies used. The two intact classes were given a pre-test to ascertain the background knowledge about the topics. Thereafter, the experimental group was taught with the group-based teaching strategy for six weeks. The same topics were taught at the control group with the traditional lecture method. At the end of the six weeks exposure, the post-test using the BSAT was administered to both groups and then then graded. The original 34 items were reduced to 30 after face validation by a senior lecturer in Science Education, who evaluated clarity, appropriateness, and adequacy of the items. The BSAT was validate for its face and content validity while the Reliability was calculated using Cronbach's alpha, yielding a coefficient of 0.95. During the main study, Basic Science teachers assisted in administering the pretest and posttest. Data were analyzed using mean and standard deviation for the research questions, while ANCOVA was used to test the null hypotheses at the 0.05 level of significance.

RESULTS AND DISCUSSIONS

Research Question 1 What is the difference in academic performance between students taught Basic Science using the group-based model and those taught using the traditional method?

Table 1.

Summary of descriptive statistics on the difference in the mean achievement scores of students taught with the Group-based learning strategy and those taught with the lecture method

Groups	Pretest		Posttest		Gain	
	N	Mean	SD	Mean	SD	Mean
Experimental Group	56	10.35	2.23	23.42	7.07	13.07

Control Group	57	9.57	3.13	23.45	7.85	13.88
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The Table 1 shows that the experimental group had a slightly higher pretest mean score (10.35) than the control group (9.57), with less variation in scores. After the intervention, both groups recorded almost identical posttest mean scores (23.42 and 23.45). However, the control group showed a slightly higher gain score (13.88) compared to the experimental group (13.07), indicating that both strategies improved performance, though the lecture method yielded a marginally greater improvement.

HO1: There is no significant difference in academic performance between students taught Basic Science using the group-based model and those taught using the traditional method.

Table 2

Summary of ANCOVA on the differences in the mean achievement scores of group-based learning strategy and those taught using the conventional lecture method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	2550.595a	2	1275.298	34.305	0
Intercept	270.349	1	270.349	7.272	0.008
Pretest	2550.574	1	2550.574	68.609	0
Group	53.937	1	53.937	1.451	0.231
Error	4089.281	110	37.175		
Total	68739	113			
Corrected Total	6639.876	112			

a R Squared = .384 (Adjusted R Squared = .373)

The ANCOVA result in Table 2 shows a significant main effect of the pretest on students' posttest achievement scores in Basic Science, $F(1, 110) = 68.61, p < .05$. This indicates that students' prior knowledge significantly influenced their post-intervention performance. However, the effect of the instructional group (teaching method) on students' achievement was not statistically significant, $F(1, 110) = 1.45, p > .05$, suggesting that both teaching methods produced comparable outcomes. The model explained approximately 38.4% of the variance in students' achievement scores ($R^2 = .384$, Adjusted $R^2 = .373$)

Research Question 2. What is the difference in the academic performance of male and female students taught using the group-based teaching strategy?

Table 3.

Summary of descriptive statistics on the difference in the mean achievement scores of male and female students taught with the group-based teaching strategy

Gender	Pretest		Posttest		Gain	
	N	Mean	SD	Mean	SD	Mean
Male	23	10.08	2.06	23.82	8.33	13.74
Female	33	10.54	2.35	23.15	7.17	12.51

The table shows that male students had a mean pretest score of 10.08 (SD = 2.06), while female students recorded a slightly higher mean of 10.54 (SD = 2.35). After the intervention, males had a posttest mean score of 23.82 (SD = 8.33), which was a bit higher than the females' mean score of ...23.15 (SD = 7.17). In terms of gain scores, male students showed greater improvement with a mean gain of 13.74 compared to their female counterparts who had a mean gain of 12.51. This suggests that although both genders benefitted from the instructional strategy, male students experienced a slightly higher improvement in achievement scores than female students

HO2: There is no significant difference in the academic performance of male and female students taught Basic Science using the group-based teaching strategy.

Table 4.

Summary of ANCOVA on the differences in the mean achievement scores of male and female students taught using the group-based learning strategy

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	76.198a	2	38.099	10.164	0
Intercept	236.819	1	236.819	63.181	0
Posttest	73.349	1	73.349	19.569	0
Gender	4.258	1	4.258	1.136	0.291
Error	198.659	53	3.748		
Total	6282	56			
Corrected Total	274.857	55			

a R Squared = .277 (Adjusted R Squared = .250)

The ANCOVA result in Table 4 reveals a significant main effect of the learning strategy on students' mean achievement scores in Basic Science after adjusting for covariates, $F(1, 53) = 19.57$, $p < .05$. This indicates that students exposed to the group-based learning strategy performed

significantly better than those taught using the conventional lecture method. However, the effect of gender on students' achievement was not statistically significant, $F(1, 53) = 1.14, p > .05$. Therefore, the H_0 is retained

DISCUSSIONS

According to the findings, students who were taught using the group-based learning strategy outperformed those who were taught using the lecture technique by a little margin and showed more consistent scores prior to the intervention. Both groups, however, had nearly comparable performance levels following the introduction of the treatment (Group-based teaching strategy) with the lecture group showing a slightly greater improvement. Although the lecture approach yielded a little higher increase in this specific situation, this pattern indicates that both instructional styles were successful in raising students' performance. These trends were further explained by the inferential statistics as the model as a whole was statistically significant, implying that a considerable amount of the variance in academic achievement could be explained by the variables included in the analysis. The substantial and highly significant impact of prior knowledge, as determined by pretest scores, on students' posttest performance was one of the main conclusions. This highlights the crucial role that baseline ability plays in determining learning gains. This finding is consistent with the work of Donovan and Bransford (2005) and has been supported by recent research from Ahmed and Pollitt (2022), who stressed that learners' preexisting cognitive structures influence how well they absorb new information. On the other hand, there was no statistically significant influence of teaching technique on achievement, indicating that neither the lecture method nor group-based learning offered a definite benefit. While a number of studies have highlighted the advantages of student-centered and cooperative approaches (Johnson & Johnson, 2019; Gyimah, 2023), other researchers have found no discernible differences when lectures are delivered effectively or when group-based learning is impeded by uneven participation or difficulties with facilitation (Prince, 2004; Al-Samarraie & Saeed, 2018). The model explained more than one-third of the variation in students' achievement, which is consistent with the findings of Hattie (2009) and Roorda et al. (2017), who pointed out that although instructional strategies are important, motivation, classroom environment, and instructional quality also have a big impact on results. Overall, the results show that while both teaching approaches enhanced learning, students' past knowledge continued to have a greater impact on accomplishment than the particular technique employed. Further insight into the efficacy of the group-based teaching technique is provided by the examination of gender-based performance in the experimental group. Male and female students performed at almost the same levels on the pretest, suggesting similar prior knowledge. This supports past findings, such as those of Adeyemi (2021), who noted that gender variations in science performance are frequently negligible prior to instruction. Both genders showed significant improvements following the intervention, proving the group-based approach's efficacy. The difference was not significant enough to suggest a gender-based educational advantage, despite the fact that males demonstrated somewhat greater gains. This is in line with the findings of Alabdulaziz (2021), who found that rather than perpetuating gender inequality, collaborative learning environments benefit both genders by encouraging shared participation and greater conceptual comprehension.

Gender did not significantly affect students' posttest performance, according to the ANCOVA results, suggesting that any observed disparities were the result of chance. Similar findings were reported by Achor et al. (2019), who discovered that by promoting equitable involvement, creative, student-centered practices like group-based learning eliminate gender differences. These results are especially significant in the field of science education, where gender disparities have frequently been brought to light. According to the current findings, group-based learning can serve as an educational equaliser that benefits both male and female students equally. This is consistent with recent research by Olatunde and Bello (2022), who found that the use of learner-centred and technology-supported pedagogies tends to reduce gender gaps in science proficiency.

CONCLUSION

The study reveals that both the group-based learning approach and the lecture method effectively boosted students' academic performance in Basic Science. Although the lecture method demonstrated a modest advantage in gain scores, both approaches significantly improved learning outcomes from pretest to posttest. Students' past knowledge emerged as a critical factor of achievement, underlining the necessity to consider baseline understanding when developing instructional activities. Additionally, the data reveal that both male and female students gained equally from the instructional tactics, demonstrating the gender-inclusive character of these approaches. The study indicates that while instructional strategies are crucial, academic success is greatly driven by prior knowledge, active participation, and effective execution of teaching approaches. Therefore, educators should integrate strategies that build on students' existing understanding and encourage inclusive, participatory learning environments.

RECOMMENDATIONS

- Teachers should prioritize diagnostic assessments and remedial instruction at the beginning of each term to strengthen students' foundational understanding before introducing new concepts.
- Teachers should continue to use strategies that engage all learners, ensuring that instructional activities are inclusive and equitable.

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