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EFFECT OF GERLACH AND ELY DESIGN MODEL ON SECONDARY SCHOOL STUDENTS' INTEREST IN ALGEBRA IN ANAMBRA STATE

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ABSTRACT

The persistent poor academic performance of students in Mathematics, as reflected in both internal and external examinations, necessitated this study. The study investigated the effect of the Gerlach and Ely design model on the interest of secondary school students in Anambra State in Algebra. three research questions guided the study, and three null hypotheses were tested. A quasi- experimental research design—specifically, the pre-test, post-test, non-equivalent control group design—was employed. The population consisted of 18,702 Senior Secondary students One (SS1) within the study area. Using purposive and simple random sampling techniques, two co- educational schools were selected, yielding a total sample size of 230 SS1 students. Data were collected using the Algebra Interest Inventory (AII). The face and content validity of the instrument were established by three experts from the Departments of Educational Foundations, Educational Technology, and Science Education. The reliability of the AII was determined using Cronbach Alpha, which produced a reliability coefficient of 0.91. Mean and standard deviation were used to answer the research questions, while Analysis of Covariance (ANCOVA) was employed to test the null hypotheses at a 0.05 level of significance. The study revealed several significant findings. Specifically, the Gerlach and Ely design model had a significantly positive effect on students' interest in Algebra when compared to those taught using the Lecture Method (LM). These findings underscore the effectiveness of the Gerlach and Ely design model in enhancing students' interest in Algebra.

KEYWORD: Gerlach and Ely design model, Algebra, and Interest.

INTRODUCTION

Mathematics is an important subject taught at all levels of education around the world. Many school subjects and everyday activities depend on it. Mathematics also helps people and countries grow and develop. Since it is the base of science and technology, any country that wants to grow and succeed must focus on teaching it well in schools. In Nigeria, the Federal Government has made Mathematics a required subject in secondary schools because of its importance in other school subjects (FRN, 2014). The knowledge and skills from Mathematics are useful in many subjects like Chemistry, Arts, Physics, Biology, and Economics. According to Abiodun et al. (2022), understanding Mathematics helps students get ready for higher education.

Mathematics is the study of numbers, shapes, and how things relate to each other. It comes from basic activities like counting, measuring, and describing shapes. Oraneto and Omile (2021) said that Mathematics involves solving problems with numbers and using logical thinking. Over time, it has become more focused on abstract ideas. William (2022) explained that Mathematicians use clear rules and careful thinking to find patterns, make guesses, and prove their ideas. Mathematics includes topics like Geometry, Algebra, Trigonometry, and Arithmetic.

Algebra is an important part of Mathematics. It helps us understand and solve real-life problems using simple equations, where the unknown appears on both sides of the equal sign. Astodillo (2024), Algebra is like arithmetic, but it uses both numbers and letters (unknowns). It is the part of Mathematics that uses symbols, letters, and numbers to write formulas and equations. In the researcher’s view, Algebra helps us describe and solve everyday problems using letters and symbols. Ojaleye and Awofala (2018) believe that the world cannot grow or develop without the help of Algebra. In Nigerian senior secondary schools, Algebra is broken into different topics such as equations (simple, simultaneous, & quadratic), set theory, inequality, and variation. For this study, the topics to be focused on include the number system, operations in number bases, indices, and changing the subject of a formula (Okafor & Nzomiwu 2021). These topics are taught to help students use what they learn to solve real-life problems. Therefore, it is very important for students to have a good understanding of Algebra. To achieve the goals of teaching Algebra in secondary schools, students must learn its basic ideas and principles. Ojaleye and Awofala (2018) also say that the success of Algebra teaching is often measured by how well students do in exams. However, even though Mathematics is very important for Nigeria's educational growth, students still show low interest and perform poorly in the subject (Okigbo & Ezeanyi, 2021).

Interest is the psychological inclination to engage with specific content, acts as a cognitive and affective motivational force, guiding attention and fostering learning across various contexts. The affective dimension of interest is, in part, shaped by an individual's level of interest or phase (Ibe, F.N et al. 2024). Within the realm of education, interest plays a pivotal role in shaping learning experiences and academic achievements across all students' levels, particularly influencing discussions on Mathematics performance, as emphasized by Dwivedi, et al (2021). Notably, task design and the organization of the learning environment significantly impact students' interest development. Understanding the development of interest involves recognizing that individuals with pre-existing interests in a specific domain often exhibit related situational interest. Tyack and Mekler (2024) illustrated that teaching through games, in contrast to traditional methods, led to enhanced achievement and interest among students. Taylor et al (2023) categorized Interest into two types: situational interest, which is temporary and sparked by specific tasks or contexts, and individual interest, which is a more enduring predisposition towards the subject Algebra. Interest in a subject refers to the psychological state of engaging or being attracted to a particular domain. In the context of Mathematics, interest can manifest as curiosity, enjoyment, and a desire to learn more about the subject. Interest plays a dual role in influencing Mathematics achievement. Okigbo and Ezeanyi (2021) view that there was enough evidence to suggest that the majority of secondary school students struggle with Mathematics. Also, even though Algebra is the key to understanding Mathematics, students often find it difficult and do not do well in it. Abiodun, et.al (2022) made a similar observation that secondary school students in Nigeria often struggle to answer Algebraic problems because they do not fully understand the concept.

When mathematics teachers rely on traditional teaching methods, students often become less engaged, less enthusiastic, and less creative. Ugwoke et al. (2020), noted this approach disrupts the learning environment and limits students' creative potential. In such situations, the teacher is typically seen as the sole source of knowledge, standing at the front of the classroom to deliver content. Alachi et al. (2016) observed that traditional teaching methods usually involve teachers lecturing and writing on the chalkboard. However, teachers can adopt a variety of innovative, student-centered strategies when teaching Algebra. These include methods such as think-pair-share, guided or open inquiry, animated-media instruction, problem-solving, brainstorming, and peer tutoring. In addition, interactive instructional strategies like the jigsaw method, student-team achievement division (STAD), learning together, constructive controversy, complex instruction, team-game-tournament, team-assisted individualization, team-accelerated instruction, group investigation, cooperative integrated reading and composition (CIRC), and small group discussions can also enhance student participation and learning outcomes. The researcher also suggests using activity-based models such as the Gerlach and Ely design model, which shifts much of the learning responsibility to the students. This approach encourages active student engagement and participation in the learning process.

The Gerlach and Ely design model, developed by Vernon S. Gerlach and Donald P. Ely in 1971, is an instructional strategy that emphasizes systematic planning. It places equal importance on two major aspects of effective teaching: clearly defining instructional objectives and identifying methods to achieve each one. Sanderson (2023), argued that this model is appropriate for teaching students at all academic levels, regardless of their background. Wildati et al. (2023) noted that it is effective at the primary, secondary, and tertiary levels and can be implemented even with limited teaching resources. They further argued that the model supports effective instructional planning and delivery, provided that learning objectives and materials are well defined in advance. Gerlach and Ely outlined ten instructional steps within this framework to help students achieve learning outcomes: specify content, state objectives, assess learners' prior knowledge, select instructional strategy, organize learners into groups, allocate time and space, choose resources, evaluate performance, and analyze feedback. Unlike conventional teaching methods, this model focuses on improving student performance through structured instructional planning.

When the Gerlach and Ely design model is applied in the classroom, it can increase students' commitment, enthusiasm, participation, and engagement during Algebra lessons because it is tailored to meet individual learning needs. Proper implementation of this model can help promote and sustain students' active involvement in Algebra. However, students who lack confidence in their abilities may shy away from challenging tasks they see as personal threats. When these students encounter difficult Algebra problems, they tend to focus more on their perceived weaknesses and the obstacles they face rather than on strategies to succeed (Horn, 2024). Such students may experience significant psychological barriers, including anxiety, nervousness, fear, and tension, which can lead to poor academic performance regardless of gender.

One factor that consistently influences students' academic performance is gender. Gender refers to the roles, behaviours, and attributes that a particular society considers appropriate for males and females. In many communities, people believe that certain responsibilities are meant for males (masculine) while others are meant for females (feminine). As a result, boys and girls are often raised and treated differently within the family setting. These gender-based differences lead many girls to accept such treatment as normal and unchangeable. Boys, on the other hand, tend to accept these expectations because they believe it works in their favour. Males are often encouraged to "act like men," while females are advised to "behave like ladies." While gender is rooted in biological and physiological differences between males and females, Onwusa and Nwaosa (2021) described it as a psychological concept that explains the expected behaviours and characteristics based on one’s sex. In recent years, educational efforts have increasingly focused on reducing the academic performance gap between male and female students in Mathematics.

It is acknowledged that if not properly addressed, certain factors—such as gender—can hinder students’ academic performance. One of the objectives of this study is to examine whether gender affects the interest of students in Mathematics when taught using either traditional teaching methods or the Gerlach and Ely instructional strategy. Rodríguez et al. (2020) reported that male students outperformed their female counterparts in Mathematics. However, this contrasts with findings by Johnson et al. (2022), which indicated that female students consistently outperformed males. Meanwhile, Ghasemi and Burley (2019) found no significant difference in Mathematics performance between male and female students. These mixed findings suggest a persistent gap or inconsistency in gender-related academic performance in Mathematics. Therefore, to ensure that students of all genders attain a strong understanding of Algebra, there is a need for a well-designed study that identifies effective instructional strategies for teaching Algebra. The sub-topics selected for this study are informed by the Chief Examiners’ reports, which highlight areas where students commonly fail in the West African Examinations Council (WAEC). These topics, which fall under the broader area of Algebra and are included in the Senior Secondary One (SS1) curriculum, were deliberately chosen. Other branches of Mathematics such as Geometry, Trigonometry, and Arithmetic are not considered in this study. Algebra was specifically selected because it includes complex concepts that often hinder students from achieving high scores. Consequently, this study aims to investigate the effect of the Gerlach and Ely instructional strategy on the interest of secondary school students in Algebra in Anambra State.

Statement of the Problem

The researcher is concerned that students' persistent poor performance in Mathematics may hinder Nigeria's ability to develop the skilled workforce needed for technological and industrial advancement. Several factors can be linked to this poor academic performance, but the researcher believes that the teaching methods used by Mathematics teachers play a major role. In most Nigerian secondary schools, conventional teaching methods continue to dominate, despite criticism from education experts who argue that these methods contribute to students' declining interest in Mathematics. To address this issue, the researcher suggests that the Gerlach and Ely instructional strategy could be employed to improve the teaching of Algebra and boost students' interest in the subject. However, because limited research has been conducted in this area, the effectiveness of this strategy must be scientifically validated.

Therefore, this study investigates the effect of the Gerlach and Ely design model on students' interest in Algebra in secondary schools in Anambra State. Specifically, the study seeks to determine the:

1. Mean interest scores of students taught Algebra using Gerlach and Ely design model and those taught with lecture method.
2. Mean interest scores of male and female students taught in Algebra using Gerlach and Ely design model.
3. Interaction effect of teaching methods and gender on students' interest in Algebra.

In line with the study's purpose, the following research questions were used to guide the investigation:

1. What are the mean interest scores of students taught algebra using Gerlach and Ely design model and those taught with lecture method?
2. What are the mean interest scores of male and female students taught in Algebra using Gerlach and Ely design model?
3. What is the interaction effect of teaching methods and gender on students' interest in Algebra?

The following null hypotheses in line with the purpose of the study were formulated and tested at 0.05 level of significance:

Ho1: There is no significant difference in the mean interest scores of students taught Algebra using Gerlach and Ely design model and those taught with lecture method.

Ho2: There is no significant difference in the mean interest scores of male and female students taught in Algebra using Gerlach and Ely design model and those taught using lecture method

Ho3: There is no interaction effect of teaching methods and gender on students' interest in Algebra

Research Method

The study employed a quasi-experimental design, specifically the non-equivalent control group design, which is appropriate for educational research where randomly assigning participants to groups is not practical (Adebayo, 2024). The research was conducted in Anambra State, situated in the southeastern region of Nigeria. Anambra State, one of Nigeria's 36 states, was established on August 27, 1991, following its separation from the former Anambra State, which itself was created in 1976 from the East Central State. The study was carried out within the Onitsha Education Zone of Anambra State. This location was purposefully selected because it is one of the oldest educational zones and represents a metropolitan area that struggles with challenges such as an insecure learning environment and persistent poor academic performance among students, particularly in mathematics. The target population of the study consisted of 18,702 Senior Secondary One (SS1) Mathematics students enrolled in 33 government-owned co-educational secondary schools within the Onitsha Education Zone. Of this population, 8,506 were males and 10,196 were females. From this population, a sample of 230 SS1 Mathematics students (comprising 90 males and 139 females) was drawn from four out of the 16 co-educational secondary schools in the zone. Both male and female students were purposefully included to ensure balanced gender representation, as gender was considered a key moderator variable in this study. Two of the selected schools were assigned to the experimental group (46 males and 68 females), using purposive sampling based on specific criteria such as being a mixed-gender school, having an adequate number of students, and the presence of qualified graduate Mathematics teachers. The remaining two schools were designated as the control group (44 males and 71 females). Within each of the four selected schools, one intact class was chosen using simple random sampling, making a total of four intact classes used for the study.

The researcher utilizes the Algebraic Interest Inventory (AII) for data collection, this is a standardized test consisting of multiple-choice and short-answer questions covering key algebraic concepts. It was used to assess students' academic achievement in Algebra. The instrument for data collection face and content validated by three experts. One expert in the department of Education Foundation Chukwuemeka Odumegwu Ojukwu University Igbariam campus, another expert from Department of Science Education Nnamdi Azikiwe University and the last expert in Department of Education Technology of Enugu State University Enugu. The reliability of the instruments was determined through a tried test involving 20 SS 1 students from a Community School in Otuocha Education Zone, in Anambra State which was not part of the area of study. the instruments were collected and handed over to the researcher. The Cronbach's alpha coefficient of were calculated for the AII to assess internal consistency because it can measure internal consistency and also improve instrument quality**.** The average coefficient value of 0.91 were obtained. These reliability coefficient values were considered high enough to serve as instrument for data collection because Ifeakor (2018) reliability coefficient of 0.60 and above can be regarded adequate for an instrument for data collection.

Before teaching began in both the experimental and control schools, students in the two groups completed the Algebra Interest Inventory (AII) as a pre-test to assess their initial interest in algebra. The experimental group received instruction in algebra using the Gerlach and Ely instructional model over a period of six weeks. This model emphasizes systematic planning and delivery of instruction, including setting objectives, selecting appropriate content and methods, and planning for assessment. Meanwhile, the control group was taught the same algebra content using the conventional lecture method. After the instructional period, both groups took the AII again as a post-test to measure any changes in their interest. Hypotheses were tested using a 0.05 level of significance: if the p-value was less than 0.05, the null hypothesis was rejected; if it was greater, the null hypothesis was accepted. Data analysis, including mean scores and ANCOVA, was conducted using SPSS version 23.

Research Question 1

What are the mean interest scores of students taught Algebra using Gerlach and Ely design model and those taught with lecture method?

Table 1: Summary of analysis on the mean interest scores of students taught Algebra using Gerlach and Ely design model and those taught with lecture method.

Source of Variance	N	Pre-Interest Mean	SD	Post-Interest Mean	SD	Mean Gain	Gain Diff.
Experimental group	114	48.65	5.03	66.75	4.63	18.1	5.03
Control group(LM)	116	37.84	4.85	40.91	5.54	3.07	

Table 1 shows a comparison of the pre-test and post-test mean interest scores for the treatment and control groups. The treatment group had a pre-test mean score of 48.65 (SD = 5.03), which increased to 66.75 (SD = 4.63) in the post-test. On the other hand, the control group started with a lower pre-test mean of 37.84 (SD = 4.85) and slightly improved to 40.91 (SD = 5.54) in the post-test. The increase in mean score for the treatment group was 18.1, while the control group gained only 3.07. This shows a mean difference of 15.03 in favour of the treatment group, suggesting that the Gerlach and Ely design model was more effective in sustaining students' interest in Algebra than the conventional lecture method. The standard deviation for the treatment group's pre-test scores was higher than that of the post-test, indicating greater variability in students' interest before the intervention. This means that, after the intervention, students' interest scores became more consistent and clustered around the mean. In contrast, the control group had a lower standard deviation in the pre-test and a higher one in the post-test, showing that their scores became more spread out and less consistent after the lecture method was applied. Overall, the findings indicate that the Gerlach and Ely design model was more effective in maintaining and improving students' interest in Algebra compared to the traditional lecture method.

Research Question 2

What is the mean interest rate scores of male and female students taught in Algebra using Gerlach and Ely design model?

Table 2: Summary of analysis on the interest mean scores of students taught Algebra using Gerlach and Ely design model to gender.

Source of Variance		N	Per-test Mean	SD	Post- Interest Mean	SD	Mean Gain
Gender	Male	46	42.40	3.92	59.10	3.10	16.70
	Female	68	48.87	4.20	66.90	6.30	18.03
Diff. in Mean							**1.33**

Table 2 shows the pre-test and post-test mean interest scores of male and female students taught Algebra using the Gerlach and Ely design model. The mean interest scores for male students were 42.40 (pre-test) and 59.10 (post-test), with standard deviations of 3.92 and 3.10 respectively. For female students, the pre-test and post-test mean scores were 48.87 and 66.90, with standard deviations of 4.20 and 6.30 respectively. The standard deviation for the male students' pre-test scores was higher than that of the post-test, indicating greater variability in their initial interest levels. This suggests that the students' interest scores became more consistent after the intervention. In contrast, the standard deviation for female students increased from pre-test to post- test, implying greater variability in their post-test scores and that their interest levels were more spread out after the intervention. The mean gain in interest for male students was 16.70, while female students recorded a mean gain of 18.03, resulting in a mean difference of 1.33 in favor of the female students. This indicates that the Gerlach and Ely design model was slightly more effective in enhancing and sustaining interest in Algebra among female students compared to their male counterparts

Research Question 3

What is the interaction effect of teaching methods and gender on students' interest in Algebra?

Table 3: Summary of analysis on the interaction effect of teaching methods and gender on tudents' interest in Algebra.

Source of Variance	Gender	N	Pre- Interest Mean	SD	Pre- Interest Mean	Interest SD	Diff. in Mean
G&E	Male	46	62.40	3.62	60.10	3.82	2.30
	Female	68	65.87	4.20	64.90	6.30	0.97
Diff in mean							**1.33**
LM	Male	44	47.44	10.72	40.60	8.34	6.84
	Female	72	46.30	9.06	39.07	7.32	7.23
Diff in mean							**-0.39**

Table 3 shows the pre-test and post-test mean scores recorded after a four-week instructional period for both the experimental and control groups. Interest test scores were also gathered four weeks after the post-test to evaluate students' retained knowledge and sustained interest in Algebra. In the experimental group, the mean loss in interest was 1.33, showing that female students sustained a higher interest in Algebra than their male peers. This suggests that the Gerlach and Ely design model was more effective in maintaining and boosting the interest of female students. In contrast, the control group had a mean loss difference of -0.39, indicating a decline in interest among female students over time. Despite this, the overall results show that both male and female students exposed to the Gerlach and Ely model remained more interested in Algebra than those taught with the conventional Lecture

Method. These findings underscore the effectiveness of the Gerlach and Ely model in promoting long-term engagement and interest in Mathematics.

Hypothesis 1

Ho1: There is no significant difference in the mean interest scores of students taught Algebra using Gerlach and Ely design model and those taught with lecture method.

Table 4: Test of significance analysis on ANCOVA for testing the significant effect of Gerlach and Ely design model on students' interest scores in Algebra when compared with those taught with lecture method.

Source	SS	df	MS	Cal. F	P value	Decision
Corrected Model	12608.778[a]	2	3226.194	18.84	0.00	
Intercept	11843.912	1	11844.912	68.54	0.00	
Post-test	222.090	1	222.090	1.30	0.27	
Method	3868.390	1	3868.390	23.16	0.00	S
Error	20036.116	227	172.334			
Total	317573.000	230				
Corrected Total	32854.893	229				

a. R Squared = .392 (Adjusted R Squared = .371) S= Significant, NS = Not Significant

Table 4 revealed that the instructional treatment had a significant effect on students' interest in Algebra, explaining 37% of the variation in their interest scores. The analysis yielded an F-value of $F(1, 229) = 23.16$ with a p-value of 0.00, which is well below the 0.05 significance threshold, indicating a highly significant result. Based on this, the null hypothesis was rejected. This confirms that students taught using the Gerlach and Ely design model developed significantly greater interest in Algebra compared to those taught with the traditional Lecture Method. The result underscores the effectiveness of the G&E model in enhancing students' engagement and enthusiasm for learning Algebra.

Hypothesis 2

Ho2: There is no significant difference in the mean interest scores of male and female students taught in Algebra using Gerlach and Ely design model and those taught using lecture method.

Table 5: Test of significance of analysis on ANCOVA for testing the significant effect of Gerlach and Ely design model on students' interest rate scores in Algebra in respect to gender.

Source	SS	df	MS	Cal. F	P-value	Decision
Corrected Model	113.360[a]	2	57.180	1.90	0.16	
Intercept	387.248	1	387.248	13.20	0.00	
Post-test	26.398	1	26.398	0.81	0.37	
Gender	96.256	1	96.256	3.17	0.08	NS
Error	1043.219	111	30.192			
Total	160298.000	114				
Corrected Total	1157.579	113				
a. R Squared = .098 (Adjusted R Squared = .046) S= Significant, NS = Not Significant						

Table 5 shows that gender did not have a significant effect on students' interest mean scores. The result of the analysis, $F(1, 111) = 3.17$, $p = 0.08$, indicates that the p-value is greater than the 0.05 level of significance. Therefore, the null hypothesis was retained, meaning that the Gerlach and Ely design model did not produce a significantly different effect on the interest of male and female students in Algebra. This implies that the instructional method promoted a similar level of interest and engagement in Algebra among both male and female students

Hypothesis 3

Ho3: There is no interaction effect of teaching methods and gender on students' interest in Algebra

Table 6: Test of significance analysis on ANCOVA for interaction effect of teaching methods and gender on students' interest

Source of Variation	SS	df	MS	Cal. F	P-value	Decision
Corrected Model	9721.893	4	2432.973			
Intercept	1168.145	1	1168.145			
Post-test	188.031	1	88.031			
Treatment models	3584.868	1	3584.868			
Gender	5.176	1	5.176			
Treatment * Gender	25.782	1	25.782	0.75	0.39	NS
Error	2577.794	227	34.794			
Total	220007.000	230				
Corrected Total	12211	229				

Table 6 shows that at the 0.05 level of significance, with 1 degree of freedom for the numerator and 229 for the denominator, the calculated F-value was 0.75, and the p-value was 0.39. Since the p-value is greater than 0.05, the null hypothesis was not rejected. This means that there was no significant interaction effect between the instructional design model and gender on students’ interest in Algebra. In other words, the impact of the teaching method on students’ interest did not depend on whether they were male or female.

DISCUSSION OF RESULTS

Findings from this study indicated that the Gerlach and Ely (G&E) design model is more effective in fostering students' interest in Algebra than the lecture method (LM). When this observed difference was tested for significance, as shown in Table 4, the results confirmed that the (G&E) design model has a significant effect on students' interest in Algebra compared to those taught using the LM. The analysis results indicated that the Gerlach and Ely (G&E) design model tends to enhance the interest of male students in Algebra slightly more than that of female students. However, when this observed difference was tested for significance, as shown in Table 5, the findings revealed that the variation in interest levels between male and female students was not statistically significant. This suggests that the G&E design model has an equal impact on student interest, regardless of gender, and any apparent differences in engagement may be due to chance rather than the instructional method itself. This implies that the effectiveness of the (G&E) design model in fostering students' interest in Algebra is not dependent on gender. In other words, male and female students benefit equally from the model’s student-centered and action-oriented instructional strategies. The results indicate that gender does not play a critical role in determining how much interest students develop in Algebra when taught using the (G&E) design model. The findings of this study revealed that there is no significant interaction effect between the instructional design model on male and female students’ interest scores in Algebra. This suggests that the Gerlach and Ely (G&E) design model is equally effective for both male and female learners, providing them with similar learning opportunities and fostering engagement regardless of gender differences. The results indicate that the model does not favor one gender over the other in terms of stimulating interest in Algebra, reinforcing its effectiveness as an inclusive instructional strategy.

CONCLUSION

The findings of this study show that the Gerlach and Ely design model enhances students’ interest, critical thinking, and problem-solving skills. It encourages learners to engage actively with academic tasks—individually, in small groups, and as a whole class. The results provide strong evidence that this model effectively boosts students’ interest in Algebra, regardless of gender. Based on the findings, the researcher concludes that using the Gerlach and Ely design model significantly improves students' interest in Algebra. Additionally, the study indicates that gender does not significantly influence students' academic achievement when this model is applied. In contrast, traditional lecture-based methods tend to make students passive, resulting in low engagement, low interest, and weaker performance in Algebra. The Gerlach and Ely model helps to overcome these issues by promoting a more interactive, student-centered learning environment. This approach not only deepens conceptual understanding but also encourages active participation, long-term retention, and better overall academic performance in Algebra.

Recommendations

Based on the findings of this study, the following recommendations were proposed to enhance the effectiveness of Mathematics instruction and improve students' learning outcomes:

1. Mathematics teachers should adopt a gender-neutral approach in Algebra classrooms, ensuring that no learning experiences, instructional resources, or teaching practices reinforce gender biases.
2. The current time allocation for Algebra lessons in secondary school timetables may not be sufficient for the effective implementation of the Gerlach and Ely design model.
3. Mathematics teachers should educate their students on the benefits of the Gerlach and Ely design model and how it can enhance their learning experience.
4. Mathematics teachers should integrate the Gerlach and Ely design model into their teaching practices to foster active student participation in the learning process. This model encourages an interactive classroom environment where students engage in problem- solving activities individually, in pairs, and within larger groups.
5. Curriculum planners should incorporate the Gerlach and Ely design model into teacher education programs to ensure that pre-service teachers are well-trained in its application.

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