



Effect of Ausubel's Advance Organisers on Senior Secondary School Students' Self-Efficacy in Algebra

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Abstract

This study examined the effect of Ausubel's Advance Organisers on students' self-efficacy in algebra and explored gender differences among senior secondary school students in Zaria Metropolis. Grounded in Bandura's social cognitive theory and Ausubel's meaningful learning framework, a quasi-experimental, non-equivalent control group design was employed with 160 students. Participants were assigned to an experimental group taught with Advance Organisers ($n = 83$) or a control group taught via the lecture method ($n = 77$). Self-efficacy was measured using the 20-item Mathematics Self-Efficacy Scale (MSES; Cronbach's $\alpha = 0.87$). Data were analysed using descriptive statistics and the Mann-Whitney U test. Results showed that students in the experimental group reported significantly higher self-efficacy than the control group, with no significant gender differences. Recommendations: Teachers should adopt Advance Organisers routinely, curriculum developers should include them in instructional guidelines, and policymakers should promote their use to enhance mathematics outcomes.

Keywords: Ausubel's Advance Organisers, self-efficacy, algebra, gender differences, mathematics education,

Introduction

Algebra is a foundational component of mathematics education, essential for developing higher-order reasoning, abstract thinking, and problem-solving skills, and it underpins success in mathematics and preparedness for STEM-related fields. Despite its importance, many students struggle to master algebraic concepts, often experiencing frustration, low confidence, and avoidance behaviours, highlighting the need to address both cognitive understanding and affective-motivational dimensions of learning. Among these, self-efficacy, an individual's belief in their capacity to organise and execute actions to achieve desired outcomes (Bandura, 1997), is a critical predictor of engagement, persistence, and achievement in algebra (Holenstein et al., 2022; Zakariya, 2022). Self-efficacy is shaped by mastery experiences, social persuasion, vicarious experiences, and physiological states, with mastery of tasks and supportive feedback from teachers and peers being particularly influential (Bandura, 1997; Dangur-Levy et al., 2023; H. Li et al., 2021; Zakariya, 2022). Instructional strategies that embed self-efficacy components such as scaffolded support, incremental challenges, and structured problem-solving, along with positive

teacher-student relationships and cognitively activating classroom practices, have been shown to enhance students' beliefs in their mathematical abilities, thereby improving problem-solving skills and achievement (H. Li et al., 2021; Zakariya, 2022; Zhou et al., 2020; Zysberg & Schwabsky, 2021). By integrating these cognitive and affective supports, educators can promote both competence and confidence in algebra learning, particularly for students from diverse or under-resourced backgrounds.

Among instructional strategies aimed at enhancing learning outcomes, Ausubel's Advance Organisers have gained considerable attention for their effectiveness in facilitating meaningful learning. These organisers are instructional tools introduced before new content to bridge students' existing knowledge with forthcoming information, thereby reducing cognitive load and promoting comprehension (Ausubel, 1960; Novak, 2003). Empirical studies have demonstrated that their use can improve academic performance, information retention, and conceptual understanding across diverse subject areas, including science and mathematics (Mufidah, 2024). By providing a

structured framework for understanding, advance organisers may also positively influence students' confidence in their learning abilities, thereby enhancing self-efficacy (Bandura, 1997; Dangur-Levy et al., 2023). Specifically, advance organisers activate prior knowledge and provide a conceptual framework that helps manage the limited capacity of working memory during learning. By structuring new information and linking it to what learners already know, they reduce extraneous cognitive load, the unnecessary mental effort that does not contribute to learning, allowing more resources for meaningful processing and schema construction (Ginns & Leppink, 2019; Kalyuga & Singh, 2016; Paas & Van Merriënboer, 2020). Nevertheless, their effectiveness depends on both the organiser's design and the learner's expertise, as poorly matched organisers or excessive detail can inadvertently increase cognitive load (Kalyuga & Singh, 2016; Skulmowski & Xu, 2022). Research consistently shows that advance organisers enhance comprehension by helping learners make connections, clarify expectations, and focus on key concepts. For instance, interactive brainstorming organisers in language learning have been found to significantly improve students' listening comprehension and confidence while reducing anxiety and supporting the integration of new information (C.-H. Li et al., 2019). In flipped classroom settings, advance organisers have been shown to improve achievement and performance in science process skills compared to traditional instruction (Elfeky et al., 2020), with the most pronounced benefits occurring when organisers are tailored to learners' needs and the complexity of the material (Kalyuga & Singh, 2016; Paas & Van Merriënboer, 2020).

In the Nigerian educational context, algebra remains a challenging subject for many senior secondary school students, as evidenced by consistently low performance in national examinations (Danlami, et al., 2024; Ibrahim et al., 2023). Factors contributing to these challenges include limited instructional support, insufficient scaffolding of abstract concepts, and students' low self-beliefs in their mathematical abilities (Zakariya, 2021; Zakariya et al., 2022). While previous studies in Nigeria have examined general teaching strategies and performance in mathematics, few have explored the integration of cognitive scaffolds such as Advanced Organisers with students' affective outcomes, particularly self-efficacy. Given that self-efficacy is a strong predictor of academic engagement, problem-solving persistence, and overall achievement (Bandura, 1997; Zakariya, 2022), understanding how instructional interventions influence this construct is essential for

enhancing mathematics education. Investigating the effect of Advance Organisers in the teaching of algebra can provide insights into how structured cognitive support can enhance both understanding and confidence, thereby improving overall learning outcomes.

Therefore, the present study seeks to address this critical gap by investigating the effect of Ausubel's Advance Organisers on self-efficacy in algebra among senior secondary school students in Zaria Metropolis, Kaduna State. Specifically, the study aims to determine whether the use of Advanced Organisers enhances students' beliefs in their ability to perform algebraic tasks and to examine any differential effects based on gender or prior academic achievement. The study is guided by the following research objectives: (1) to assess the effect of Advance Organisers on students' self-efficacy in algebra; (2) to examine gender differences in the impact of Advance Organisers on self-efficacy. In line with these objectives, the study tests the following null hypotheses: (1) there is no significant difference in self-efficacy between students taught using Advance Organisers and those taught using conventional methods; (2) there is no significant gender-based difference in self-efficacy among students exposed to Advance Organisers. By addressing these questions, the study aims to provide empirical evidence to inform instructional practice, curriculum design, and policy decisions aimed at improving algebra learning in Nigerian secondary schools.

Literature Review

Advance Organisers: Ausubel's Theory and Contemporary Perspectives

David Ausubel's theory of meaningful learning introduced the concept of advance organisers, structured, introductory materials presented before instruction, to help students connect new information to existing knowledge. This foundational idea has significantly influenced educational theory and practice over the decades, although its assumptions and applications have been re-examined in light of contemporary cognitive science and educational technology.

Advance organisers serve as cognitive bridges, linking students' prior knowledge with new content to foster meaningful learning. By providing a conceptual framework before instruction, they help learners organise and integrate information effectively. Early research demonstrated the usefulness of advance organisers across multiple disciplines, including science and mathematics education, showing improvements in comprehension

and retention. However, challenges in practical implementation emerged, largely due to individual differences among learners and the abstract nature of some organisers, highlighting the need for careful instructional design (Bryce & Blown, 2024).

While Ausubel's original framework remains influential, recent cognitive and neuroscience research has prompted critical reassessment. Studies now recognise that memory is dynamic rather than strictly representational, influencing how prior knowledge is accessed and applied. Additionally, the importance of in-depth dialogue, such as Socratic questioning, is emphasised to accurately gauge learners' existing knowledge. Contemporary perspectives also advocate viewing concepts as flexible skills rather than fixed entities, and highlight the interplay of conscious and unconscious memory processes. Furthermore, collaborative and scaffolded learning has been shown to complement the effectiveness of advanced organisers in modern educational settings (Bryce & Blown, 2024). Despite critiques, advance organisers remain highly relevant, particularly in technology-enhanced learning environments such as flipped classrooms. Empirical studies demonstrate that the strategic use of advance organisers in such contexts can significantly improve students' integrated science process skills and overall achievement when compared with traditional instructional methods that do not employ organisers (Elfeky et al., 2020). These findings suggest that, when adapted to modern pedagogical contexts, advance organisers can continue to enhance learning outcomes effectively.

Self-Efficacy in Mathematics Learning

Self-efficacy, defined as students' belief in their ability to succeed in mathematics, has been widely recognised as a powerful predictor of mathematics learning, achievement, and motivation (Grigg et al., 2018; Holenstein et al., 2022; Skaalvik et al., 2015). Students with higher self-efficacy not only perform better but also engage more consistently in cognitive and metacognitive strategies, demonstrating greater persistence and effort in mathematics tasks (Bernacki et al., 2015; Cleary & Kitsantas, 2017). This relationship is reciprocal; while self-efficacy influences performance, prior achievement can also shape students' confidence, although the impact of self-efficacy on subsequent achievement is generally stronger (Iaochite et al., 2025; Zakariya, 2022). Therefore, fostering self-efficacy in mathematics is essential for both immediate performance and long-term learning outcomes. The development of mathematics self-efficacy is influenced by multiple interrelated factors. Mastery experiences successful

engagement with mathematics tasks are the most significant contributors, providing students with concrete evidence of their capabilities (Lau et al., 2018; Sheu et al., 2018; Zientek et al., 2017). In addition to mastery, vicarious experiences, social persuasion, and emotional states play supporting roles in shaping self-efficacy beliefs. Beyond individual experiences, the classroom environment exerts a critical influence; cognitively activating instruction, teacher support, and positive teacher-student interactions enhance students' confidence in mathematics, which in turn improves their achievement (Dangur-Levy et al., 2023; H. Li et al., 2021; Skaalvik et al., 2015). Socioeconomic status and parental education further interact with these classroom factors, highlighting the importance of targeted teacher support, particularly for students from less advantaged backgrounds (Dangur-Levy et al., 2023; H. Li et al., 2021).

Importantly, self-efficacy does not operate in isolation but mediates the effects of other determinants on mathematics outcomes. For instance, students' motivation, prior achievement, and use of learning strategies often exert their influence through self-efficacy beliefs (H. Li et al., 2021; Roick & Ringeisen, 2018; Skaalvik et al., 2015). Empirical studies have confirmed that self-efficacy mediates the relationship between instructional practices and mathematics performance, reinforcing its central role in the learning process (Holenstein et al., 2022; H. Li et al., 2021; Schöber et al., 2018). This suggests that interventions aimed at improving mathematics outcomes may be more effective if they directly address students' self-efficacy alongside content knowledge and skills. Collectively, the evidence underscores self-efficacy as a central construct in mathematics education. Large-scale, longitudinal, and multi-level studies consistently demonstrate that students' confidence in their mathematical abilities predicts achievement and persistence, while teacher support and cognitively activating classroom practices can enhance self-efficacy (Grigg et al., 2018; Holenstein et al., 2022; Perera & John, 2020). Moreover, the mediating role of self-efficacy highlights its importance not only as a predictor but also as a mechanism through which other factors influence learning outcomes (Cleary & Kitsantas, 2017; H. Li et al., 2021; Schöber et al., 2018).

While existing studies underscore the importance of self-efficacy in mathematics achievement, there is limited research within Nigeria and Sub-Saharan Africa that explicitly examines the integration of cognitive scaffolds such as Ausubel's Advanced Organisers with affective constructs. Most Nigerian studies have focused either on the effect of

instructional strategies on performance outcomes (e.g., Zakariya, 2021; Ibrahim et al., 2023) or broad motivational factors (Danlami et al., 2024), with less attention given to how specific scaffolding tools may simultaneously influence students' confidence in their mathematical abilities. This gap is critical because interventions that address both cognitive and affective domains are more likely to produce sustainable improvements in mathematics learning (Holenstein et al., 2022; Schöber et al., 2018). Moreover, the role of gender in shaping mathematics self-efficacy remains an area of ongoing debate. International evidence suggests that male students often report higher self-efficacy in mathematics than females, a disparity attributed to stereotype threat, social expectations, and differential classroom participation (Grigg et al., 2018; Skaalvik et al., 2015). In Sub-Saharan Africa, these differences are frequently reinforced by socio-cultural factors such as gender norms, access to resources, and societal perceptions of mathematics as a male-dominated field (Zakariya et al., 2022; Ibrahim et al., 2023). However, empirical findings are mixed; while some studies confirm significant gender gaps in mathematics self-beliefs (Zakariya, 2021), others suggest that when supportive and cognitively activating instructional strategies are used, these differences diminish (Dangur-Levy et al., 2023; H. Li et al., 2021). Against this backdrop, examining gender differences in the context of Advance Organisers is particularly important. If these scaffolds enhance self-efficacy equally across gender groups, they may serve as a valuable tool for fostering inclusivity and narrowing persistent gaps in mathematics education. Conversely, if disparities persist, this would signal the need for additional targeted interventions.

Methodology

Research Design

This study employed a quasi-experimental pretest-posttest non-equivalent control group design to examine the effect of Ausubel's Advance Organisers on students' mathematics self-efficacy in algebra. The design was considered appropriate because random assignment of students to groups was not feasible in the school setting, and intact classes were used instead. Both the experimental and control groups completed a pretest on mathematics self-efficacy before the instructional intervention and a posttest afterwards. The experimental group received instruction supported with Advance Organisers, while the control group was taught the same algebra topics using the conventional lecture method.

Population and Sample

The population of the study consisted of all Senior Secondary School Two (SSS II) mathematics students in Zaria Metropolis, Kaduna State, during the 2024/2025 academic session. This population was chosen because students at this level are introduced to more complex algebraic concepts that demand confidence and higher levels of self-efficacy, while still being free from the pressures of external exit examinations. From this population, a sample of 164 students was drawn from four intact classes in two coeducational schools that were purposively selected. The schools were comparable in terms of teacher qualifications, learning facilities, and student demographics. One school was assigned to the experimental group and the other to the control group, while intact classes were maintained to preserve the natural classroom structure.

Instrumentation

The instrument used for data collection was the Mathematics Self-Efficacy Scale (MSES), adapted from Bandura's (1997) self-efficacy framework and modified for the Nigerian secondary school context. The scale comprised 20 items rated on a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). The items measured students' confidence in handling algebra-related tasks such as solving equations, working with word problems, and interpreting algebraic expressions. The face and content validity of the instrument were established by three experts in mathematics education, educational psychology, and measurement and evaluation, ensuring the instrument was suitable, clear, and contextually appropriate. A pilot test conducted with a comparable group of students yielded a Cronbach's alpha of 0.87, indicating high internal consistency and reliability.

Data Collection Procedure

Data collection was conducted in three phases. In the pretest phase, both the experimental and control groups completed the Mathematics Self-Efficacy Scale (MSES) to establish baseline levels of self-efficacy. Extraneous variables were controlled by matching groups on prior performance and demographic characteristics, using the same instructor and standardised materials for both groups, and ensuring equal instructional time and content coverage. During the treatment phase, which lasted six weeks, the experimental group was taught algebra concepts using Advance Organisers such as outlines, concept maps, and structured diagrams, designed to link prior knowledge with new content. The control group was taught the same topics using the

conventional lecture method, without organisers. Both groups received equal instructional time and materials to ensure comparability. In the posttest phase, the MSES was re-administered to both groups, with items rearranged to reduce test–retest bias. These procedures ensured that observed differences in self-efficacy were attributable to the instructional strategy rather than extraneous factors.

Data Analysis

The data obtained were analysed using both descriptive and inferential statistics. Means and standard deviations were computed to describe students' mathematics self-efficacy across the two groups. To test the study's hypotheses, the Mann–Whitney U test was employed. This non-parametric alternative was selected because preliminary diagnostic checks indicated that the assumptions required for parametric tests such as ANCOVA (e.g., normality and homogeneity of variances) were not fully satisfied. The Mann–Whitney U test is suitable for comparing differences in central tendency between two independent groups and ensures that the analysis remains robust despite the data's deviation from parametric assumptions. For the Mann–Whitney U test, if the p-value ≤ 0.05 , the null hypothesis is

rejected, indicating a statistically significant difference between groups; if the p-value > 0.05 , the null hypothesis is not rejected, indicating no significant difference. All hypotheses were tested at the 0.05 level of significance in line with standard practices in educational research (Field, 2024).

Treatment Fidelity

To ensure that the intervention was implemented as intended, lesson plans for the experimental group were developed using Ausubel's Advance Organisers, including outlines, concept maps, and structured diagrams that explicitly linked prior knowledge to new algebraic concepts. These lesson plans were reviewed by two experts in mathematics education for content validity and alignment with the study objectives. During the six-week treatment period, the researcher conducted periodic classroom observations using a fidelity checklist to monitor adherence to the instructional procedures. In addition, the control group teacher was observed to confirm the consistent use of conventional lecture methods without organisers. These procedures ensured that differences in students' self-efficacy outcomes could be attributed to the instructional strategy rather than extraneous instructional variations.

Result

Research Question One

What is the difference in the self-efficacy level of students taught algebra using Ausubel's Advanced Organisers and those taught by the lecture method?

To answer this research question, descriptive statistics of students' self-efficacy levels were compared across the experimental and control groups. Figure 1 provides a boxplot visualisation of the distributions.

Figure 1

Boxplot of students' self-efficacy levels in algebra across experimental and control groups.

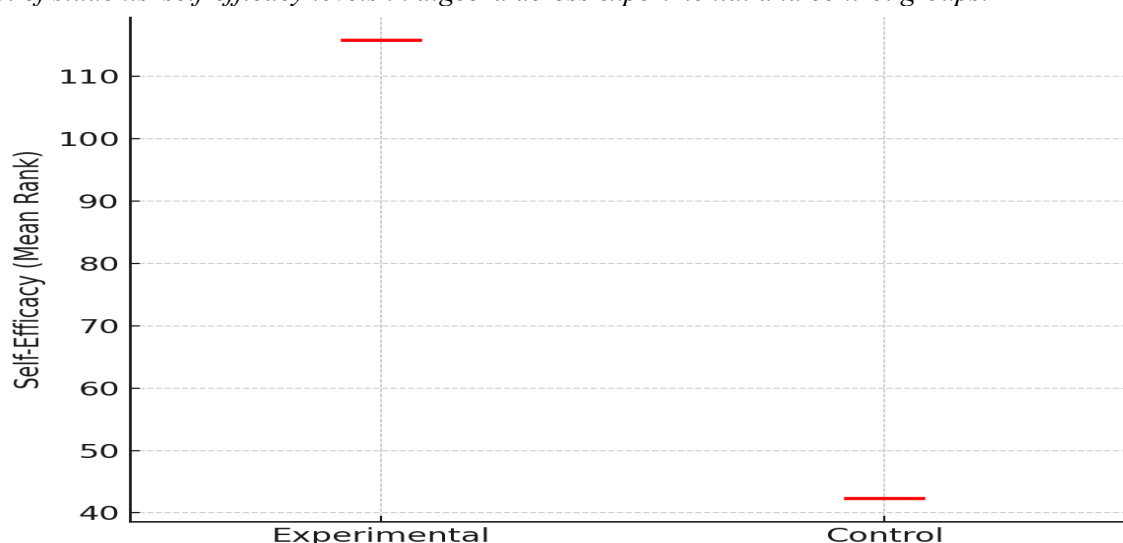


Figure 1 illustrates the distribution of students' self-efficacy levels in algebra for the experimental group

(n = 83), taught using Ausubel's Advance Organisers, and the control group (n = 77), taught using the

lecture method. The boxplot shows that the experimental group reported a higher median self-efficacy compared to the control group. Descriptive statistics support this pattern: students in the experimental group obtained a mean score of 70.51 (SD = 11.14), while the control group recorded a mean of 49.82 (SD = 11.87). Similarly, rank-based results showed that the experimental group achieved a mean rank of 115.80 (sum of ranks = 9,611.50), whereas the control group obtained a mean rank of

42.45 (sum of ranks = 3,268.50). The spread of scores also differed between groups. The interquartile range (IQR) for the experimental group was broader, indicating greater variability in self-efficacy beliefs, while the control group's distribution was more compressed, reflecting lower and more clustered confidence levels. The experimental group additionally showed higher maximum values, suggesting that some students achieved the highest levels of self-efficacy overall.

Null Hypothesis 1

There is no significant difference in self-efficacy between students taught algebra using Ausubel's Advanced Organisers and those taught using conventional lecture methods.

A Mann-Whitney U test was performed to assess differences in self-efficacy between the experimental group ($n = 83$) and the control group ($n = 77$). As shown in Table 1, the experimental group recorded a higher mean rank (115.80) compared to the control group (42.45), suggesting that students exposed to Advance Organisers generally reported greater levels of self-efficacy.

Table 1

Mann-Whitney U Test for Self-Efficacy between Experimental and Control Groups

Group	N	Mean (M)	SD	Mean Rank	Sum of Ranks	U	Z	p (2-tailed)	Effect size r
Experimental	83	70.51	11.14	115.80	9611.50				
Control	77	49.82	11.87	42.45	3268.50				
Test statistics	160					265.50	-10.02	< .001	.79

Note. Self-efficacy measured on a 5-point Likert scale rescaled to 100.

Table 1 presents the results of the Mann-Whitney U test comparing self-efficacy levels between students taught algebra using Ausubel's Advanced Organisers and those taught with the conventional lecture method. The experimental group ($n = 83$) reported a higher mean self-efficacy score ($M = 70.51$, $SD = 11.14$) and mean rank (115.80) than the control group ($n = 77$; $M = 49.82$, $SD = 11.87$; mean rank = 42.45).

The test indicated that this difference was statistically significant, $U = 265.50$, $Z = -10.02$, $p < .001$. The effect size was large ($r = .79$), signifying a strong practical influence of the instructional method on students' self-efficacy. Consequently, the null hypothesis that no significant difference exists between the two groups was rejected.

Research Question Two:

What is the difference in the self-efficacy level of male and female students when taught using Ausubel's advanced organisers?

To answer this research question, descriptive statistics of the self-efficacy levels of male and female students within the experimental group were compared. Figure 2 presents a bar chart visualisation of the mean self-efficacy scores for both genders.

Figure 2

Bar chart of male and female students' self-efficacy levels in algebra.

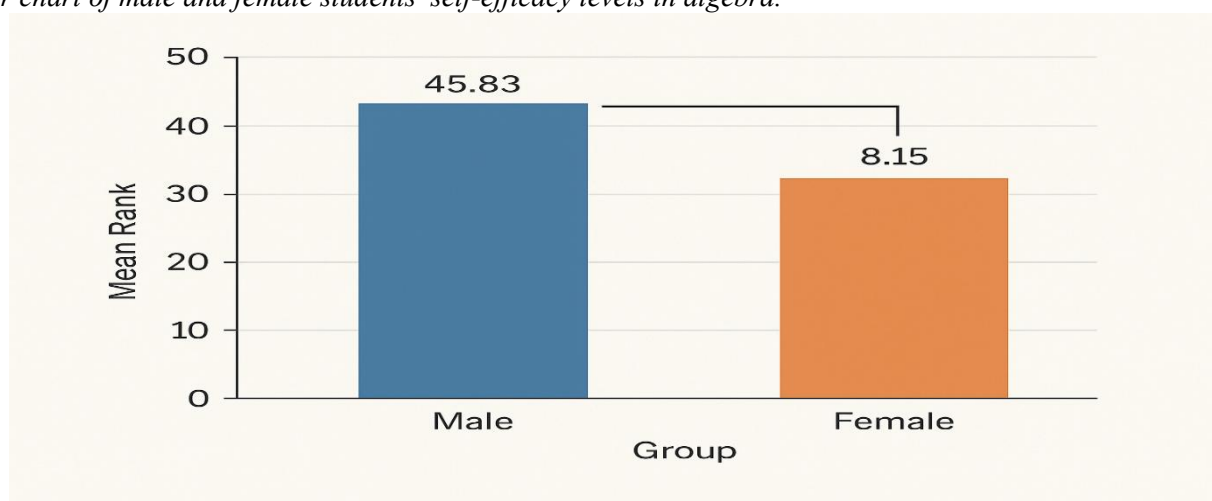


Figure 2 shows the distribution of self-efficacy levels among male ($n = 44$) and female ($n = 39$) students in the experimental group. Descriptive statistics indicate that male students obtained a mean self-efficacy score of 70.32 ($SD = 12.21$), while female students reported a closely similar mean of 70.72 ($SD = 9.96$). Rank-

based results provide further detail: male students recorded a mean rank of 45.83 (sum of ranks = 2,016.50), compared to a mean rank of 37.68 (sum of ranks = 1,469.50) for female students. The mean rank difference of 8.15 reflects a modest variation in self-efficacy beliefs between the two groups.

Null Hypothesis 2

There is no significant gender-based difference in self-efficacy among students exposed to Advanced Organisers. To examine this hypothesis, a Mann–Whitney U test was conducted to compare the self-efficacy levels of male and female students in the experimental group. The results are presented in Table 2.

Table 2

Summary of Mann-Whitney Test for Self-Efficacy between Male and Female Students in the Experimental Group

Group	N	Mean (M)	SD	Mean Rank	Sum of Ranks	U	Z	p (2-tailed)	Effect size r
Male	44	70.32	12.21	45.83	2016.50				
Female	39	70.72	9.96	37.68	1469.50				
Test statistics	83					689.50	-1.54	0.123	-0.17

Note. Self-efficacy measured on a 5-point Likert scale rescaled to 100.

Table 2 presents the results of the Mann–Whitney U test comparing self-efficacy levels of male and female students in the experimental group taught algebra using Ausubel's Advanced Organisers. Male students ($n = 44$) recorded a mean self-efficacy score of 70.32 ($SD = 12.21$; mean rank = 45.83), while female students ($n = 39$) reported a mean score of 70.72 ($SD = 9.96$; mean rank = 37.68). The Mann–Whitney U test indicated that this difference was not statistically significant, $U = 689.50$, $Z = -1.54$, $p = .123$. The effect size was small ($r = -0.17$), suggesting that gender accounted for little variation in students' self-efficacy within the experimental group.

Discussion

Two key findings emerged from the analysis: first, students taught with Advance Organisers reported

significantly higher self-efficacy than those taught with the conventional lecture method; and second, while male students recorded slightly higher self-efficacy levels than their female counterparts within the experimental group, this difference was not statistically significant.

For the first research question, the findings provide strong evidence that Ausubel's Advance Organisers positively influenced students' self-efficacy in algebra. Students in the experimental group achieved not only higher mean scores but also substantially higher mean ranks compared to their peers in the control group. The difference was large and practically meaningful, with an effect size of $r = .79$. This outcome aligns with previous research suggesting that instructional strategies which provide cognitive strategies, activate prior knowledge, and

clarify learning structures can foster confidence and perceived competence in mathematics (Borchers et al., 2025; Grothérus et al., 2019; Shao et al., 2023; Zuo et al., 2024). By presenting abstract algebraic concepts in an organised and meaningful way, Advance Organisers appear to enhance students' sense of control and mastery, thereby strengthening their self-efficacy beliefs.

To the second research question, the findings showed that male students reported slightly higher self-efficacy beliefs than female students, though the difference was not statistically significant and the effect size was small ($r = -0.17$). This suggests that the benefits of Advance Organisers were experienced relatively equally across genders. While some studies in Sub-Saharan Africa have reported persistent gender disparities in mathematics self-beliefs (Gyan & Mensah, 2025; Onoshakpokaiye, 2021), the current results indicate that gender may not play a decisive role when students are supported with structured cognitive strategies such as Advance Organisers. This reinforces the potential of innovative teaching approaches to mitigate gendered patterns of mathematics learning by creating more equitable opportunities for engagement and confidence-building.

Taken together, these findings underscore the dual value of Advance Organisers as both a cognitive and affective strategy. Beyond improving achievement, they appear to strengthen students' mathematics-related self-beliefs, which are critical predictors of persistence, motivation, and long-term success in STEM fields (Bandura, 1997; Semela et al., 2015). Importantly, the absence of significant gender effects suggests that Advance Organisers may serve as a particularly inclusive strategy in mathematics classrooms, ensuring that both male and female learners benefit equally. From a practical standpoint, the study highlights the importance of incorporating a structured instructional strategy into secondary mathematics teaching in Nigeria and similar contexts. Teachers should be encouraged and trained to use Advance Organisers not only to simplify complex content but also to enhance students' confidence and engagement. By addressing both cognitive and affective dimensions of learning, such approaches can contribute to improved learning outcomes and greater equity in mathematics education.

Conclusion

This study examined the effect of Ausubel's Advance Organisers on students' self-efficacy in algebra and explored potential gender differences among senior secondary school students in Zaria Metropolis. Findings showed that students taught with Advance

Organisers reported significantly higher self-efficacy than those taught via conventional lecture methods, with a large practical effect. Gender analysis revealed no statistically significant differences, suggesting that the benefits of Advance Organisers are equitable across male and female students. The study underscores that Advance Organisers not only enhance cognitive engagement but also strengthen students' confidence in handling abstract mathematical concepts. These findings support their integration into classroom practice, teacher education, and curriculum development.

Recommendation

1. Teachers should routinely adopt Advance Organisers in mathematics instruction; curriculum developers should incorporate them into instructional guidelines; and policymakers should promote their use to improve mathematics outcomes.
2. Future research should explore their effects in other areas of mathematics, other subject domains, and diverse contexts, including longitudinal studies to assess long-term impacts on students' confidence, achievement, and engagement in STEM pathways.

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