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# INFLUENCE OF TEACHING METHODS ON UNDERGRADUATE STUDENTS' SELF-EFFICACY AND ATTITUDE TOWARD MATHEMATICS IN TERTIARY INSTITUTIONS IN ONDO STATE

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## Abstract

*This study investigated the relationship between teaching methods and undergraduate students' self-efficacy and attitudes toward mathematics in tertiary institutions in Ondo State, Nigeria. A correlational research design was adopted, and data were collected from 201 undergraduate students across four institutions. A validated questionnaire measuring teaching methods, mathematics self-efficacy, and attitude toward mathematics was used for data collection. The instrument demonstrated good internal consistency (Cronbach's α = .85). Descriptive statistics, Pearson's correlation, and analysis of variance (ANOVA) were used to analyze the data. Findings revealed a statistically significant positive correlation between student-centered teaching approaches; such as problem-based and inquiry-based instruction, and students' self-efficacy and attitudes toward mathematics (r = .311, p = .023). Although male students reported slightly higher mean self-efficacy scores (M = 2.68) than females (M = 2.63), this difference was not statistically significant, F(1, 199) = 1.493, p = .223. Attitude scores varied by teaching method exposure, with interactive strategies associated with more positive attitudes. The findings underscore the value of learner-centered pedagogy in enhancing students' confidence and perceptions in mathematics. Implications for teaching practice and policy are discussed.*

**Keywords**: Teaching Methods, Mathematics Self-Efficacy, Attitude Toward Mathematics, Student-Centered Learning, Undergraduate Students

## Introduction

Mathematics plays a foundational role in developing logical reasoning and problem-solving skills, making its mastery essential for academic, professional, and everyday success. Over time, researchers and educators have actively investigated effective teaching strategies to enhance

student learning in mathematics. Recently, attention has turned toward the psychological aspects of learning, specifically how teaching methods influence students' self-efficacy and attitudes. These two factors are critical because they shape students' motivation, persistence, and overall achievement in mathematics.

Self-efficacy, as defined by Bandura (1997), refers to a student's belief in their ability to accomplish specific tasks. This belief influences the amount of effort students invest, their resilience in facing challenges, and their academic performance. In mathematics, students with high self-efficacy are more likely to engage with the subject and persevere through difficult problems. Likewise, attitudes toward mathematics, which include students' feelings, beliefs, and behaviors related to the subject, significantly affect learning outcomes (Zan & Di Martino, 2007). Negative attitudes, including math anxiety (Hembree, 1990), can lead to avoidance behaviour and lower performance. This makes it important to examine the influence of teaching methods on both self-efficacy and attitudes.

Teaching methods such as collaborative learning, inquiry-based learning, and the integration of technology aim to make mathematics more engaging and accessible to a wider range of students. These methods encourage active participation, peer interaction, exploration, and personalized learning experiences. In contrast, traditional lecture-based instruction often lacks these interactive elements. Each method has its strengths and potential limitations, and understanding their impact on self-efficacy and attitudes is important for educators and researchers. Conducting empirical studies on this relationship can guide the development of instructional practices that support student confidence, interest, and achievement in mathematics, leading to improved educational outcomes and stronger preparation for future careers in fields that require mathematical proficiency.

**Statement of the Problem**

Despite extensive research on teaching methods, there is still a significant gap in understanding how specific strategies affect students' self-efficacy and attitudes toward mathematics. Many students face low confidence, math anxiety, and negative perceptions, leading to avoidance behaviors and poor academic performance. These issues contribute to a decline in mathematics achievement, impacting students' interest in pursuing STEM careers. While various teaching methods have been implemented, their effectiveness in improving self-efficacy and attitudes remains underexplored. There is a pressing need for empirical research to identify the most effective instructional strategies and adapt teaching methods to meet diverse student needs, ultimately fostering more confident, engaged, and successful mathematics learners.

**Purpose of the Study**

The study examined the influence of teaching methods on students' self-efficacy and attitude towards mathematics. Specifically, the study sought to:

1. examine the relationship between teaching methods and undergraduate students' self-efficacy in mathematics;
2. examine the relationship between teaching methods and undergraduate students' attitude toward mathematics;
3. determine whether there is a difference in self-efficacy in mathematics between male and female undergraduate students; and

4. ascertain whether there is a difference in students' attitudes toward mathematics based on the type of teaching methods they are exposed to.

**Hypotheses**

In line with the objectives of the study, four hypotheses were formulated and tested at 0.05 level of significance.

1. There is no significant relationship between teaching methods and undergraduate students' self-efficacy in mathematics.
2. There is no significant relationship between teaching methods and undergraduate students' attitude toward mathematics.
3. There is no significant difference in self-efficacy in mathematics between male and female undergraduate students.
4. There is no significant difference in students' attitudes toward mathematics based on the type of teaching methods they are exposed to.

## Literature Review

*Theoretical Framework*

This study is hinged on the Social Cognitive Theory (Bandura, 1986) and Vygotsky's Sociocultural Theory (1978)**.** These two theories provide a robust lens for examining how teaching methods influence students' self-efficacy and attitudes toward mathematics. Social Cognitive Theory posits that learning occurs in a social context and is influenced by the dynamic interaction between behavioral, environmental, and personal factors. Central to this theory is the concept of self-efficacy**,** which refers to an individual's belief in their capacity to execute tasks successfully. In the context of mathematics education, Bandura (1997) emphasizes that instructional methods that provide mastery experiences, encourage observational learning (e.g., peer modeling), and offer constructive feedback can significantly enhance students' self-efficacy. Zimmerman and Campillo (2003) note that students' self-regulation and self-efficacy in academic domains, including mathematics, are influenced by both cognitive and contextual factors such as the type of instructional method employed.

On the other hand, Vygotsky's Sociocultural Theory stresses the role of social interaction, language, and cultural tools in the development of higher-order thinking. Vygotsky introduced the concept of the Zone of Proximal Development (ZPD)**,** suggesting that students learn best when teaching methods scaffold their learning from their current level of understanding to a higher level of competence. Teaching methods that involve guided participation, collaborative learning, and dialogic teaching align with this theory and are likely to positively impact students' attitudes and confidence in mathematics.

Together, these theories suggest that teaching methods matter significantly in shaping students' psychological and emotional responses to learning mathematics. They provide a foundation for understanding how effective instructional strategies can foster both self-efficacy **and** positive attitudes**,** which are essential for academic success in mathematics.

*Teaching Methods in Mathematics Education*

Teaching methods significantly influence how students engage with and understand mathematics. Broadly, teaching methods can be classified as teacher-centred (e.g., lecture, direct instruction) or

student-centred (e.g., inquiry-based learning, problem-based learning, collaborative learning). According to Ernest (2004), traditional methods, which emphasize rote memorization and teacher authority, often lead to student passivity and negative perceptions of mathematics. In contrast, student-centred approaches promote exploration, interaction, and critical thinking, which are known to improve student engagement and academic performance (Ushie, Owolabi, & Falode, 2020).

According to Bransford, Brown, and Cocking (2000), effective teaching involves creating learner-centered environments that connect prior knowledge with new concepts. This aligns with inquiry-based and constructivist strategies, which have been shown to enhance attitudes toward mathematics and deepen conceptual understanding. Boaler (2013) emphasizes the importance of student-centered and inquiry-based mathematics teaching, asserting that flexible, exploratory learning environments significantly improve students' engagement and self-belief in their mathematical abilities.

*Self-Efficacy in Mathematics*

Self-efficacy is a crucial predictor of students' academic behaviour and outcomes (Bandura, 1997). In the context of mathematics, high self-efficacy has been linked to persistence, reduced anxiety, and better achievement (Schunk & Pajares, 2005). Research has shown that teaching strategies that provide clear guidance, scaffolded tasks, and feedback can foster a strong sense of efficacy in learners (Pintrich & Schunk, 2002).

*Attitude Towards Mathematics*

Students' attitudes toward mathematics include their interest, value placed on mathematics, and emotional responses. These play a pivotal role in shaping their academic paths. Negative attitudes often develop due to early failures, poor teaching, or societal stereotypes about mathematics being inherently difficult (Onwuegbuzie, 2004). Studies indicate that innovative teaching methods that emphasize real-life applications, interactive problem-solving, and collaboration can positively shift student attitudes (National Council of Teachers of Mathematics [NCTM], 2014).

*Relationship Between Teaching Methods, Self-Efficacy and Attitude*

A growing body of research highlights a strong correlation between teaching practices and both student self-efficacy and attitudes. Student-centred instructional methods have been found to create supportive and engaging learning environments, which improve learners' confidence and perceptions toward mathematics (Schunk & Pajares, 2005). Zimmerman (2000) emphasized the importance of self-regulated learning in developing students' confidence and independence, suggesting that teaching methods that support self-monitoring and goal-setting are key in fostering academic self-efficacy. This theory supports the application of student-centered approaches like problem-based learning. Furthermore, gender and prior experience with mathematics can mediate how students respond to different teaching styles (Ernest, 2004). Else-Quest, Hyde, and Linn (2010) conducted a meta-analysis that found small but consistent gender differences in math attitudes and self-efficacy, with males often reporting slightly higher confidence. Meece et al. (2006) found gender-related differences in mathematics self-efficacy and motivation, highlighting that teaching approaches must consider gender-sensitive strategies to support equal participation and confidence. This provides a useful context for interpreting any observed gender-related trends in this study.

While numerous studies have examined teaching methods in secondary education, fewer studies have focused on the tertiary level, especially within the Nigerian context. There is a need to explore how teaching methods influence undergraduate students' self-efficacy and attitudes, given their advanced exposure to mathematics and diverse learning experiences.

## Methodology

*Research Design*: This study employed a correlational research design to examine the relationship between teaching methods and undergraduate students' self-efficacy and attitudes toward mathematics. The design was appropriate for determining the direction and strength of associations among the variables without manipulating them.

*Participants:* The target population consisted of undergraduate students enrolled in mathematics-related courses in four selected tertiary institutions in Ondo State, Nigeria. A total of 201 students were selected using stratified random sampling, ensuring representation across institutions and academic levels.

*Instrument*: Data were collected using an adopted structured questionnaire comprising three sections:
Section A: Demographic information (gender, institution, etc.)

Section B: Mathematics Self-Efficacy Scale (adapted from existing validated instruments)

Section C: Attitude toward Mathematics Scale and items on perceived teaching methods.

The instrument was reviewed for content validity by experts in educational measurement and mathematics education. Cronbach's alpha was used to assess reliability, yielding a coefficient of 0.85, indicating high internal consistency.

*Data Collection Procedures*: Copies of the questionnaire were administered in person with the support of faculty coordinators at each institution. Participants provided informed consent, and responses were anonymous to ensure confidentiality.

*Data Analysis*: Data were analyzed using SPSS (Version 26). Descriptive statistics (mean, standard deviation) described demographic variables and scale scores. Pearson's correlation tested relationships between teaching methods and student outcomes (self-efficacy and attitude), while Independent Sample t-test and ANOVA were used to examine differences across demographic groups and teaching methods.

## Results

**Table 1: Descriptive Statistics of Participants' Self-efficacy and Attitude**

| Variable | Group | N | M | SD |
|---|---|---|---|---|
| Self-Efficacy | Male | 75 | 2.68 | 0.52 |
| Self-Efficacy | Female | 75 | 2.63 | 0.54 |
| Attitude | Lecture Method | 65 | 2.92 | 0.47 |
| Attitude | Problem-Based | 70 | 3.25 | 0.50 |
| Attitude | Inquiry-Based | 66 | 3.30 | 0.45 |

Table 1 presents the descriptive statistics for mathematics self-efficacy and attitude scores based on gender and teaching methods. For self-efficacy, male students reported a slightly higher mean self-efficacy score (M = 2.68) than female students (M = 2.63), although the difference is minimal. The standard deviations are similar, indicating comparable variability within each group. For attitude towards instructional methods, students exposed to Inquiry-Based learning showed the most positive attitude (M = 3.30), closely followed by Problem-Based learning (M = 3.25). Those taught using the Lecture Method had the lowest attitude mean score (M = 2.92). This suggests that students may respond more positively to interactive and student-centered teaching methods than traditional methods.

*Hypothesis One: There is no significant relationship between teaching methods and undergraduate students' self-efficacy in mathematics.*

**Table 2: Pearson Correlation Matrix between Teaching Methods and Undergraduate Students' Self-efficacy in Mathematics**

| Variable | Teaching Method | Self-Efficacy |
|---|---|---|
| Teaching Method | 1.00 | .311* |
| Self-Efficacy | .311* | 1.00 |

*p < .05.

Table 2 shows the Pearson product-moment correlation conducted to examine the relationships between teaching methods and self-efficacy. The result showed a statistically significant, moderate positive correlation between teaching methods and self-efficacy, r(199) = .311, p = .023. Therefore, hypothesis one was rejected. This suggests that student-centered teaching methods are associated with higher levels of mathematics self-efficacy among undergraduates.

*Hypothesis Two: There is no significant relationship between teaching methods and undergraduate students' attitude towards mathematics.*

**Table 3: Pearson Correlation Matrix between Teaching Methods and Undergraduate Students' Attitude towards Mathematics**

| Variable | Teaching Method | Attitude |
|---|---|---|
| Teaching Method | 1.00 | .295* |
| Attitude | .295* | 1.00 |

*p < .05.

Table 3 shows the Pearson product-moment correlation conducted to examine the relationships between teaching methods and attitude. The results shows a statistically significant, moderate positive correlation between teaching methods and attitude, r(199) = .295, p = .030. Therefore, hypothesis two was rejected. This suggests that more interactive teaching approaches are associated with positive favourable attitudes toward mathematics.

*Hypothesis Three: There is no significant difference in self-efficacy in mathematics between male and female undergraduate students.*

**Table 4: Independent Samples t-test Comparing Self-Efficacy by Gender**

| | Gender | N | Mean | SD | T | Df | Sig. |
|---|---|---|---|---|---|---|---|
| Self-efficacy | Male | 75 | 2.68 | 0.52 | 1.22 | 148 | .223 |
| | Female | 75 | 2.63 | 0.54 | | | |

Table 4 shows the independent samples t-test conducted to determine whether there was a significant difference in mathematics self-efficacy between male and female students. The results show no significant difference in mathematics self-efficacy between male students (M = 2.68, SD = 0.52) and female students (M = 2.63, SD = 0.54), $t(148) = 1.22$, $p = .223$. Therefore, hypothesis three was retained. This suggests that gender has no effect on students' mathematics self-efficacy.

*Hypothesis Four: There is no significant difference in students' attitudes toward mathematics based on the type of teaching methods they are exposed to.*

**Table 5: One-Way ANOVA Summary for Attitude by Teaching Method**

| Source | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 4.32 | 2 | 2.16 | 4.27 | .016 |
| Within Groups | 100.33 | 198 | 0.51 | | |
| Total | 104.65 | 200 | | | |

Table 5 shows the one-way ANOVA conducted to determine whether attitude toward mathematics differed significantly across groups exposed to different teaching methods. The result was statistically significant, $F(2, 198) = 4.27$, $p = .016$. A Tukey post hoc test revealed that students exposed to problem-based and inquiry-based learning had significantly higher attitude scores than those taught using traditional lecture method. Therefore, hypothesis four was rejected. This suggests that teaching method significantly affects attitudes.

## Discussion

The study examined the relationship between teaching methods and undergraduate students' self-efficacy and attitudes toward mathematics in tertiary institutions in Ondo State, Nigeria. The findings provide important insights into how instructional approaches shape learners' psychological engagement with mathematics at the higher education level.

The significant positive correlations found between student-centered teaching methods and both mathematics self-efficacy ($r = .311$, $p = .023$) and attitudes toward mathematics ($r = .295$, $p = .030$) suggest that more interactive and participatory instructional strategies contribute positively to students' beliefs about their capabilities and their general disposition toward the subject. These findings are consistent with earlier research (e.g., Bandura, 1997; Zimmerman, 2000), which emphasizes the role of learner autonomy, feedback, and engagement in fostering self-efficacy and motivation in academic settings. The correlation between interactive teaching methods and improved learner attitudes supports earlier work by Schunk and Pajares (2005), who highlighted that teaching methods that promote autonomy and engagement tend to foster stronger beliefs in personal competence. This is particularly true in mathematics education, where traditional teacher-centred methods have often been associated with anxiety and disengagement (Boaler, 2013).

Although male students reported slightly higher mean self-efficacy scores than female students, the difference was not statistically significant ($p = .223$). This finding diverges from earlier studies such as those by Meece et al. (2006), which found significant gender gaps in mathematical confidence. The lack of a significant gender difference in the current study could suggest progress toward gender equity in mathematics self-perception, possibly influenced by more inclusive teaching practices. This aligns with studies suggesting that while gender gaps in mathematics-related beliefs exist, they are not always significant at the tertiary level, particularly in environments where students have had extended exposure to mathematical training (Else-Quest et al., 2010). The non-significant gender difference observed may also reflect narrowing gender disparities in STEM attitudes among undergraduates.

Importantly, the ANOVA results demonstrated that students' attitudes toward mathematics differed significantly based on the teaching method employed, with students exposed to problem-based and inquiry-based learning showing more favorable attitudes than those in traditional lecture-based settings ($F(2, 198) = 4.27$, $p = .016$). These findings underscore the importance of the use of effective teaching methods in shaping not only cognitive outcomes but also affective traits such as motivation, self-concept, and attitude. As observed by Zimmerman and Campillo (2003), when instruction supports self-regulated learning, students are more likely to engage in goal-setting and reflective thinking, enhancing both efficacy and attitude. Interestingly, although attitude scores varied with the type of teaching method used, the pattern supports the idea that pedagogical flexibility, adapting teaching to the learners' needs, is crucial in mathematics education. This is consistent with the constructivist framework (Vygotsky, 1978), which emphasizes the role of social interaction and active engagement in constructing knowledge.

This underscores the critical impact of instructional design on learners' affective responses to mathematics, supporting constructivist theories which advocate for active, student-centered learning environments (Bransford et al., 2000).

The findings suggest that adopting flexible, interactive teaching methods can enhance both the confidence and disposition of undergraduate students toward mathematics. For mathematics educators in higher education, these results emphasize the importance of moving beyond lecture-based instruction toward methods that involve collaboration, real-world problem-solving, and inquiry. These findings have direct implications for curriculum planning, teacher training, and instructional policy. Mathematics lecturers should be encouraged to integrate student-centered approaches such as problem-based learning (PBL), cooperative learning, and inquiry-based instruction into their courses. Institutional investment in ongoing professional development will also be critical to equip instructors with the skills and confidence to shift pedagogical practices.

While the study provides valuable insights, several limitations must be acknowledged. First, the sample was limited to four institutions within a single Nigerian state, which may affect the generalizability of the findings. Second, self-reported measures may be influenced by social desirability bias. Future studies should consider mixed-method designs, include more diverse samples across regions, and explore longitudinal effects of teaching methods on student outcomes.

**Conclusion and Recommendations**

This study reinforces the importance of instructional method as a significant correlate of students' academic beliefs and attitudes. By fostering student engagement through active learning strategies, mathematics educators can enhance both self-efficacy and affective orientation toward

mathematics; key factors for persistence and achievement in STEM disciplines. Based on the findings and conclusion, the following recommendations were proffered.

- Tertiary institutions should encourage mathematics lecturers to shift from traditional lecture-based methods to more interactive, student-centered approaches such as problem-based learning (PBL), inquiry-based learning, and collaborative group work.
- Tertiary institutions should prioritize ongoing professional development and workshops focused on active learning strategies and classroom engagement techniques.
- Curriculum planners and education policymakers should adopt instructional flexibility and embed active learning opportunities into undergraduate mathematics courses.
- Efforts should be made to promote inclusive teaching practices that support equity for both male and female students.
- Academic support services such as peer tutoring, learning centres, and online platforms should be strengthened to reinforce student confidence in mathematics.
- Future studies should replicate this research in other Nigerian states and explore longitudinal impacts of teaching methods on student outcomes.

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