

Teachers' Problem-Solving Skills as Predictor of Senior Secondary Students' Task Persistence in Mathematics in Cross River State

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Abstract

This study examined teachers' problem-solving skills as predictor of senior secondary students' task persistence in mathematics in Cross River State. Two research questions and two null hypotheses were created to guide the study. This study was conducted using a correlational survey design. All 13,922 senior secondary three (SS 3) math teachers and students in Cross River State's 269 public secondary schools made up the study's population. 377 respondents 16 male math teachers, 16 female math teachers, and 345 students made up the study's sample size. The sample for this study was selected using a multi-stage selection technique. Data was gathered using the Students' Mathematics Task Persistence Rating Scale (SMTPRS) and the Rating Scale for Mathematics Teachers Problem Solving Skills (RSMT PSS). RSMT PSS and SMTPRS had reliability values of 0.81 and 0.91, respectively. Research problems were addressed using Pearson Product Moment Correlation, and all hypotheses were examined using regression ANOVA (F-ratio) at a significance level of 0.05. The findings showed a significant and favorable relationship between students' task persistence in learning mathematics and teachers' problem-solving abilities. The results also demonstrate that students' task endurance in learning some-infused mathematical concepts was significantly predicted by teachers' problem-solving abilities. With a coefficient of determination of 0.19, or 19% predictive capacities, male math teachers' problem-solving abilities predicted students' task persistence in studying mathematics more than their female counterparts. It was suggested that math teachers participate in ongoing professional development courses aimed at improving their ability to solve problems, think strategically, and effectively teach enriched subjects.

Keywords: Mathematics, Predictor, Problem-solving skills, Task persistence, Teachers.

Introduction

Teachers work in the classroom plays a major role in curriculum implementation; this makes them to continually be the most vital resource in the educational system. Through teachers' pedagogical choices, classroom interactions, and professional competences, convert curriculum intents into meaningful learning experiences they could be seen in today's educational discourse as instructional leaders. Teacher quality is the most significant school-based factor affecting children's academic and behavioural performance (Darling-Hammond, 2020; OECD, 2019). Students' acquirer organized experiences, conceptual knowledge, problem-solving techniques, and cognitive resources necessary for lifelong learning in the context of mathematical education from teachers. Regardless of how well-designed mathematics curricula are or how suitable instructional materials and facilities may be, the success of its implementation mostly depends on teachers' topic knowledge and problem-solving abilities (Ball, Thames, & Phelps, 2020; Hill, 2020). This implies that the professional competency of teachers, especially their problem-solving skills is still the determinant of the quality of educational output in senior secondary schools in Cross River State. Pedagogical reasoning, analytical thinking, and strategic decision-making in resolving instructional issues, in addition to their aptitude for accurate computation could skills that belong to teachers' problem-solving skills. Mathematical problem-solving competency is defined as the capacity to understand issues, express them in a variety of ways (symbols, diagrams, models), choose suitable approaches, defend methods, and assess solutions (Liljedahl et al., 2021; Schoenfeld, 2019). This means that employing visual aids, model strategic thinking, and examine how students solve issues are constitutes mathematics teachers successfully use of problems solving skills. Chapman (2020) opined that mathematics instruction is effective, when teachers guide students through systematic reasoning processes and make their thoughts evident. Consequently, teachers' problem-solving skills could be seen then as the capacity to properly explain mathematical concepts, convert symbolic expressions into everyday language, scaffold complex activities, and encourage reflective evaluation of answers.

Problem solving stills is widely acknowledged as a fundamental 21st-century competency because it gives students the ability to negotiate complicated, unexpected circumstances, problem-solving (OECD, 2021; UNESCO, 2020). The ability of teachers to solve problems is essential to establishing real-world learning settings where students actively participate in tasks that demand for analysis, reasoning, and strategic decision-making rather than just following procedures in mathematics education in particularly. Deeper conceptual understanding, greater strategic flexibility, and higher levels of engagement when teachers create and implement structured problem-solving approaches, such as tasks requiring investigation, reasoning justification, and application of multiple strategies are typically develop by students (Smith et al., 2022; Trigo, 2024). Critical thinking, draw connections between representations, and consider how they solve problems all of which are essential components of a solid mathematical understanding are developed by students. Research abounds that students do not only perform better on difficult tasks but also exhibit greater persistence and a willingness to tackle challenging material once teachers support problem-solving through scaffolded questioning, metacognitive prompts, and collaborative exploration, (Stein et al., 2020; Boaler, 2022). These approaches stand in blunt opposition to conventional, procedural teaching techniques, where memorization of procedures or formula application are emphasized. Since it is unable to relate procedures to underlying concepts or employ strategies flexibly, learners are more likely to experience fragmented understanding, low motivation, and disengagement in settings where instruction emphasizes rote procedures without meaningful problem engagement (OECD, 2021). Therefore, Students ability to use

mathematics to figure out things and keep going when it gets tough depends on how good their teachers are at solving problems. The way teachers solve problems skills really affects students' mathematics skills. How they deal with hard situations. Students learn to think and stick with it when things get difficult because their teachers are good, at problem-solving.

Evidence shows that some teachers still struggle with mathematics and solving teaching problems even though they are very important for teaching. Teachers need to be good at math and know how to explain it to students. Mathematical reasoning and problem-solving are skills, for teachers. They help teachers make lessons that work for their students. Studies conducted in topics in mathematics like calculus, coordinate geometry, matrices, and statistics, in sub-Saharan Africa reveal deficiencies in instructors' content knowledge and strategic teaching techniques (Tatto et al., 2020; Mereku, 2021). Recent publications (FRN, 2019; WAEC Chief Examiners' Report, 2022), also revealed that teachers' poor problem-solving skills and lack of professional development chances are contributing factors to the ongoing difficulties in mathematics instruction in Nigeria. These deficits may affect how students behave, think about learning mathematic and their academic performance in mathematics may suffer because of this.

The quality of instruction is affected by a crucial behavioural trait which is task persistence. Task persistence is students' perseverance, fortitude, and resolve to keep working on difficult assignments in spite of obstacles (Duckworth, 2019; Credé, 2021). Students' effort continually to solve challenging problems in mathematics, their continue willingness to try new approaches, and their refusal to give up is task persistence in mathematics is task persistence in mathematics. Studies revealed that, instructional strategies that encourage reasoning, autonomy support, and structured problem-solving increase students' perseverance (Skinner & Pitzer, 2020; Ryan & Deci, 2020). This suggest that persistence, strategic thinking, and reflective practice that students are likely to emulate are products of strong problem-solving abilities.

On the other hand, the situation in which mathematics instruction primarily relies on rote procedures, poorly structured explanations, or a lack of strategic guidance, students are more likely to feel frustrated, lose confidence, and have higher levels of mathematics anxiety factors that prevent them from persevering through difficult tasks. Memorization of steps without conceptual understanding can unintentionally cause anxiety and disengagement in students, especially when they perceive tasks as overwhelming or disconnected from meaning, according to research in mathematics education are emphasized by traditional or teacher-centered methods (Wen & Dubé, 2022; Estonanto et al., 2019). It is well recognized that cognitive skills like working memory, making it more difficult for students to maintain effort or persevere through challenging problems are adversely affected by mathematics anxiety, which is characterized by tension and worry when faced with mathematical tasks (Wu et al., 2020; Zhang et al., 2019). Students' motivation and task perseverance is lowered through avoidance, low self-confidence, and disengagement can reinforce one another in a feedback loop caused by high anxiety and bad classroom experiences (Makaka et al., 2023). On the contrary, learning settings that involve students in cognitively challenging tasks and offer suitable scaffolding, prompts, and strategic support enhances better persistence and resilience in problem-solving. When teachers offer scaffolds to help them overcome obstacles, students are encouraged to conceptualize problems and they show greater levels of perseverance and are better able to re-engage after facing challenges (Middleton et al., 2022; DiNapoli & Miller, 2023). Conceptual thinking supports the cognitive processing required for deep mathematical reasoning, scaffolding prompts helps students control their emotional reactions to difficulty, increasing engagement and perseverance (Stein et al., 2022). This suggest that teachers' problem-solving abilities could significantly predict students' propensity to persevere through difficult

arithmetic assignments. Concerns about pupils' persistently poor performance on senior secondary school math exams in Cross River State have continued to draw attention from academics and policymakers. According to the WAEC Chief Examiners' Reports (2020–2023), students' incapacity to maintain effort in multi-step issues, poor logical thinking, and inadequacies in problem-solving skills are repeatedly highlighted would be connected to teachers' problem-solving skills and instructional strategies. The complex and abstract concepts like differentiation, integration, and coordinate geometry demand strategic reasoning could be resolved by teachers' expertise and modeling of problem-solving procedures. Students are more likely to stay engaged once they learn in a learning environment that is supportive where they are encouraged to be independent and feel capable, they (Ryan & Deci, 2020). Social and educational environment may also impact a student's determination to keep going. Students may really boost their confidence and motivation once teachers take time to guide students through a step-by-step problem-solving process, give constructive feedback, and encourage students to think critically about problems. How they feel about mathematics and are motivated to learn better would be enhanced by a teacher's ability to solve problems may not only affects how well students understand mathematics. Gender as a moderating factor in math education is still up for debate. While some recent research indicates that there are no appreciable gender differences in instructional ability (Breda & Napp, 2019), other research indicates that instructor qualities, including gender, may have an impact on students' motivating beliefs and classroom interaction patterns (OECD, 2019). Given these conflicting results, it is necessary to investigate whether gender influences the relationship between math teachers' problem-solving abilities and students' task persistence in the Cross-River State setting. There is a strong need to look into teachers' problem-solving abilities as a predictor of senior secondary students' task persistence in mathematics given the ongoing low achievement in mathematics, reports of students' poor problem-solving proficiency, and conflicting results regarding moderating variables like gender. This study specifically ascertained if gender moderates the association between teachers' problem-solving skills and students' task persistence.

Literature Review

There have been increasing recognition of as teachers' problem-solving skills as an important factor influencing students' learning outcomes and behavioural engagement in mathematics. Through reasoning processes, and provide effective instructional support during learning activities, teachers' ability to analyze mathematical situations, apply appropriate strategies, guide learners is problem-solving skills. Teachers who make classrooms fun and interactive help students think critically and solve problems, encourage students to join in and take part in mathematics lessons. These teachers are usually good, at solving problems themselves (Schoenfeld, 2019). These teachers use a few methods to help students learn mathematics. They ask questions, provide support to help students understand the ideas, show students ways to solve a problem. This helps students learn mathematics concepts and keep trying when the work gets tough. They want students to keep going even when they find something hard. These teachers use things like questioning techniques and scaffolding to help mathematics learners.

Plenty research show that instructional competence of teachers significantly affects students' persistence and engagement in mathematics learning. Boaler (2022) found that students who are taught demonstrate greater confidence and willingness to persevere through challenging mathematical activities when teachers who emphasized conceptual understanding and strategic problem-solving. Similarly Stein et al. (2020) found that students get more motivated, resilient and engaged when doing math tasks if they are taught problem-solving. This also suggests that when

teachers show students how to reason and give them help with thinking it can help students stay focused and keep trying to solve math problems.

Task persistence is students' ability to sustain effort and continue working on difficult academic tasks despite obstacles or frustration (Duckworth, 2019). Task persistence is essential because many mathematical activities require sustained concentration, logical reasoning, and repeated attempts before solutions are achieved in mathematics. Research showed that students' persistence in mathematics learning is enhanced by supportive instructional practices, including scaffolded guidance and collaborative problem-solving significantly (Middleton et al., 2022). When teachers encourage students, provide constructive feedback, and opportunities for students to think reflectively during classroom activities students tend to most likely persevere.

Ineffective teaching approaches with reduced persistence and increased mathematics anxiety among students have connections. Wen and Dubé (2022) revealed that when teachers focus on making students memorize things it does not help students to really understand problems. Because students who just memorize the answers, do not really reflect about the problems. Likewise, Makaka et al. (2023) in their study revealed that that students that do not get help from teachers often likely frustrated when they are doing tasks in mathematics, they do not feel confident, and they try to avoid doing mathematics. These suggest that the way teachers solve problems effect student's mathematics learning. The problem-solving skills of teachers are very important, for mathematics learning. Mathematics is the thing that is affected by the way teachers teach and solve problems. In Africa, empirical studies conducted also support the relationship between teacher competence and students' behavioural outcomes in mathematics. Mereku (2021) reported that inadequate pedagogical and problem-solving skills among mathematics teachers contributed to poor student engagement and low achievement in secondary schools. WAEC Chief Examiners' Reports (2020–2023) steadily identified that Nigeria students' inability to solve multi-step problems and sustain effort in mathematics examinations as major weaknesses. WAEC Chief Examiners' Reports further emphasized the need for teachers to embrace instructional methods that are more strategic and problem-solving-oriented. In spite of the growing body of literature on mathematics instruction and student engagement, several gaps still exist Limited attention are given specifically to task persistence as a behavioural outcome, most previous studies focused mainly on students' academic achievement, mathematics anxiety, or general classroom engagement. Also, without concentrating specifically on teachers' problem-solving skills as predictors of students' persistence in mathematics tasks, many studies examined teachers' instructional competence broadly. In Cross River State, Nigeria few empirical studies have investigated this relationship within the context of senior secondary schools. It became difficult to generalize their findings to the sociocultural and educational realities of Cross River State because existing studies were largely conducted outside the state or in different educational settings. Evidence on whether gender moderates the relationship between teachers' problem-solving skills and students' task persistence in mathematics were also limited. It is against these identified gaps that the present study investigated teachers' problem-solving skills as predictors of senior secondary students' task persistence in mathematics in Cross River State.

Methodology

Research Design

The research design used in this study was a correlational survey. The design of the study is considered sufficient because it helps to illustrate the kind and degree of the relationship between the variables under investigation. The design allows the researcher to ascertain whether students'

self-efficacy in the infused themes in the senior high school mathematics curriculum is correlated with teachers' problem-solving abilities. Cross River State was the study's location. The state was selected for this study since it has been noted more often that some pupils lose motivation to finish mathematical activities when they encounter difficulties. Furthermore, the causes of students' avoidance and lack of enthusiasm are still unknown. These, along with other factors, may have contributed to students' consistent and recurrent low performance in mathematics on the West African Examination Council (WAEC) and National Examination Council (NECO). As a result, students have been unable to gain admission to the courses of their choice in postsecondary institutions because admission requires mathematics at the credit level. Also, from the literature, not much study has been carried out on mathematics teachers' problem-solving skills in teaching mathematics and in Cross River State.

Sample and Data Collection

The study's population comprised 13,653 senior secondary three (SS 3) students and all 269 senior secondary three (SS 3) mathematics teachers in the 269 public secondary schools in Cross River State that run senior secondary.

377 respondents 16 male math teachers, 16 female math teachers, and 345 students—made up the study's sample size. 377 respondents 16 male math teachers, 16 female math teachers, and 345 students were selected using Cohen, Manion, and Morrison's (2018) criteria for a population of roughly 13,922 at a 95 percent confidence level. Correlation analysis is predicated on the idea that "x must be equal to y" for the purposes of data analysis. As a result, the 345-student sample size was reduced to 32 students.

The Students' Mathematics Task Persistence Rating Scale (SMTPRS) and Teachers Problem-solving Skills (RSMT PSS) were the tools utilized to gather data for this study. A measurement and evaluation specialist assisted in the development of the Rating Scale for Mathematics Teachers Problem-solving Skills (RSMT PSS). There were two portions to the instrument (A and B). Teachers of mathematics were asked to provide personal information in Section A, including their gender and school code. The statements in Section B assessed the problem-solving abilities of math teachers. There were three clusters of six items each, totaling eighteen items. The three clusters addressed problem-solving techniques employed prior to problem-solving, during problem-solving, and following the discovery of solutions. It was designed on a four-point Likert-type scale of very good (VG), good (G), poor (P), and very poor (VP) to elicit information on mathematics teachers' problem-solving skills.

Students' Mathematics Task Persistence Rating Scale (SMTPRS) was adapted from Eze (2015). The researcher rephrased items like "I do give up if I am not successful in solving mathematics problems" to "I give up when solving problems in the new mathematics topics," among others. The instrument is divided into two sections: sections A and B. Section A contained demographic information about the respondents (students), such as school codes. Section B is comprised of a 20-item instrument. It was designed on a four-point Likert-type scale of strongly agree (SA), agree (A), disagree (D), and strongly disagree (SD) to elicit information on students' task persistence in the infused topics in the mathematics curriculum.

The initial draft copies of the instruments were given to experts for validation. Their comments and suggestions helped in modifying the items to suit the problem under investigation.

The reliability of the instruments was ascertained by administering the instruments to ten (10) SS 3 mathematics teachers and twenty (20) senior secondary (SS 3) students in public secondary schools in Ogoja education zone which is the education zone not included in the sample. The

respondents' responses were subjected to reliability analysis. The Cronbach Alpha (α) method was used to determine the internal consistency of the Rating Scale for Mathematics Teachers Problem Solving Skills (RSMT PSS) and Students' Mathematics Task Persistence Rating Scale (SMTPRS). The instruments are polytomously scored hence the choice of Cronbach's alpha. The reliability coefficients of the various clusters of the Rating Scale for Mathematics Teachers Problem Solving Skills (RSMT PSS), A, B, and C of the instrument were 0.81, 0.88, and 0.91, respectively, and the general reliability coefficient of 0.81 was obtained. The reliability coefficient of 0.91 was obtained for the Students' Mathematics Task Persistence Rating Scale (SMTPRS).

The Pearson Product Moment Correlation Coefficient was used to answer the research questions. If the r-value is between ± 0.50 and ± 1 the correlation is strong, if the r-value is between ± 0.30 and ± 0.49 the correlation is medium, and if the r-value is below ± 0.29 the correlation is small. Regression ANOVA, which is also known as the F-ratio was used to test the hypotheses of the research. All of the hypotheses were tested to see if they are true at a level of significance of 0.05. The null hypotheses were rejected if the probability value was, less than 0.05 ($P < 0.05$), but the null hypotheses were not rejected if the probability value was 0.05 or more ($P \geq 0.05$).

Findings/Results

Research Question 1.

What is the predictive power of teachers' problem-solving skills in some infused topics in Mathematics on students' task persistence in learning Mathematics?

Table 1. Correlation Coefficient and Coefficient of Determination (predictive power) Analysis of Teachers' Problem-Solving Skills in some Infused Topics in Mathematics and Students' Task Persistence in Learning Mathematics

Variables	N	r	R ²
Teachers' Problem-Solving Skills	32	0.72	0.52
Students' Task Persistence	32		

N = Number of students, R² = coefficient of determination

Result in table 1 shows the relationship between teachers' problem-solving skills in some infused topics in mathematics and students' task persistence in learning mathematics. The correlation between teachers' problem-solving skills in some infused topics in mathematics and students' task persistence in learning mathematics was 0.72. This implies that there is a strong and negative correlation between teachers' problem-solving skills and students' task persistence in learning mathematics. The coefficient of determination of 0.52 which is also known as the predictive value means that 52% of students' task persistence in learning mathematics was due to teachers' problem-solving skills in some infused topics in mathematics.

Hypothesis 1:

Mathematics teachers' problem-solving skills does not significantly predict students' task persistence in learning some infused topics in Mathematics.

Table 2. Regression ANOVA of Teachers' Problem-Solving Skills in some Infused Topics in Mathematics on Students' Task Persistence in Learning Mathematics.

Model	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	0.665	23	0.029	1.265	0.03
Within Groups	0.183	8	0.023		
Total	0.848	31			

$\alpha = 0.05$, df = Degree of freedom, F= F-ratio

In order to test hypothesis 1, Regression ANOVA was used. The result in table 2 shows that an F-ratio of 1.265 with a degree of freedom of 31 and an associated exact probability value of 0.03 was obtained. The probability value of 0.03 is less than 0.05 level of significance set as bench mark for testing the hypothesis ($P < 0.05$) and it was found to be significant. The null hypothesis which stated that Mathematics teachers' problem-solving skills does not significantly predict students' task persistence in learning someinfused topics in Mathematics is therefore rejected and inference drawn is that, Mathematics teachers' problem-solving skills significantly predict students' task persistence in learning someinfused topics in Mathematics.

Research Question 2.

What is the moderating influence of gender on the predictive power of teachers' problem-solving skills of some infused topics in Mathematics and students' task persistence in learning Mathematics?

Table 3: Correlation Coefficient and Coefficient of Determination (predictive value) of the Influence of Gender on the Predictive Power of Teachers' Problem Solving Skills of some Infused Topics in Mathematics and Students' Task Persistence in Learning Mathematics.

Gender	Variables	r	R ²
Male	Teachers' Problem Solving Skills	0.82	0.67
	Students' Task Persistence		
Female	Teachers' Problem Solving Skills	0.69	0.48
	Students' Task Persistence		

Result in table 3 shows the moderating influence of gender on the predictive power of teachers' problem-solving skills of some infused topics in mathematics and students' task persistence in learning mathematics. The results show that the correlation between male teachers' problem-solving skills of some infused topics in mathematics and students' task persistence in learning mathematics was 0.82 and the coefficient of determination was 0.67. This means that 67% of students' task persistence in learning mathematics was due to male teachers' problem-solving skills of some infused topics in mathematics. Result also shows that the correlation between female teachers' problem-solving skills of some infused topics in mathematics and students' task persistence in learning mathematics was 0.69 and the coefficient of determination was 0.48. This means that 48% of students' task persistence in learning mathematics was due to female teachers' problem-solving skills of some infused topics in mathematics. The result also shows that the predictor variables i.e. teachers' problem-solving skills of male mathematics teachers predict students' task persistence in learning mathematics more than their female counterparts with a coefficient of determination of 0.19 i.e. 19% predictive power.

Hypothesis 2:

Mathematics teachers' gender does not significantly moderate the influence of the predictive power of Mathematics teachers' problem solving skills on students' task persistence in learning some infused topics in Mathematics.

Table 4. Regression ANOVA of the Moderating influence Teachers' Gender on the predictive power of Mathematics teachers' problem solving skills on students' task persistence in learning some infused topics in Mathematics

Model	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	18.285	3	6.095	4.559	0.01
Within Groups	37.433	28	1.337		
Total	55.719	31			

$\alpha = 0.05$, df = Degree of freedom, F= F-ratio

Regression ANOVA was used to test hypothesis 2. The result in table 4 shows that an F-ratio of 4.559 with a degree of freedom of 31 and an associated exact probability value of 0.01 was obtained. The probability value of 0.01 is less than 0.05 level of significance set as bench mark for testing the hypothesis ($P < 0.05$) and it was found to be significant. The null hypothesis which stated that Mathematics teachers' gender does not significantly moderate the influence of the predictive power of Mathematics teachers' problem-solving skills on students' task persistence in learning some infused topics in Mathematics is therefore not accepted and inference drawn is that, Mathematics teachers' gender significantly moderate the influence of the predictive power of Mathematics teachers' problem-solving skills on students' task persistence in learning some infused topics in Mathematics.

Based on the analysis of data and interpretation of results, the following findings emerged that.

1. There was a strong and positive correlation between teachers' problems solving skills and students' task persistence in learning mathematics. The finding also shows that teachers' problem-solving skills significantly predicted students' task persistence in learning some-infused topics in the mathematics.
2. Teachers' problem-solving skills of male mathematics teachers predicted students' task persistence in learning mathematics more than their female counterparts with a coefficient of determination of 0.19 i.e.19% predictive powers. Also that Mathematics teachers' gender significantly moderates the influence of the predictive power of Mathematics teachers' problem-solving skills on students' task persistence in learning some-infused topics in the mathematics.

Discussion

The findings of this study are discussed under the following sub-headings:

Teachers' problem-solving skills and students' task persistence in learning mathematics

The study discovered a strong positive predictive power between students' task persistence in learning mathematics and teachers' problem-solving abilities in certain embedded mathematical themes. The first hypothesis test verified that students' task perseverance in learning certain infused subjects in mathematics was significantly predicted by the problem-solving abilities of math teachers. This result corroborated the findings of Middleton, Jansen, and Goldin (2022), who discovered that students showed noticeably higher levels of persistence and sustained engagement

in challenging problem-solving situations when teachers implemented cognitively demanding mathematical tasks supported by strategic scaffolding and metacognitive prompts. Their study revealed that teachers' ability to structure problem-solving experiences directly influenced students' willingness to persist even after encountering initial failure. This supports the present study's finding of a high positive predictive power between teachers' problem-solving skills and students' task persistence. In the same vein, Stein et al. (2020) found that in classes where teachers maintained high cognitive demand through excellent questioning, representation, and strategic coaching enhanced students' resilience and persistence in multi-step mathematics tasks. The authors furthered that mathematics teachers with good problem-solving skills are better able to keep assignments from becoming monotonous exercises, which keeps students' interest and effort levels high. This supports the recent discovery that students' task perseverance is highly predicted by teachers' problem-solving abilities.

Additionally, Boaler (2022) showed that learning environments that support numerous solution pathways, mathematical reasoning, and constructive struggle boost students' perseverance and decrease their anxiety related to mathematics. Her research demonstrated that pupils gain greater perseverance and self-assurance while taking on abstract subjects like algebra and calculus when professors display adaptable problem-solving techniques and normalize difficulty. The notion that teachers' problem-solving abilities are a reliable indicator of students' task persistence is further supported by this data. Nevertheless, the current result is not entirely supported by the results of certain investigations. For example, Credé (2021) contended that stable personality qualities and motivational dispositions have a greater impact on students' task persistence than instructional elements alone in a thorough analysis of grit and persistence research. The study suggested that although classroom practices matter, individual differences in perseverance may overshadow the predictive power of teacher-related variables. This viewpoint is in contrast to the current study's substantial predictive association. Similarly, OECD (2019, 2021) assessments of PISA data showed that although teacher instructional quality influences student engagement, students' persistence and success outcomes are frequently more strongly impacted by broader school climate factors and socioeconomic background determinants. These results suggest that high levels of task persistence may not be solely explained by teachers' problem-solving abilities, which somewhat contradicts the study's excellent predictive power.

Furthermore, in a meta-analysis of instructional strategies and math anxiety, Wen and Dubé (2022) discovered that improvements in persistence and decreases in anxiety were more strongly correlated with students' perceptions of autonomy support and emotional climate than with teachers' actual problem-solving abilities. According to their findings, the association between instructional competency and persistence may be mediated or moderated by affective classroom characteristics, which could account for the weaker direct predictive relationships shown in some research. These contradictory results demonstrate the intricacy of task persistence as a multifaceted concept and emphasize the need for additional study, especially in the context of Cross River State's senior secondary mathematics education.

Influence of gender on teachers' problem-solving skills and students' task persistence in learning mathematics

The outcome demonstrated that, with a predictive value of 19%, the predictor variables that is, the problem-solving abilities of male mathematics teachers predicted students' task persistence in learning mathematics more than their female counterparts. This result showed that students' task persistence in learning mathematics was better predicted by male math teachers' problem-solving

abilities than by their female counterparts. The second hypothesis test found that the predictive effect of math teachers' problem-solving abilities on students' task persistence in learning some infused subjects in mathematics is strongly moderated by the gender of mathematics teachers.

This result agrees with the findings of Grosser and Pretorius (2019), the authors found that male mathematics teachers were more likely to use directive problem-solving strategies that prioritize challenge orientation and structured reasoning. The stressed that students who were taught by male teachers showed greater levels of perseverance on challenging assignments, possibly as a result of gender-linked teaching approaches that prioritize analytical thinking and competitive engagement. This is consistent with the study discovery that male teachers' problem-solving abilities showed higher predictive power for students' perseverance.

Also, Verma and Sharma (2021) findings supports the idea that instructor gender influences how students' task perseverance is influenced by their ability to solve problems as their study discovered that male mathematics teachers showed more confident in their ability to model problem-solving techniques than their female counterparts, and that this instructional confidence was associated with increased student perseverance and decreased avoidance of difficult mathematics assignments. Additionally, male teachers were more likely to employ difficult questions and calculated prompts when teaching mathematics, according to Park and Lee's (2022) investigation into variations in teacher interactions. Students in male-taught courses had greater task perseverance in tackling non-routine issues, according to their findings, which showed a statistically significant difference in students' prolonged engagement. The notion that male teachers' approaches to problem-solving can more accurately predict persistent outcomes is supported by this study. Several investigations have challenged the notion that male teachers' problem-solving abilities are intrinsically more predictive by finding little to no gender influence on the association between teacher competencies and student perseverance. For example, after adjusting for classroom atmosphere and instructional quality, Saito et al. (2019) on that note, found no significant difference in student involvement or persistence attributed to teacher gender. Their results imply that the main factor influencing students' perseverance in arithmetic assignments is pedagogical ability rather than gender per se. OECD (2021) discovered that teacher gender did not significantly affect the association between instructional techniques, such as problem-solving oriented teaching, and student cognitive persistence in a large-scale quantitative study based on PISA data. Regardless of the teacher's gender, what mattered most were the teachers' professional competence and the students' impressions of classroom assistance. This refutes the notion that male educators' problem-solving abilities naturally result in greater persistence outcomes.

Furthermore, when armed with excellent problem-solving abilities and student-centered pedagogies, female teachers attained comparable levels of student perseverance and resilience as male teachers, according to Lee and Zhou's (2023) analysis of teacher gender and instructional methods in mathematics. In particular, their study found that if instructional competency characteristics were taken into consideration, gender effects were minor, suggesting that professional training, pedagogical approach, and classroom interaction style were more important factors in predicting task persistence than gender alone.

Conclusion

The study's findings lead to the following conclusions: students are more likely to stay engaged, resilient, and determined when faced with difficult mathematical tasks when math teachers exhibit higher levels of problem-solving competence, such as the capacity to analyze complex problems, apply strategic reasoning, model solution processes, and scaffold learning. Therefore, encouraging

children to put up consistent effort and perseverance requires teachers to be proficient in problem-solving techniques in infused mathematical disciplines like calculus, coordinate geometry, matrices, and other abstract concepts. Additionally, gender-related instructional dynamics, classroom interaction patterns, or students' opinions of teachers can all affect how persistent students are.

Recommendations

The following suggestions are offered in light of the study's findings:

1. Increase students' perseverance, workshops, seminars, and in-service training should place a strong emphasis on modeling multiple solution methodologies, scaffolding techniques, and the use of cognitively challenging assignments through continuous professional development programs aimed at improving teachers problem-solving abilities, strategic reasoning, and the successful teaching of infused themes should be implemented.
2. Both male and female educators should be assisted in creating classroom interaction tactics that encourage equitable student participation, self-assurance, and perseverance.

Limitations

1. The study was limited to only public senior secondary schools in Cross River State.
2. The study was limited to some infused topics in mathematics.

Ethics statement

The study involving human participants was reviewed and approved by the Department of Curriculum and Instructional Technology, University of Cross River State (UNICROSS), Calabar, Nigeria. Permission to conduct the study was also obtained from the management of the selected public secondary schools in Cross River State. The participants were informed about the purpose of the study, and their participation was voluntary. Informed consent was obtained from the respondents before the administration of the research instruments. The researcher also assured the participants that all information provided would be treated with confidentiality and used strictly for academic purposes.

Conflict of interest

I declare that there is no conflict of interest regarding the publication of this study.

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Generative AI statement

Generative AI technology, was not used.

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