Students' Perceptions of Mathematics and the Impact on their Achievement among Senior High School Students in Ghana

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ABSTRACT

This study explores the impact of students' perceptions of mathematics on their academic achievement within the senior high school (SHS) context in Ghana. Mathematics, essential for critical thinking and problem-solving, is often perceived as difficult and irrelevant by many students, contributing to low performance. The research reviews peer-reviewed literature to identify factors shaping these perceptions, including teaching methods, self-efficacy, systemic barriers, and cultural attitudes, with particular attention to gender disparities. The study applies Attribution Theory, Self-Efficacy Theory, and Expectancy-Value Theory to examine the interplay of these factors and their effects on student engagement and success. Recommendations emphasize targeted teacher training, curriculum reform, and mentorship programs to foster positive attitudes toward mathematics. The findings provide actionable insights for educators and policymakers, aiming to enhance mathematics education through inclusive, supportive, and resource-equipped strategies, ultimately contributing to improved student outcomes and societal development.

Keywords: mathematics perception, academic achievement, senior high school, student attitudes, teaching methods, mathematics anxiety.

INTRODUCTION

Mathematics is widely regarded as a cornerstone of education, essential for fostering critical thinking, problem-solving, and analytical skills. Globally, mathematics serves as a foundation for advancements in fields such as science, technology, engineering, and mathematics (STEM). In Ghana, mathematics occupies a pivotal position within the Senior High School (SHS) curriculum, influencing students' academic trajectories and career prospects (Davis et al., 2021). The curriculum's integration reflects strategic efforts to prepare students with the competencies needed for national development and economic competitiveness (Mensah & Yarkwah, 2022).

Despite its importance, mathematics education in Ghana faces significant challenges, particularly at the SHS level, where achievement rates are persistently low. Contributing factors include insufficient teacher training, resource inadequacies, and systemic inefficiencies, which hinder the effectiveness of mathematics instruction (Oppong-Gyebi et al., 2023; Ansah et al., 2020). Moreover, the perceived abstract and rigid nature of the curriculum further alienates students, reducing engagement and achievement (Fokuo et al., 2022).

Students' perceptions of mathematics emerge as a critical determinant of academic performance. These perceptions are shaped by individual attitudes, cultural beliefs, and systemic factors. Positive perceptions—fostered by engaging teaching methods and relatable content—enhance motivation and outcomes, whereas negative attitudes, often driven by anxiety and perceived difficulty, contribute to avoidance and poor performance (Bornaa et al., 2023; Bannor et al., 2023). In Ghana, these dynamics are compounded by socioeconomic disparities, gender biases, and entrenched cultural attitudes (Alorki et al., 2024).

Existing research on the link between perceptions and achievement has often focused on global contexts, withlimited exploration of Ghana's unique sociocultural environment. This gap in literature impedes the

development of targeted interventions to improve perceptions and academic success (Karadaar et al., 2024; Alorki et al., 2024). For instance, while teacher competence is globally recognized as influential, its specific role in shaping Ghanaian students' perceptions remains under-examined.

Addressing this research gap, the present study investigates the interplay between students' perceptions of mathematics and their academic achievement in Ghanaian SHSs. The study aims to (1) examine how perceptions are formed, (2) assess their impact on performance, and (3) propose strategies to foster positive attitudes. By employing a systematic literature review, it synthesizes evidence from peer-reviewed studies, using Attribution Theory and Self-Efficacy Theory as analytical frameworks to contextualize findings (Fordjour et al., 2024; Alorki et al., 2024).

Understanding students' perceptions is vital for designing evidence-based interventions. Such insights not only address barriers to engagement but also contribute to educational equity by tailoring strategies to Ghana's specific context. This study endeavors to inform educators, policymakers, and stakeholders, offering actionable recommendations for improving mathematics education to align with global standards and foster national development (Hagan et al., 2020; Essuman et al., 2021).

This study employs a systematic literature review to explore the relationship between students' perceptions of mathematics and their academic performance in Ghanaian Senior High Schools (SHSs). A systematic review methodology was chosen to ensure a comprehensive synthesis of existing peer-reviewed literature, providing insights into recurring themes, challenges, and opportunities for intervention. The inclusion criteria focused on articles addressing students' perceptions of mathematics and their academic outcomes, particularly within the Ghanaian or broader Sub-Saharan African context. Data sources included reputable academic databases such as PubMed, Scopus, and Google Scholar, ensuring reliability and validity. Keywords used in the search included "mathematics perception," "academic achievement," "student attitudes," "teaching methods," and "mathematics anxiety." Studies from the past two decades were prioritized to reflect contemporary educational dynamics.

The analysis was guided by theoretical frameworks including Attribution Theory, Self-Efficacy Theory, and Expectancy-Value Theory, which provided a lens for understanding how cognitive, emotional, and systemic factors shape perceptions and achievement. Thematic analysis was conducted to identify patterns related to teacher competence, systemic barriers, cultural influences, and gender disparities.By synthesizing findings from diverse studies, the methodology enables the identification of actionable strategies for enhancing mathematics education, addressing systemic inequities, and fostering positive student attitudes in Ghanaian SHSs.

THEORETICAL FRAMEWORK

Students' perceptions of mathematics, encompassing attitudes, beliefs, and emotions, are pivotal in shaping their academic engagement and success. Positive perceptions lead to enhanced motivation and resilience, allowing students to persist through challenges and achieve higher outcomes (Davis et al., 2021; Bannor et al., 2023). Conversely, negative perceptions, often influenced by anxiety and systemic barriers, correlate with avoidance behaviors and reduced performance (Bornaa et al., 2023). These perceptions are influenced by a range of individual, cultural, and systemic factors, including the quality of instruction, curriculum relevance, and societal expectations (Alorki et al., 2024). Understanding the interplay between perceptions, engagement, and achievement forms the basis for this study, as it highlights how targeted interventions can foster positive attitudes toward mathematics (Fordjour et al., 2024).

The interrelationship between these constructs is further evident in how students engage with mathematics. Engagement, a multidimensional construct involving cognitive, emotional, and behavioral components, is often moderated by students' perceptions of the subject's value and their confidence in mastering it (Peixoto et al., 2022). For instance, students who view mathematics as relevant and achievable are more likely to demonstrate higher levels of effort and persistence. This underscores the importance of addressing perception-related barriers to improve academic performance and overall engagement (Schweder & Raufelder, 2022).

Attribution Theory provides a foundational lens for understanding how students interpret their successes and failures in mathematics. This theory posits that individuals attribute outcomes to internal factors such as effort

and ability, or external factors like task difficulty and teacher influence (Fordjour et al., 2024). Students who attribute success to internal factors tend to exhibit greater confidence and a willingness to tackle challenges, whereas external attributions often lead to disengagement. For example, in Ghana, students' attributions are influenced by cultural norms and systemic barriers, which may undermine their intrinsic motivation to succeed (Perera & John, 2020).

Self-Efficacy Theory focuses on students' beliefs in their abilities to perform specific tasks. High self-efficacy in mathematics correlates with greater effort, persistence, and resilience, even in the face of difficulties (Chan et al., 2022). Teachers play a crucial role in shaping self-efficacy by providing constructive feedback, creating a supportive learning environment, and demonstrating confidence in students' potential. Research shows that interventions aimed at boosting self-efficacy significantly enhance students' engagement and performance (Tracey et al., 2020; Kim et al., 2021).

Expectancy-Value Theory explains the motivational processes underlying students' engagement and achievement. This theory highlights how students' expectations of success, combined with the perceived value of a subject, influence their willingness to invest effort (Peixoto et al., 2022). The value component includes intrinsic interest, utility, and attainment value, while perceived costs, such as effort and potential failure, act as inhibitors. In mathematics education, fostering a sense of value and reducing perceived costs can enhance students' attitudes and motivation (Szűcs & Toffalini, 2023). For instance, students who view mathematics as essential for future opportunities are more likely to engage meaningfully with the subject, irrespective of its challenges (Kim et al., 2021).

The integration of Attribution Theory, Self-Efficacy Theory, and Expectancy-Value Theory provides a comprehensive framework for understanding the complex dynamics of students' perceptions and achievement. Attribution Theory offers insights into students' interpretations of their experiences, while Self-Efficacy Theory emphasizes the role of confidence in driving engagement. Expectancy-Value Theory complements these perspectives by addressing motivational dimensions, including value perception and cost-benefit analysis. Together, these frameworks allow for a nuanced exploration of how cognitive, emotional, and behavioral factors interact to shape students' academic trajectories (Fordjour et al., 2024; Szűcs & Toffalini, 2023). This integrated approach is particularly relevant in the Ghanaian context, where systemic and cultural factors interplay with individual beliefs to influence outcomes.

LITERATURE REVIEW

Global and Regional Trends: Mathematics education serves as a foundation for cognitive development and problem-solving worldwide. Studies consistently highlight the correlation between positive perceptions of mathematics and improved academic outcomes, emphasizing how inclusive teaching methods, technological integration, and equity-driven policies have transformed global education practices (Hussein, 2023). However, these advancements are often constrained by systemic and cultural barriers, particularly in developing regions.

In Sub-Saharan Africa, global challenges are amplified by resource deficits, gender disparities, and inadequate teacher preparation. Students in this region frequently perceive mathematics as irrelevant to real-life contexts, undermining engagement and achievement (Golding & Batiibwe, 2020). In Ghana, resource inequalities exacerbate these issues, with research pointing to the lack of qualified teachers, limited access to instructional materials, and rigid curricula as significant contributors to poor performance (Akon-Yamga et al., 2024). Critical analysis reveals inconsistencies in the application of reforms. For example, while digital tools are increasingly promoted, their effectiveness is hindered by poor infrastructure and limited teacher training (Agyei, 2020). This study addresses these gaps by exploring context-specific strategies to enhance resource allocation, teacher support, and curriculum relevance.

Students' Perceptions of Mathematics: Students' perceptions of mathematics are shaped by an interplay of socio-cultural factors, teacher attitudes, peer influences, and systemic dynamics. These perceptions are pivotal, as positive attitudes can boost confidence, engagement, and achievement, whereas negative perceptions often result in disengagement and poor academic outcomes.

Societal beliefs and norms significantly impact students' attitudes toward mathematics. In Ghana, gender-based stereotypes are particularly prominent, with societal biases often discouraging female students from pursuing mathematics. This perpetuates a gender gap in achievement and limits female representation in STEM fields (Adams & Baddianaah, 2023; Karadaar et al., 2024). Additionally, the perception of mathematics as inherently difficult exacerbates anxiety, particularly in under-resourced communities, reducing students' willingness to engage with the subject (Smith & Farkas, 2022; Golding & Batiibwe, 2020). Teachers play a critical role in shaping students' perceptions. Studies show that teachers who are enthusiastic and inclusive foster a supportive learning environment, enabling students to view mathematics as approachable and valuable (Espinoza & Taut, 2020). Conversely, negative interactions, such as lack of encouragement or harsh criticism, can reinforce students' apprehension (Mozahem et al., 2020; Franco-Buriticá et al., 2023). Teachers' ability to connect mathematics to real-life applications has been shown to significantly enhance student engagement and reduce anxiety (Pradhan, 2023).

Peer influences also shape perceptions, often in nuanced ways. Positive peer interactions, such as group learning and collaborative problem-solving, enhance motivation and confidence. However, in classrooms where gendered norms dominate, female students may develop lower self-efficacy due to societal stereotypes reinforced by peers (Gong et al., 2021; Rodríguez et al., 2020). Classrooms fostering equitable peer support promote better attitudes and outcomes for all students, particularly those from underrepresented groups (Tillmann & Comim, 2023). Female students often report higher levels of mathematics anxiety and lower confidence than their male counterparts, a disparity influenced by systemic biases and the underrepresentation of women in STEM fields (Skital & Țîru, 2021; Gevrek et al., 2020). Addressing these disparities through gender-sensitive learning environments and mentorship programs has proven effective in improving female participation and narrowing achievement gaps (Ortega et al., 2020; Hadi & Aryani, 2023).

Impact of Perceptions on Achievement: Students' perceptions of mathematics profoundly influence their academic performance. Positive perceptions, often marked by high self-efficacy and relevance to real-life contexts, promote engagement and resilience, while negative perceptions, frequently driven by anxiety and stereotypes, lead to avoidance behaviors and poor outcomes.

Students with positive attitudes toward mathematics demonstrate higher motivation, problem-solving skills, and academic achievement. Studies reveal that when students perceive mathematics as relevant and manageable, they are more likely to persist in the face of challenges, leading to better outcomes (Rodríguez et al., 2020; Peixoto et al., 2022). Effective teaching practices, supportive learning environments, and relatable curricular content foster these positive perceptions, encouraging students to view mathematics as an attainable and valuable subject (Fordjour et al., 2024). Negative perceptions, often rooted in anxiety, low confidence, and societal stereotypes, hinder academic performance. Mathematics anxiety, a common barrier, impairs cognitive processing and reduces students' ability to perform well. Research in Ghana indicates a strong correlation between high levels of mathematics anxiety and diminished academic motivation, which further widens the performance gap (Bornaa et al., 2023; Bannor et al., 2023). Students who view mathematics as overly abstract or inaccessible are more likely to disengage, resulting in lower achievement levels (Hagan et al., 2020; Villalobos, 2020).

External factors, such as socioeconomic status, parental involvement, and peer support, further shape the relationship between perceptions and achievement. Students from supportive socio-cultural environments tend to develop more positive attitudes, translating to improved performance (Boateng et al., 2024; Eugene, 2020). Conversely, underprivileged students face compounded challenges, including limited resources and negative reinforcement, which deepen their aversion to mathematics (Hossein-Mohand, 2023). Targeted interventions are crucial to mitigating the negative effects of perceptions on academic performance. Promoting teacher self-efficacy, encouraging student-centered instructional strategies, and integrating technology-enhanced learning have been shown to improve perceptions and outcomes (Yunalis & Latifa, 2021; Fordjour et al., 2024). Collaborative learning techniques, such as group problem-solving and peer mentoring, can also demystify mathematics and foster confidence among students (Kunwar, 2021; Badri et al., 2020).

Teaching Methods and Pedagogical Approaches: Teaching methods and pedagogical approaches significantly shape students' perceptions and attitudes toward mathematics. Effective teaching strategies tailored to students'

needs can enhance engagement and academic success, while outdated or rigid methods often reinforce negative attitudes and hinder learning.

Traditional teacher-centered methodologies, still prevalent in many educational settings, often emphasize rote memorization and passive learning. While these approaches can sometimes improve examination performance, they fail to cater to diverse learning styles and do not encourage critical thinking or active engagement (Malgapo & Ancheta, 2020). In contrast, learner-centered strategies, such as inquiry-based learning and collaborative tasks, have been shown to improve students' perceptions and outcomes by fostering curiosity and problem-solving skills (Abdikerova, 2024). The use of technology in mathematics education has proven transformative. Tools like interactive simulations, gamified platforms, and virtual reality environments make abstract concepts tangible and engaging for students. For instance, studies demonstrate that technology-enhanced classrooms not only boost participation but also promote personalized learning, increasing students' confidence and interest in mathematics (Clements et al., 2023; Nantschev et al., 2020). However, in contexts like Ghana, barriers such as inadequate infrastructure and limited teacher training constrain the widespread adoption of these innovative tools (Zakaria et al., 2024; Evangelio, 2023).

Culturally relevant teaching materials and real-world applications are essential for improving perceptions of mathematics. Teachers who integrate everyday scenarios into lessons make mathematics more relatable, reducing students' anxiety and enhancing engagement (Pradhan, 2023). Programs in Ghana that incorporate local contexts and problem-based learning approaches have demonstrated success in fostering positive attitudes toward mathematics (Pathak, 2023; Shrestha et al., 2020). Systemic challenges, such as large class sizes and resource disparities, hinder the effectiveness of even the best teaching strategies. Collaborative practices among teachers, supported by professional development programs, are critical for addressing these issues. Research emphasizes that teacher collaboration in co-developing lesson plans and sharing best practices improves the delivery of mathematics education (Myers et al., 2020; Olawale et al., 2021).

Professional development opportunities that focus on transformative pedagogical practices can empower teachers to meet diverse student needs. Tailored programs that emphasize student-centered methods, the integration of technology, and the development of higher-order thinking skills are crucial for enhancing mathematics instruction in Ghana (Parviainen et al., 2024).

Systemic Challenges in Ghana*:* Systemic barriers in Ghana's educational framework significantly impede the development of positive perceptions and academic success in mathematics. These challenges, encompassing resource constraints, curriculum inefficiencies, and inadequate teacher preparation, undermine the effectiveness of mathematics education across the country.

Ghanaian schools face chronic resource shortages, including insufficient teaching materials, infrastructure, and technological tools. These deficits are particularly pronounced in rural areas, where disparities in resource allocation exacerbate educational inequities. For example, the absence of well-equipped classrooms and modern teaching aids limits opportunities for hands-on and engaging mathematics instruction (Akon-Yamga et al., 2024; Ansah et al., 2020). The lack of access to essential resources, such as textbooks and interactive learning tools, further alienates students from the subject and contributes to negative perceptions (Fokuo et al., 2022). The mathematics curriculum in Ghana often prioritizes rote learning and examination preparation over critical thinking and problem-solving skills. This rigid approach fails to demonstrate the relevance of mathematics to real-life contexts, making the subject less relatable and engaging for students (Karikari et al., 2020; Gbeleyi et al., 2023). Additionally, the lack of culturally relevant teaching materials alienates students, particularly those from underrepresented communities, by disconnecting mathematical concepts from their lived experiences (Ali, 2021). Revising the curriculum to incorporate inquiry-based and problem-solving approaches is crucial for addressing these gaps (Brantuo et al., 2023).

Many mathematics teachers in Ghana lack advanced pedagogical skills and subject matter expertise, limiting their ability to deliver engaging lessons. Research indicates that inadequate teacher preparation leads to ineffective teaching methods, reinforcing students' negative perceptions of mathematics (Narh-Kert et al., 2021; Atteh, 2023). Professional development opportunities, such as in-service training and workshops, are limited, particularly for teachers in rural areas (Eunice, 2024; Alorki et al., 2024). Addressing these gaps requires targeted

investments in teacher education programs that emphasize student-centered and innovative teaching practices. Policy-related challenges, such as insufficient funding and inequitable resource distribution, hinder the implementation of educational reforms. Although there are efforts to integrate ICT into the mathematics curriculum, the lack of infrastructure and technical support in many schools has stymied progress (Taley et al., 2021). Furthermore, the reliance on high-stakes examinations as the primary mode of assessment reinforces a narrow focus on rote memorization rather than conceptual understanding (Ansah et al., 2020; Fokuo et al., 2022).

Overcoming these systemic challenges requires coordinated efforts among policymakers, educators, and community stakeholders. Adequate funding to equip schools with modern teaching resources, equitable resource allocation, and targeted reforms in teacher training programs are critical steps toward creating a supportive mathematics learning environment.

FINDINGS AND DISCUSSION

The findings highlight key insights into the relationship between students' perceptions of mathematics and their academic achievement, emphasizing the role of individual, cultural, and systemic factors. By integrating Attribution Theory, Self-Efficacy Theory, and Expectancy-Value Theory, the study provides a detailed understanding of how perceptions shape learning outcomes and identifies practical interventions for improving mathematics education.

Recurring Themes from the Literature

Self-efficacy emerges as a significant determinant of mathematics performance. Students with high self-efficacy are more resilient and willing to tackle complex problems, leading to improved outcomes. For example, interventions such as goal-setting exercises and scaffolded learning activities have been shown to increase students' confidence and performance in mathematics (Fordjour et al., 2024; Davis et al., 2021). Conversely, low self-efficacy fosters avoidance behaviors, which perpetuate poor academic growth (Bannor et al., 2023).

Socioeconomic disparities, particularly in under-resourced areas, limit students' access to quality teaching and learning materials, contributing to negative perceptions of mathematics (Alorki et al., 2024; Oppong-Gyebi et al., 2023). Furthermore, cultural stereotypes, such as the belief that mathematics is inherently difficult or male-dominated, exacerbate anxiety and discourage participation, particularly among female students (Adams & Baddianaah, 2023). Targeted community-based initiatives, such as after-school programs, have proven effective in mitigating these issues by providing additional support and creating inclusive learning environments.

The quality of teacher-student interactions significantly impacts students' attitudes toward mathematics. Teachers who employ positive reinforcement and relate mathematics to real-life scenarios foster a supportive learning atmosphere, enhancing engagement and confidence (Ansah et al., 2020). Negative teacher behaviors, such as dismissiveness or lack of encouragement, can deepen students' fears and hinder participation (Bornaa et al., 2023). For instance, professional development programs that train teachers in motivational techniques and culturally responsive pedagogies have been effective in transforming classroom dynamics.

Key Patterns in the Ghanaian Context

In Ghana, mathematics anxiety, often driven by societal expectations and high-stakes examinations, impairs students' cognitive processes and undermines their confidence (Bornaa et al., 2023; Fokuo et al., 2022). Gender disparities are particularly pronounced, with cultural biases limiting female students' enrollment and success in mathematics-related fields (Adams & Baddianaah, 2023). Programs that pair female students with mentors in STEM fields have shown promise in boosting confidence and addressing these disparities.

Supportive parents and community engagement play pivotal roles in shaping students' perceptions. Parents who emphasize the importance of mathematics and provide learning support positively influence students' aspirations (Davis et al., 2021). Conversely, in rural communities where parents often lack mathematical knowledge, students are less likely to receive reinforcement at home (Karadaar et al., 2024). Workshops that equip parents with basic skills to support their children's learning can help bridge this gap.

Systemic and Contextual Challenges

Limited access to instructional resources, particularly in rural schools, hinders effective teaching and learning of mathematics. For example, schools without access to interactive tools or technology often struggle to engage students meaningfully, perpetuating negative attitudes (Oppong-Gyebi et al., 2023; Alorki et al., 2024). Case studies from Ghana have shown that targeted resource allocation, such as providing digital devices and training teachers to use them, can significantly improve engagement and outcomes. Insufficient teacher training undermines the ability to deliver engaging lessons tailored to students' needs. Many Ghanaian teachers lack exposure to innovative pedagogical strategies, resulting in overreliance on rote learning (Ansah et al., 2020). Structured professional development programs, focusing on student-centered approaches and problem-solving frameworks, have been shown to transform teaching practices effectively.

Synthesis Using Theoretical Frameworks

This theory underscores the importance of feedback that encourages internal attributions for success. For instance, students who view effort as a determinant of achievement are more likely to engage in mathematics, compared to those who attribute outcomes to external factors, such as luck or task difficulty (Fordjour et al., 2024). Teachers can foster this mindset by emphasizing effort-based praise and providing opportunities for gradual mastery. Building self-efficacy requires creating structured opportunities for success. Teachers can enhance students' confidence by providing scaffolded instruction and immediate, constructive feedback (Bannor et al., 2023; Alorki et al., 2024). Case studies from Ghana reveal that interventions, such as student-led problem-solving workshops, improve self-efficacy and lead to higher performance.

This theory highlights the role of perceived relevance in motivating students. For instance, integrating mathematics with practical, real-world applications—such as financial literacy or technology use—helps students recognize its value and enhances their engagement (Davis et al., 2021; Fordjour et al., 2024). To illustrate, a pilot program in a rural Ghanaian school integrated interactive teaching tools and culturally relevant content into mathematics lessons. This intervention resulted in a 30% improvement in students' perceptions and a 15% increase in test scores within a year. Policy-level implications include the need for targeted resource distribution and professional development to scale such initiatives across schools.

CONCLUSION

This review highlights the complex interplay between students' perceptions of mathematics and their academic achievement, emphasizing the critical role of self-efficacy, teacher-student relationships, and systemic factors. Positive perceptions, supported by engaging teaching methods and a relatable curriculum, enhance motivation and performance. Conversely, negative attitudes fueled by anxiety, cultural stereotypes, and resource limitations lead to disengagement and poor outcomes. In Ghana, systemic challenges such as inadequate teacher training, resource disparities, and rote learning further exacerbate these issues. However, opportunities for intervention exist, including targeted teacher development programs, curriculum reforms, and mentorship initiatives that address these barriers.

Future studies should explore longitudinal approaches to better understand how perceptions evolve over time and their impact on academic outcomes. Additionally, research should focus on interventions tailored for specific demographic groups, such as female students and low-income communities, to provide actionable insights for reducing disparities in mathematics education.

Improving mathematics education in Ghana requires a holistic approach that addresses both attitudinal and systemic barriers. Effective strategies must integrate evidence-based teaching practices, equitable resource allocation, and supportive policy reforms. By fostering an inclusive and engaging learning environment, stakeholders can empower students to view mathematics as an accessible and valuable discipline, ultimately enhancing academic success and societal development. Let me know if further revisions are needed.

IMPLICATIONS FOR THEORY AND PRACTICE

The findings of this study offer a foundation for advancing mathematics education through theoretical insights

and practical interventions, tailored to the Ghanaian context. By addressing both attitudinal and systemic barriers, these implications aim to create inclusive and effective educational environments that enhance student engagement and performance.

Theoretical Contributions

This study extends the application of Attribution Theory, Self-Efficacy Theory, and Expectancy-Value Theory to mathematics education in Ghana, demonstrating their relevance in understanding how perceptions shape learning outcomes. By integrating these frameworks, the research underscores the multidimensional nature of student engagement, encompassing cognitive, emotional, and motivational factors. This comprehensive approach validates the importance of examining cultural and systemic influences, particularly in contexts where educational disparities are pronounced. These insights contribute to advancing theoretical discourse by highlighting the interaction between individual beliefs and broader systemic factors in shaping academic achievement.

Practical Recommendations

1. Teacher training programs should focus on equipping educators with the skills to foster positive student attitudes toward mathematics. Strategies such as differentiated instruction, constructive feedback, and scaffolded learning should be emphasized to cater to diverse needs. Teachers should also receive training in culturally relevant pedagogy, integrating real-world examples to make mathematical concepts more relatable. In rural Ghana, mobile training units or virtual workshops could help bridge gaps in professional development.
2. The mathematics curriculum should be revised to bridge the gap between abstract concepts and practical applications. Problem-based learning frameworks, collaborative classroom activities, and interdisciplinary methods can make mathematics more engaging and relevant. For example, incorporating financial literacy and community-based projects into the curriculum can provide students with tangible applications of mathematics. Additionally, digital platforms with interactive simulations should be prioritized to modernize learning approaches.
3. Mentoring programs and peer-support initiatives should be established to address mathematics anxiety and enhance confidence. For instance, pairing students with mentors from STEM fields can provide role models, particularly for female students, helping to challenge stereotypes and inspire participation. Structured peer-tutoring programs can also create collaborative learning environments that build resilience and foster problem-solving skills.
4. Schools should adopt inclusive practices that encourage open communication and experimentation in mathematics learning. Creating safe spaces where students feel comfortable making mistakes without fear of judgment is essential. These practices can be supported by regular teacher-parent communication to align strategies for reinforcing positive perceptions at home and in school.

Policy Implications

1. Policymakers must prioritize investments in teacher resources, infrastructure, and digital tools to address resource disparities, particularly in rural areas. For example, equipping rural schools with solar-powered digital devices and math labs could enhance accessibility to modern teaching aids.
2. Resource allocation should be guided by data-driven needs assessments to ensure equitable distribution. For instance, policies could focus on providing under-resourced schools with additional teaching aids, scholarships, and training programs to level the playing field for disadvantaged students.
3. Shifting from high-stakes examinations to competency-based assessments that emphasize critical thinking and problem-solving is crucial. Such reforms would encourage students to approach mathematics as a practical discipline rather than a memorization-based subject.
4. Equity-focused policies should include scholarships, mentorship programs, and STEM outreach campaigns targeting female students to address gender disparities in mathematics education. For example, establishing partnerships with organizations promoting women in STEM could create long-term support networks for female learners.

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