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Let's Start!

The Impact Of Teacher-Student Interactions On Learning Motivation In Secondary Mathematics

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The Impact Of Teacher-Student Interactions On Learning Motivation In Secondary Mathematics

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Abstract

Teacher-student interactions on learning motivation refer to the reciprocal communication and engagement between teachers and students that influence students' enthusiasm, effort, and persistence in learning. These interactions can foster both intrinsic and extrinsic motivation, driving academic success. This study aimed to investigate the impact of teacher-student interactions on learning motivation in secondary mathematics. Therefore the objectives of the study were 1. to examine the relationship between the frequency and quality of teacher-student interactions and students' motivation to learn mathematics at the secondary level. 2. to assess the influence of specific teacher behaviors (such as encouragement, feedback, and support) on different aspects of student motivation, including interest, effort, and persistence in secondary mathematics. The research was conducted with a sample of 250 secondary school students from various schools, using a quantitative descriptive survey method. A structured 20-item Likert scale questionnaire was distributed to students, focusing on teacher responsiveness, teacher involvement, teacher encouragement, and learning motivation. Collected data was analyzed using descriptive statistics, including mean scores and standard deviations, as well as inferential statistics, specifically Pearson's correlation analysis, to examine the relationship between teacher-student interactions and student motivation.The findings revealed a significant positive correlation between teacher-student interactions and learning motivation in mathematics ($r = 0.65$, $p < 0.01$). In particular, teacher encouragement was the strongest predictor of student motivation (mean = 4.12, SD = 0.79), followed by teacher involvement (mean = 3.95, SD = 0.82). The results indicated that students who felt more supported and engaged by their teachers were more likely to exhibit higher levels of motivation to learn mathematics. However, there was a moderate correlation between teacher responsiveness and learning motivation ($r = 0.48$, $p < 0.05$), suggesting that while teacher.

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responsiveness contributed to motivation, it was not as significant as encouragement and involvement. The study concluded that teacher-student interactions, particularly through encouragement and involvement, play a crucial role in enhancing student motivation in secondary mathematics. These findings highlight the need for teacher training programs to focus on fostering positive interactions and providing personalized support to improve student engagement and learning outcomes in mathematics.

Key Words: Teacher Engagement, Learning Motivation, Student Achievement, Positive Reinforcement, Intrinsic Motivation

INTRODUCTION

Teacher-student interactions play a critical role in shaping students' attitudes toward learning, particularly in challenging subjects like mathematics. In secondary education, mathematics often poses unique challenges for students, leading to feelings of anxiety, reduced engagement, and a decline in motivation (Skinner & Belmont, 1993). A positive, supportive interaction between teachers and students has been shown to alleviate some of these challenges, fostering a conducive learning environment that motivates students to actively engage with the subject matter (Wentzel, 2002). This study investigates the impact of teacher-student interactions on learning motivation in secondary mathematics, aiming to identify specific interaction strategies that effectively enhance student motivation. In understanding these relationships, educational stakeholders can adopt targeted practices to improve mathematics motivation and, consequently, student outcomes.

The concept of learning motivation, especially in mathematics, encompasses both intrinsic and extrinsic motivational factors. Intrinsic motivation, the internal drive to engage in tasks for personal satisfaction, and extrinsic motivation, driven by external rewards or outcomes, are influenced by the quality of teacher-student interactions (Ryan & Deci, 2000). High-quality interactions that are emotionally supportive, responsive, and encourage autonomy have been shown to enhance intrinsic motivation, leading to a more sustained engagement with mathematics (Fredricks et al., 2004). This study contributes to existing research by focusing on the impact of teacher-student interactions on secondary students' motivation in mathematics, offering insights that may guide educational practices and improve learning outcomes in mathematics education.

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LITERATURE REVIEW

THEORETICAL FRAMEWORK OF TEACHER-STUDENT INTERACTIONS

Teacher-student interactions are underpinned by theories of social and cognitive learning, which suggest that students' behaviors, attitudes, and motivation are shaped significantly by their social interactions within the classroom environment (Vygotsky, 1978). According to Pianta et al. (2008), the quality of teacher-student relationships impacts students' engagement, motivation, and overall academic success. For example, the Self-Determination Theory (SDT) posits that teacher support for students' autonomy, competence, and relatedness fosters intrinsic motivation (Ryan & Deci, 2000). Empirical studies further support SDT's relevance in explaining how teacher-student interactions in mathematics influence students' motivation to engage with challenging subjects (Reeve, 2012).

IMPORTANCE OF TEACHER SUPPORT AND STUDENT MOTIVATION

Teacher support, including emotional, instructional, and autonomy support, has been widely documented to influence student motivation positively. Pianta et al. (2003) emphasized that emotionally supportive interactions where teachers acknowledge students' perspectives and provide feedback lead to increased motivation, particularly in secondary mathematics. Similarly, teachers' instructional support, such as offering constructive feedback and clarity in explaining complex topics, correlates positively with students' engagement and motivation (Fredricks et al., 2004).

Research by Klem and Connell (2004) found that students who perceive their teachers as supportive are more likely to show higher levels of motivation and persistence in academic tasks, highlighting the impact of teacher-student interactions on academic motivation. Furthermore, secondary students' motivation in mathematics is positively influenced when teachers provide autonomy-supportive environments that encourage independent thinking and problem-solving (Black & Deci, 2000).

IMPACT OF TEACHER EXPECTATIONS ON STUDENT MOTIVATION IN MATHEMATICS

UNDERSTANDING TEACHER EXPECTATIONS AND THEIR INFLUENCE ON MOTIVATION

Teacher expectations refer to the beliefs and attitudes teachers hold about their students' potential for success, often influencing how they interact with and support each student. High expectations can foster an environment where students feel capable, motivated, and supported, leading to improved academic motivation, particularly in subjects like mathematics (Good & Brophy, 000). Conversely, low expectations may reduce student engagement and motivation, as students internalize these beliefs and become less likely to take academic risks or exert effort (Rubie-Davies, 2007).

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The Pygmalion effect, where students' performance improves when teachers hold high expectations, is one of the foundational theories explaining the impact of expectations on student motivation (Rosenthal & Jacobson, 1968). In mathematics, a subject often perceived as challenging, teacher expectations play a pivotal role in shaping student attitudes toward learning. When teachers convey confidence in their students' mathematical abilities, students are more likely to develop a growth mindset, which encourages persistence and resilience (Dweck, 2006).

IMPACT OF HIGH EXPECTATIONS ON MATHEMATICS MOTIVATION AND ACHIEVEMENT

Studies show that students in classrooms where teachers set high but attainable expectations tend to exhibit greater motivation and achievement in mathematics. A study by Hattie (2009) found that high teacher expectations positively correlate with student motivation and achievement, with an effect size of 0.43, indicating a moderate to substantial impact. This positive relationship suggests that when students perceive their teachers believe in their potential, they are more inclined to engage actively in mathematics tasks, develop confidence, and ultimately achieve better results.

Further research highlights the impact of high expectations on self-efficacy, which is essential for students facing challenging tasks in mathematics (Schunk & Pajares, 2002). Self-efficacy, or one's belief in their ability to succeed, is positively influenced by supportive teacher expectations, which encourage students to view mathematics as an achievable subject. Teacher encouragement, when coupled with high expectations, helps students build resilience and a positive attitude toward problem-solving (Eccles & Roeser, 2011).

TEACHER BEHAVIORS REFLECTING HIGH EXPECTATIONS

Teacher expectations are often reflected in their behaviors, including the language used, the level of autonomy they grant students, and the feedback provided. Good and Brophy (2000) identified that teachers who communicate high expectations through constructive feedback and challenging tasks enhance student motivation, especially in mathematics. These teachers typically offer more autonomy, encouraging students to take ownership of their learning and approach mathematics tasks with curiosity and perseverance (Reeve, 2012).

The feedback that teachers provide also plays a crucial role in how students perceive their abilities and motivation in mathematics. When feedback is framed positively, focusing on improvement and effort rather than ability, students are more likely to feel motivated and capable (Hattie & Timperley, 2007). Feedback practices that align with high expectations—such as constructive criticism and encouragement to tackle complex problems—are particularly influential in shaping students' motivation to excel in mathematics (Black & Wiliam, 1998).

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LOW EXPECTATIONS AND THEIR DETRIMENTAL EFFECTS ON MATHEMATICS MOTIVATION

While high expectations encourage motivation, low expectations can have the opposite effect, potentially leading to a decrease in student motivation and self-confidence in mathematics. Rubie-Davies (2007) found that students in low-expectation classrooms often perceive themselves as less capable, internalizing these beliefs and disengaging from mathematical tasks. This self-fulfilling prophecy, where students perform poorly due to the teacher's low expectations, reinforces a negative cycle of low motivation and achievement.

The negative effects of low expectations are particularly pronounced in mathematics, where anxiety and self-doubt can already be prevalent. According to Boaler (2013), students who perceive that their teacher has low expectations for their math ability often become less motivated and less willing to engage in the learning process. This can lead to a reduction in academic risk-taking and a fixed mindset, where students feel that their mathematical abilities are limited and unchangeable (Dweck, 2006).

RECOMMENDATIONS FOR STRENGTHENING TEACHER EXPECTATIONS

Professional development aimed at fostering high expectations can help teachers create an environment that motivates students to succeed in mathematics. Training programs that focus on equitable and inclusive teaching practices can equip teachers with strategies to communicate positive expectations to all students, regardless of their current skill level (Jennings & Greenberg, 2009). Additionally, fostering a growth mindset in teachers may further encourage them to adopt high expectations, which can inspire students to see mathematics as a subject where effort leads to improvement (Yeager & Dweck, 2012).

Hattie (2012) suggests that effective teacher training should include self-reflective practices where teachers analyze their expectations and consider how these impact their teaching behaviors. This self-awareness can encourage teachers to adopt more constructive feedback and instructional practices that align with high expectations, enhancing students' motivation and persistence in mathematics.

The classroom environment shaped by teacher-student interactions, significantly impacts students' motivation and engagement in mathematics. According to Wentzel (2002), a positive classroom climate that fosters respect, collaboration, and inclusivity enhances student motivation. A positive climate encourages students to take risks, ask questions, and develop a growth mindset toward mathematics (Dweck, 2006). Research by Skinner and Belmont (1993) indicated that when teachers create a supportive learning environment, students are more likely to stay engaged and motivated, especially in subjects perceived as difficult, such as mathematics.

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CLASSROOM CLIMATE AND STUDENT ENGAGEMENT

The classroom climate, which encompasses the overall learning environment shaped by teachers' behaviors, interactions, and expectations, significantly affects student motivation and engagement, especially in subjects like mathematics (Patrick, Ryan, & Kaplan, 2007). A positive classroom climate fosters a sense of belonging, safety, and support, which are essential for motivating students to engage with challenging subjects. When teachers maintain high expectations within a supportive environment, students are more likely to develop a positive attitude towards mathematics, feeling encouraged to participate, ask questions, and persist through challenges (Wentzel, 2002). Research highlights that a classroom environment marked by warmth and encouragement enhances students' willingness to engage, as it signals that their success is both expected and supported by the teacher (Eccles & Roeser, 2011). Teachers who create an inclusive climate by showing respect and empathy contribute to students' intrinsic motivation and self-determination, which are key to their long-term engagement in mathematics (Reeve, 2002). In contrast, a negative classroom climate—where students sense low expectations or feel unsupported—can discourage engagement, particularly for students who may already feel vulnerable in mathematics (Jussim & Harber, 2005).

Moreover, a classroom climate that encourages collaboration rather than competition can be instrumental in motivating students. Urdan and Schoenfelder (2006) found that cooperative learning environments, where students feel they are collectively working toward success, help sustain motivation in mathematics. By setting clear expectations for both individual and group work, teachers can build a climate that emphasizes effort and persistence, which are critical to engagement and performance in mathematics (Ames, 1992). This positive climate further reinforces high expectations and supports students in meeting challenging academic goals, making them more likely to view mathematics as an accessible and rewarding subject.

CHALLENGES IN TEACHER-STUDENT INTERACTIONS AND RECOMMENDATIONS FOR IMPROVEMENT

Effective teacher-student interactions are essential for fostering motivation and engagement in mathematics. However, various challenges can hinder these interactions, impacting students' motivational levels.

CHALLENGES IN ESTABLISHING CONSISTENT HIGH EXPECTATIONS

One significant challenge lies in setting and maintaining high expectations for all students. Teachers may unintentionally communicate lower expectations to certain students, often influenced by stereotypes, biases, or preconceived notions of students' abilities (Jussim & Harber, 2005). This discrepancy can discourage students from engaging fully in mathematics,

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particularly if they sense that their teacher doubts their potential. Research has shown that when teachers fail to communicate high expectations uniformly, students from underrepresented groups are often the most affected (Tenenbaum & Ruck, 2007).

Recommendation: To overcome this challenge, educators can benefit from training that focuses on identifying and addressing implicit biases, as well as on developing strategies for setting and communicating high expectations for every student. Structured feedback that emphasizes effort and improvement over innate ability can help bridge the gap in expectations (Dweck, 2006).

DIFFICULTY IN BUILDING RAPPORT AND TRUST

Another challenge in teacher-student interactions is the difficulty in building rapport and trust with students, which is crucial for motivating them in subjects like mathematics. Some students may approach mathematics with anxiety or skepticism, making it harder for teachers to establish a trusting relationship (Hattie, 2012). This lack of rapport can reduce students' motivation, as they may feel unsupported or misunderstood.

Recommendation: Building rapport requires a consistent display of empathy, patience, and understanding. Teachers can establish trust by being approachable, showing genuine interest in students' learning journeys, and acknowledging their unique challenges. Incorporating regular, informal check-ins with students can also help foster a sense of connection and trust (Cornelius-White, 2007).

MANAGING CLASSROOM DIVERSITY AND INDIVIDUAL LEARNING NEEDS

In increasingly diverse classrooms, teachers face the challenge of addressing various learning needs, which can affect their ability to interact effectively with each student. Differences in students' cultural backgrounds, prior knowledge, and learning paces can create difficulties in fostering a supportive, motivating environment for all (Gay, 2002). This challenge is often more pronounced in mathematics, where students' pre-existing skill levels can vary significantly.

Recommendation: Professional development that emphasizes culturally responsive teaching methods can equip teachers with strategies to address diverse learning needs. Additionally, differentiated instruction can help teachers engage students at their respective levels, allowing each student to feel capable and motivated (Tomlinson, 2001).

BALANCING DISCIPLINE WITH SUPPORT

Maintaining a disciplined yet supportive environment is a complex balancing act that many teachers find challenging. Strict classroom management techniques can sometimes discourage student engagement, especially if students perceive them as unsupportive or authoritarian (Lewis, Romi, Qui, & Katz, 2005). However, a lack of structure can lead to a chaotic environment, which also hinders effective learning.

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Recommendation: Adopting a balanced approach that includes positive reinforcement and clear guidelines can help teachers create a supportive yet structured classroom environment. Techniques such as positive behavior reinforcement and collaborative rule-setting can promote a disciplined yet inclusive space that supports motivation and engagement in mathematics (Marzano, Marzano, & Pickering, 2003).

OVERCOMING COMMUNICATION BARRIERS

Effective communication is essential for teacher-student interactions, yet barriers such as language differences, complex terminology, or a lack of active listening can hinder this process. In mathematics, specifically, teachers may use jargon or abstract explanations that are challenging for some students to understand (Fuson, 2003). This can lead to frustration and decreased motivation among students who struggle to grasp mathematical concepts due to communication issues.

Recommendation: Teachers should adopt clear and accessible language, avoiding overly technical terms when explaining mathematical concepts. Additionally, incorporating visual aids, real-world examples, and active listening techniques can make complex ideas more understandable, helping students feel more connected and motivated in their learning (Hattie & Timperley, 2007).

METHODOLOGY

The study employed a quantitative descriptive survey design to investigate the impact of teacher-student interactions on learning motivation in secondary mathematics. This approach allowed for the collection of numerical data that could be analyzed statistically to examine the relationship between the variables.

SAMPLE AND SAMPLING TECHNIQUE

The study targeted secondary school students from a range of educational institutions. A sample of 250 students was selected using a stratified random sampling technique to ensure representation from different schools. Stratification was based on school location (urban and rural) and grade level (Grade 9 and Grade 10) to account for potential variations in teacher-student interactions across different contexts.

INSTRUMENT

The primary data collection tool was a structured 20-item Likert scale questionnaire. The questionnaire was divided into two sections:

i. Teacher-Student Interaction (10 items): This section assessed various dimensions of teacher-student interactions, including teacher responsiveness, teacher involvement, and teacher encouragement.

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ii. Learning Motivation (10 items): This section measured students' motivation to learn mathematics, focusing on intrinsic and extrinsic motivational factors such as interest in the subject, self-confidence, and perceived relevance of mathematics.

DATA COLLECTION PROCEDURE

The questionnaires were distributed to students in their respective classrooms, with the assistance of school administrators and teachers. Participants were informed about the purpose of the study, and their participation was voluntary. Informed consent was obtained from both students and their parents or guardians before data collection. Students were asked to complete the questionnaires independently, and they were given approximately 20-25 minutes to respond.

DATA ANALYSIS

The data collected was analyzed using both descriptive and inferential statistical methods. Descriptive statistics, such as means, standard deviations, and frequency distributions, were used to summarize the responses to individual items and identify overall trends in teacher-student interactions and student motivation. To examine the relationship between teacher-student interactions and learning motivation, Pearson's correlation analysis was conducted. This statistical test was used to determine the strength and direction of the relationship between the variables. A significance level of $p < 0.05$ was considered for all tests.

LIMITATIONS

While the study provided valuable insights into the impact of teacher-student interactions on student motivation in mathematics, there were some limitations. The study was cross-sectional, meaning it captured data at a single point in time. Therefore, causal inferences cannot be drawn. Additionally, the use of self-reported data may introduce bias, as students may have provided socially desirable responses. Future studies could consider longitudinal designs or more diverse data sources to build on these findings.

FINDINGS OF THE STUDY

Table: Data Summary of Teacher-Student Interactions and Learning Motivation

Variable	Mean (M)	SD	Pearson Correlation (r)	Significance (p-value)
Teacher-Student Interaction	3.75	0.85		
i. Teacher Responsiveness	3.80	0.90	0.65	0.001
ii. Teacher	3.72	0.88	0.58	0.002

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	Involvement				
iii.	Teacher Encouragement	3.68	0.84	0.72	0.000
Learning Motivation		3.89	0.91		
i.	Intrinsic Motivation (Interest, Enjoyment)	4.02	0.94	0.62	0.001
ii.	Extrinsic Motivation (Grades, Rewards)	3.72	0.90	0.50	0.003
Overall Teacher-Student Interaction & Motivation		3.82	0.89	0.68	0.000

TEACHER-STUDENT INTERACTIONS AND MOTIVATION

The findings revealed a significant positive correlation between teacher-student interactions and students' learning motivation in secondary mathematics. A moderate to strong correlation was observed, suggesting that better interactions between teachers and students are linked to higher levels of motivation to learn mathematics.

IMPACT OF TEACHER RESPONSIVENESS

Teacher responsiveness, defined as the extent to which teachers address students' individual needs and questions, showed a strong positive correlation ($r = 0.65$, $p < 0.05$) with students' intrinsic motivation. This indicates that when teachers are more responsive to students, it enhances their internal drive to learn and enjoy mathematics.

TEACHER INVOLVEMENT AND LEARNING MOTIVATION

Teacher involvement, such as active participation in students' learning processes and showing interest in their academic progress, also demonstrated a moderate positive correlation ($r = 0.58$, $p < 0.05$) with students' motivation. The finding suggests that when teachers actively engage with students, their motivation to succeed in mathematics increases.

TEACHER ENCOURAGEMENT AND MOTIVATION

Teacher encouragement, which involves providing praise and positive reinforcement, exhibited the strongest correlation ($r = 0.72$, $p < 0.01$) with both intrinsic and extrinsic motivation. This finding underscores the importance of teacher encouragement in fostering both the internal interest and external rewards (e.g., grades, recognition) that drive students' motivation to learn mathematics.

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INTRINSIC MOTIVATION AND TEACHER INTERACTIONS

The subcomponent of intrinsic motivation, which refers to students' enjoyment and interest in the subject, showed a significant positive relationship with teacher-student interactions, particularly teacher responsiveness and encouragement. This finding indicates that when teachers create a supportive and responsive classroom environment, students are more likely to develop a genuine interest in mathematics.

EXTRINSIC MOTIVATION AND TEACHER SUPPORT

While the correlation between teacher-student interactions and extrinsic motivation (e.g., desire for grades or rewards) was lower ($r = 0.50$, $p < 0.05$), it still indicated that teacher interactions play a role in motivating students through external incentives. Encouragement and involvement were found to be key in increasing students' focus on achieving tangible academic outcomes, such as grades.

OVERALL TEACHER-STUDENT INTERACTION IMPACT

The overall findings suggest that teacher-student interactions have a moderate to strong impact on students' learning motivation in secondary mathematics. Positive teacher behaviors, such as responsiveness, involvement, and encouragement, were all found to contribute significantly to students' motivation, both intrinsically and extrinsically. These interactions appear to be crucial in creating a classroom environment where students feel supported, valued, and motivated to excel in mathematics.

The study concludes that teacher-student interactions, particularly through responsiveness, involvement, and encouragement, are essential in enhancing students' learning motivation in secondary mathematics. Teachers who establish positive and supportive relationships with students can foster both intrinsic and extrinsic motivation, leading to better academic engagement and performance in mathematics. These findings highlight the importance of teacher training and development in improving communication skills and interaction techniques to support student motivation.

CONCLUSION

Based on the findings of this study, it is evident that teacher-student interactions play a significant role in shaping students' learning motivation in secondary mathematics. The data analysis highlighted that teacher responsiveness, involvement, and encouragement were key factors contributing to higher levels of motivation among students. Teachers who actively engage with students, respond to their individual needs, and provide consistent positive reinforcement foster both intrinsic and extrinsic motivation in their students.

The strongest relationship was observed between teacher encouragement and motivation, suggesting that positive reinforcement can significantly impact students' interest in

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the subject and their drive to achieve academic success. Furthermore, the moderate correlation between teacher involvement and motivation points to the importance of creating an interactive and supportive classroom environment that encourages students to participate actively in their learning process.

Although the correlation between teacher-student interactions and extrinsic motivation was somewhat lower, it still underscores the role of teachers in motivating students through external rewards and recognition. This highlights the necessity for teachers to provide both intrinsic and extrinsic motivational strategies to support students' learning across diverse motivational needs.

Overall, the study emphasizes that effective teacher-student interactions are fundamental to enhancing learning motivation in mathematics at the secondary level. Teachers who demonstrate responsiveness and foster a supportive, engaging classroom environment are more likely to cultivate motivated learners. These findings suggest that professional development focused on improving teacher-student communication, as well as the ability to encourage and involve students, should be a priority in educational settings.

In conclusion, teacher-student interactions are not only crucial for creating a positive learning environment but are also instrumental in improving students' academic motivation, particularly in subjects like mathematics, where engagement and persistence can significantly influence performance outcomes.

DISCUSSION

The findings of this study underscore the vital role that teacher-student interactions play in fostering learning motivation among secondary mathematics students. As noted, a significant proportion of students demonstrated higher levels of motivation when they perceived their teachers as being responsive, engaged, and encouraging. These interactions were linked to both intrinsic and extrinsic motivation, suggesting that teachers who actively engage with their students can stimulate both internal desires to learn as well as external rewards that propel academic achievement.

The high correlation between teacher encouragement and motivation supports previous research that highlights the importance of positive reinforcement in the classroom. This finding is consistent with Vygotsky's (1978) social development theory, which emphasizes the role of social interactions in cognitive development. Encouragement acts as a catalyst for self-confidence and academic persistence, particularly in mathematics, which can often be perceived as a challenging subject. By offering continuous encouragement, teachers can reduce math anxiety and boost students' self-esteem, making them more willing to engage with difficult tasks.

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Similarly, teacher involvement was found to be a key factor in student motivation, which aligns with the idea that active participation in lessons fosters deeper engagement and a sense of responsibility in learners. Teachers who create a collaborative and participatory environment where students feel valued tend to cultivate greater motivation. This reflects the principles of active learning, where students take on a more participatory role in their education. In secondary mathematics, this approach is particularly important, as students often struggle with abstract concepts. Teachers who encourage exploration, discussion, and problem-solving are likely to see improvements in students' persistence and enthusiasm for the subject.

Although extrinsic motivation—as measured by external rewards like grades and recognition—was less strongly correlated with teacher-student interactions than intrinsic motivation, the data still highlighted its relevance. Students who receive recognition for their efforts in mathematics feel a sense of accomplishment and validation, which can encourage continued effort and achievement. However, this correlation was moderate, suggesting that extrinsic rewards should complement rather than replace intrinsic motivators like personal satisfaction and intellectual curiosity.

Interestingly, the findings also suggest a gap in teacher-student interaction effectiveness when it comes to individualized student support. While teacher encouragement and involvement were strong motivators, there was a moderate indication that certain students did not perceive these interactions as adequately personalized to their needs. This could indicate the need for teachers to tailor their approaches more specifically, particularly in large classrooms where individual needs might be overlooked.

Furthermore, it is crucial to recognize that student motivation is multifaceted, and the teacher's role is just one factor in a larger constellation of influences. Family background, peer relationships, and personal attitudes towards mathematics also contribute to a student's motivation levels. Thus, while improving teacher-student interactions is a key factor in increasing motivation, it must be part of a broader effort that addresses these additional dimensions.

In line with these findings, it is recommended that teacher professional development programs focus on strategies for fostering supportive and engaging teacher-student relationships. Specific training on providing individualized feedback, encouraging student autonomy, and using motivational strategies tailored to the diverse needs of secondary students would likely enhance the effectiveness of teacher-student interactions. Additionally, fostering collaboration between teachers and other stakeholders, such as counselors and parents, can create a more holistic approach to student motivation.

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In conclusion, the data confirms that teacher-student interactions significantly influence learning motivation in secondary mathematics, and that by improving these interactions, educators can play a crucial role in enhancing students' academic performance and overall attitude towards the subject. However, continuous efforts are needed to address gaps in personalization and tailor motivational strategies to meet the diverse needs of students. This study contributes to the growing body of research that highlights the importance of teacher-student relationships in educational outcomes and provides actionable insights for enhancing teaching practices in secondary mathematics.

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