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THE RECIPROCAL CYCLE OF TEACHING AND MOTIVATION IN MATHEMATICS ACHIEVEMENT: INSIGHTS FROM SECONDARY EDUCATION IN PAKISTAN

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ABSTRACT

Mathematics education stands at the intersection of pedagogy and psychology, where teaching quality and learner motivation converge to shape achievement. This study examines that intersection by exploring how teacher effectiveness and student motivation operate as mutually reinforcing forces within secondary mathematics classrooms in Punjab, Pakistan. Guided by an interpretivist qualitative design, the research draws upon semi-structured interviews with ten mathematics teachers to uncover how pedagogical practice, motivational dynamics, and systemic realities coalesce in everyday teaching. Thematic analysis revealed four interdependent themes: teaching effectiveness as the cornerstone of achievement, motivation as the driver of persistence, the reciprocal cycle linking both, and systemic constraints that undermine their potential. Teachers described effective practice not merely as technical competence but as relational engagement where empathy, clarity, and constructive feedback build confidence and curiosity. Motivation, particularly intrinsic motivation, emerged as the sustaining energy that transforms effort into persistence and understanding. The findings illuminate a continuous cycle: effective teaching inspires motivated learning, which in turn revitalizes the teacher's commitment and creativity. Yet this cycle is often strained by structural limitations such as overcrowded classrooms and exam-oriented policies. The study concludes that genuine educational improvement does not stem from isolated reforms but from nurturing the reciprocal relationship at the core of teaching and learning—a dynamic interaction in which effective teaching fosters student

	motivation, and motivated learners, in turn, enhance teachers' engagement and instructional effectiveness. Findings highlight the need for professional development and systemic reforms that reinforce the reciprocal relationship between effective teaching and motivated learning.

Introduction

Education stands as one of the most powerful instruments for personal advancement and societal transformation. It not only equips individuals with essential knowledge, skills, and ethical principles but also enables them to make meaningful contributions to their communities and nations. Globally, education functions as a cornerstone of human development and economic growth. Empirical evidence consistently supports this connection: each additional year of schooling can raise individual income by up to 10% and contribute to an annual increase of 0.37% in national GDP (Psacharopoulos & Patrinos, 2018). These findings affirm that the benefits of education extend beyond individual advancement to collective prosperity, stimulating innovation, productivity, and social mobility.

Beyond its economic value, education strengthens the moral and cultural fabric of societies. It fosters understanding, empathy, and respect among diverse populations, thereby cultivating social cohesion and tolerance. Moreover, education serves as a key mechanism for promoting equity by empowering historically marginalized groups—such as women and minorities—to participate fully in social and economic life (Carney, 2022). This transformative capacity underscores education's role not merely as an instrument of personal improvement but as a fundamental human right and a driver of inclusive progress.

Among the many disciplines within education, mathematics occupies a uniquely pivotal position. Mathematics is essential not only for developing logical reasoning and analytical problem-solving but also for nurturing creativity and critical thought. According to Inglis and Attridge (2017), mathematical thinking enables learners to approach complex challenges systematically and to apply structured reasoning to practical problems. In the context of Pakistan, mathematics holds particular significance as it is recognized as a foundational subject in national educational policies and is consistently taught from the primary through the secondary levels. The subject's importance lies in its capacity to enhance students' cognitive abilities and equip them with the skills necessary to navigate an increasingly technology-driven world (Rind & Mughal, 2020). However, despite the acknowledged importance of mathematics, Pakistani students often exhibit a negative attitude toward the subject, perceiving it as overly complex, abstract, and monotonous (Aijaz, 2001). This perception contributes to declining interest and motivation, which in turn hinders the development of essential mathematical competencies. Numerous factors both internal and external have been identified as barriers to effective mathematics learning. These include low self-concept, lack of motivation, insufficient support from teachers and parents, and peer influences (Rameli & Kosnin, 2016). Additionally, the phenomenon of mathematics anxiety, often stemming from repeated failure or the belief that mathematics is inherently difficult, further impedes student engagement. Recent research suggests that when learning environments are adaptive, supportive, and relevant to students' interests, anxiety can be reduced and performance improved. For instance, a study by Ng et al. (2022), demonstrated that a remedial tutoring program for early-grade learners not only diminished mathematics-related anxiety but also improved neural responses associated with fear regulation.

External factors such as overcrowded classrooms, poor instructional quality, weak foundational understanding, and ineffective problem-solving strategies further exacerbate learning challenges (Waswa & Al-Kassab, 2022). The gravity of these issues is underscored by findings from the Trends in International Mathematics and Science Study (TIMSS) 2019, which revealed that Pakistan ranked second to last among 64 participating countries. Alarmingly, among Grade 4 students, only 27% reached the low international benchmark, 8% achieved the intermediate benchmark, and a mere 1% met the high international benchmark in mathematics (Halai, 2020). These statistics highlight a critical need to improve both teaching practices and motivational frameworks to enhance students' mathematical achievement.

A substantial body of research underscores the central role of teacher effectiveness in shaping student learning outcomes. According to Ferguson and Danielson (2015), effective teaching is defined by its capacity to generate meaningful learning and foster academic growth. High-quality instruction enhances student achievement by combining pedagogical competence, subject expertise, and the ability to inspire learners. Evaluating teacher effectiveness, therefore, requires a multidimensional approach incorporating classroom observation, student progress measures, and feedback from learners and peers. Bardach and Klassen (2020), emphasize that effective teaching not only improves learning outcomes but also cultivates environments that enhance both intrinsic and extrinsic motivation among students. This relationship between teacher effectiveness and student motivation is particularly significant in mathematics, where engagement and persistence are critical for success.

Effective teachers employ innovative pedagogical, methodological, and technological strategies to make learning interactive and meaningful (Tadese et al., 2022). Recent evidence from Pakistan confirms that approaches such as problem-based learning, flipped classrooms, and interactive teaching significantly improve academic performance and critical thinking (Bhuttah et al., 2024).

Closely intertwined with teacher effectiveness is the construct of student motivation, which has long been recognized as a fundamental determinant of academic performance and personal development. Motivation influences how much effort students invest in learning, how persistently they pursue goals, and how effectively they self-regulate (Reeve, 2016). Motivated students tend to display greater resilience when confronted with challenges, employ more effective learning strategies, and achieve stronger educational outcomes (Mandasari, 2020). Mehndroo (2020), identified internal factors such as job interest, competitiveness, and personal intent, along with external factors like teacher and parental guidance, as major drivers of student motivation. The theoretical foundation for extrinsic motivation lies in operant conditioning, wherein behavior is reinforced through rewards or the avoidance of punishment (Hennessey et al., 2015).

Although teacher effectiveness and student motivation are known to influence academic performance, their reciprocal relationship remains underexplored, especially in developing contexts like Pakistan. This study addresses the problem that educational reforms often treat teaching and motivation as separate forces rather than interconnected processes. By examining teachers' perspectives on how these factors interact in secondary mathematics classrooms, the research contributes to a more integrated understanding of effective, motivation-driven teaching.

The objective of this study is:

1. To explore teachers' views on how their teaching effectiveness and student motivation impact students' academic performance in mathematics

Literature Review

Mathematics holds a vital place in secondary education, shaping learners' logical reasoning, analytical capacity, and problem-solving abilities. Despite this significance, persistent concerns regarding students' underachievement—particularly in developing regions—have prompted ongoing scholarly inquiry. This challenge underscores the need to identify the key determinants of success in mathematics. Two central variables frequently examined in empirical research are teacher effectiveness and student motivation.

Motivation and Academic Achievement

The relationship between student motivation and academic achievement remains a central concern in educational research. Motivation influences not only students' engagement but also the quality and persistence of their learning efforts. As Baynard (2020) observes, understanding motivational processes enables educators and policymakers to develop effective strategies to enhance student success, particularly in mathematics.

Motivation is generally categorized into intrinsic and extrinsic dimensions. Intrinsic motivation arises from curiosity and personal enjoyment of learning, whereas extrinsic motivation depends on external incentives such as grades or social approval. Two influential frameworks—Self-Determination Theory (SDT) and Achievement Goal Theory (AGT)—offer valuable perspectives on how individual and contextual factors shape learning motivation. SDT by (Ryan & Deci, 2000) emphasizes the psychological needs for autonomy, competence, and relatedness, while AGT differentiates between mastery and performance goals that influence motivation differently (Camacho-Morles et al., 2021; Howard et al., 2021).

Academic achievement is typically measured through indicators such as grades, standardized test scores, and course completion rates, each reflecting students' progress and mastery (Ferrer et al., 2022). Within mathematics education, motivation plays a decisive role in engagement and performance. Intrinsically motivated learners display greater persistence, problem-solving capacity, and higher academic results (Özhan & Kocadere, 2020; Prieto Andreu, 2020). Conversely, students with low motivation—often due to negative beliefs or anxiety about mathematics—tend to perform poorly and disengage from learning activities (Abín et al., 2020; Husein et al., 2018).

The Role of Motivation in Mathematics Achievement

A growing body of evidence demonstrates that intrinsic motivation serves as a stronger and more sustainable predictor of mathematics achievement than extrinsic motivation. Kirkham et al. (2023) found that intrinsic and attainment values, closely linked to students' self-concept and interest in mathematics, significantly influenced course selection and academic outcomes. Similarly, (Zhang et al., 2023) reported that intrinsic motivation had a reciprocal relationship with cognitive engagement, highlighting its role in deep, conceptual learning.

In contrast, extrinsic motivation, though effective in the short term, often promotes superficial engagement. Wu et al. (2022) demonstrated that students primarily driven by external rewards showed lower persistence when faced with challenging mathematical problems compared to their intrinsically motivated peers.

Evidence from developing contexts also underscores the importance of intrinsic drives. Okaka et al. (2024) found that intrinsic motivation was a stronger predictor of mathematics achievement than extrinsic motivation among Kenyan secondary students, emphasizing the value of curiosity-driven learning. Schukajlow et al. (2022) likewise noted that strategy-based motivation—where students develop self-regulated learning strategies—enhances engagement and achievement. Collectively, these findings suggest that mathematics education should focus on cultivating students' intrinsic interest and sense of competence rather than reliance on external incentives.

Teacher Effectiveness

Teacher effectiveness remains a decisive factor in shaping students' academic success, especially in mathematics. Effective teachers employ pedagogical, technological, and methodological strategies that enhance student learning outcomes (Gómez-García et al., 2020; Trujillo-Torres et al., 2020). They also establish supportive and inclusive classroom environments that foster engagement and a sense of belonging (Domínguez et al., 2020).

A particularly critical aspect of effectiveness is the student–teacher relationship. Positive interactions enable teachers to better understand individual needs, personalize instruction, and foster motivation (Sánchez-Matamoros et al., 2019; van der Kleij, 2019). Conversely, poor instructional practices and weak classroom management can lead to disengagement, disruptive behaviors, and diminished performance (Lerang et al., 2018). Roorda et al. (2019) emphasized that negative teacher–student relationships often cause students to perceive mathematics as inaccessible, which further hinders their performance.

Formative feedback and interactive learning are also fundamental components of effective teaching. Munna and Kalam (2021) found that methods such as feedback, role-play, and active learning significantly increased students' confidence, inclusion, and performance. These practices not only enhance comprehension but also reinforce motivation by making learners feel supported and competent.

Impact of Teacher Effectiveness on Mathematics Achievement

Recent empirical research consistently confirms that teacher effectiveness predicts mathematics achievement. Waswa et al. (2024) reported that effective teachers manage classrooms efficiently, use formative assessments to adapt instruction, and communicate learning objectives clearly, leading to improved student outcomes. Zhu and Kaiser (2022) similarly, found that classroom practices in Shanghai influenced students' mathematics interest, self-efficacy, and achievement. Meulenbroeks et al. (2024) demonstrated that inquiry-based learning led by skilled teachers enhanced both intrinsic motivation and performance in Dutch secondary schools.

Eminita et al. (2024), using multi-level modeling, found that while teacher competence varied moderately, student motivation differed substantially, suggesting that teachers must tailor instruction to diverse motivational profiles. Moreover, formative assessment practices—such as timely, specific, and constructive feedback—are associated with increased engagement and learning outcomes (Phillips et al., 2016).

Classroom management also plays a key role. Zhang et al. (2023) found that consistent and respectful routines increase students' sense of security and motivation, particularly when paired with autonomy-supportive instruction. Karjanto and Acelajado (2022) reported that flipped classroom strategies improved conceptual understanding and problem-solving ability, demonstrating the importance of careful instructional planning.

In Rwanda, NZABAHIMANA and Andala (2024) found that teacher motivation—through fair remuneration, recognition, and continuous professional development—positively influenced students' mathematics achievement. Their study, grounded in self-determination theory, underscores that supporting teachers' professional growth enhances their effectiveness and, consequently, their students' motivation and achievement.

The reviewed literature establishes a clear, reciprocal relationship between teacher effectiveness and student motivation. Effective teachers cultivate motivationally rich environments through autonomy-supportive practices, formative feedback, and empathetic communication. Motivated students, in turn, demonstrate stronger engagement, persistence, and achievement, reinforcing the effectiveness of instructional practices.

Research Methodology

Research Design

This study adopted a qualitative research design to explore mathematics teachers' perspectives on how their teaching effectiveness and students' motivation shape academic performance in secondary-level mathematics. A qualitative approach was chosen for its capacity to capture the subtleties of teachers' experience, professional judgment, and contextual understanding that cannot be meaningfully expressed through numerical data alone. As Creswell and Poth (2016) suggest, qualitative inquiry is particularly valuable when the goal is to understand human experiences in depth rather than to measure them. The study's interpretive orientation acknowledges that teachers' insights are situated within complex classroom realities where pedagogical decisions, student attitudes, and institutional constraints interact dynamically. This design, therefore, enabled a rich exploration of how teaching and motivation coalesce to influence students' mathematical achievement.

Participants and Sampling

The study engaged ten mathematics teachers from government secondary schools in Lahore, Punjab. Teachers were intentionally selected as participants because they occupy a dual role as practitioners and observers of the learning process, providing a broader and more systemic understanding of how teaching effectiveness and student motivation intersect. Their reflections encompass both pedagogical strategies and student engagement patterns, offering a holistic account of the teaching–learning relationship.

A purposive sampling strategy was employed to ensure a diversity of perspectives across gender, teaching experience, and school context. This approach aligns with Patton (2015) guidance that purposive sampling should privilege "information-rich cases" that illuminate the phenomenon under study. All participating teachers were responsible for teaching Grade 10 mathematics, a level where the demands of national examinations intensify both instructional responsibility and student pressure. Participants' professional experience ranged from five to twenty years, encompassing both early-career and veteran educators. This range allowed the study to capture variations in professional practice and pedagogical insight that might emerge from differing levels of experience.

The decision to focus exclusively on teachers, rather than students, was intentional. Teachers, by virtue of their sustained interaction with learners and curricular demands, can observe motivational trends, academic struggles, and the pedagogical factors that shape achievement outcomes. Their voices offer a valuable professional perspective on systemic and classroom-level factors that may be less visible in student self-reports. This focus thus provides an opportunity to bridge the gap between pedagogical intent and student experience.

Data Collection

Data were gathered through semi-structured interviews, a method chosen for its balance between structure and openness. This format provided a guiding framework for inquiry—ensuring consistent coverage of key topics such as teacher effectiveness, motivational dynamics, and academic performance—while allowing participants the freedom to elaborate on their own experiences and priorities. Semi-structured interviews are particularly effective in educational research because they invite reflection and encourage participants to connect professional insights with concrete classroom realities.

Interviews were conducted in a quiet, private space within the school environment to promote comfort and candor. To foster authentic expression, interviews were conducted in Urdu, the participants' preferred language. This linguistic alignment helped participants articulate their

thoughts more naturally, allowing richer data collection. All interviews were audio-recorded with participants' informed consent and subsequently transcribed verbatim.

Following transcription, the data were translated into English for analysis. The translation process adhered to the principles outlined by Temple and Young (2004), emphasizing conceptual rather than literal equivalence to preserve meaning across languages. Field notes were also maintained throughout the data collection process, capturing non-verbal cues, contextual details, and researcher reflections that informed later stages of analysis.

Data Analysis

Data analysis followed the six-phase thematic analysis framework proposed by (Braun & Clarke, 2021). This method was chosen for its flexibility and rigor in identifying, analyzing, and interpreting patterns of meaning across qualitative data. The process began with an intensive familiarization stage, during which the researcher repeatedly read and annotated the transcripts to gain a holistic sense of each participant's account. Next, initial codes were generated inductively to capture salient features of the data. These codes were then organized into potential themes that represented recurring ideas or conceptual linkages relevant to teacher effectiveness, motivation, and academic performance.

Themes were subsequently reviewed and refined, ensuring coherence within themes and distinctiveness between them. During this phase, relationships among themes were also examined to construct a coherent narrative about how teaching practices and motivational factors interact in mathematics classrooms. Once finalized, the themes were defined and named, and illustrative quotations were selected to support the analytic interpretations. The final stage involved producing the analytic account, in which findings were integrated with existing theoretical constructs to situate them within broader scholarly discourse.

Ethical Considerations

The research strictly adhered to established ethical standards in qualitative inquiry. Informed consent was obtained from all participants after a clear explanation of the study's aims, procedures, and their rights as contributors. Participants were assured that their involvement was voluntary and that they could withdraw at any stage without consequence. To protect confidentiality, pseudonyms were assigned and identifying details were removed during transcription and reporting.

The interviews were designed to maintain participants' professional dignity and psychological comfort. Given that discussions about teaching effectiveness can potentially evoke self-critique, care was taken to frame questions constructively and reflectively. Participants were encouraged to view their insights as contributions to collective professional learning rather than personal evaluation. These ethical safeguards ensured that the research process was transparent, respectful, and aligned with institutional and international standards for educational research ethics.

Results/Findings

Thematic analysis of teacher interviews revealed four deeply interconnected themes that collectively illuminate how teaching effectiveness and student motivation interact to shape academic achievement in mathematics. These themes include: (1) teaching effectiveness as the cornerstone of achievement, (2) motivation as the driver of persistence, (3) the reciprocal cycle of effectiveness and motivation, and (4) systemic constraints undermining pedagogy and motivation.

Table 1: Summary of Emergent Themes from Teacher Interviews

Theme	Key Dimensions
Teaching Effectiveness as the	Content expertise, clear explanations, formative

Cornerstone of Achievement	assessment, and feedback build student confidence and performance.
Motivation as the Driver of Persistence	Intrinsic motivation fosters resilience; extrinsic motivation often linked to grades and parental expectations.
Reciprocal Cycle of Effectiveness and Motivation	Effective teaching fuels student motivation, which in turn inspires teachers to innovate and persist.
Systemic Constraints	Large classes, exam-driven curricula, resource limitations, and inconsistent parental support undermine both pedagogy and motivation.

Teaching Effectiveness as the Cornerstone of Achievement

Across interviews, teachers consistently articulated that their own teaching effectiveness was central to determining students' mathematical success. They described effectiveness not merely as mastery of content, but as the capacity to communicate complex concepts in accessible ways, employ appropriate assessments, and cultivate supportive classroom climates. Content expertise alone, many noted, does not guarantee understanding; clarity of explanation and the ability to connect abstract ideas to real-life examples were viewed as indispensable.

One teacher elaborated, "It is not enough to know mathematics deeply; if I cannot communicate it clearly, students lose interest. Explaining concepts step by step, using examples from daily life, makes all the difference." This reflection underscores the communicative dimension of pedagogical effectiveness, where understanding students' cognitive readiness is as vital as subject knowledge. Lesson planning also emerged as a recurring subtheme; teachers recognized that careful preparation enhanced lesson flow, minimized confusion, and strengthened student engagement. As another participant explained, "Planning my lesson carefully means fewer gaps during teaching. When I prepare well, students also prepare well."

Formative assessment was identified as a key tool for maintaining academic discipline and tracking comprehension. One teacher observed, "Without regular tests, students do not take mathematics seriously. When they know there will be questions every week, they stay attentive. Feedback, too, was emphasized as a vital motivational tool rather than a punitive measure. One teacher noted, "If a student makes a mistake, I don't scold them; I explain again and encourage them. This way, they try harder the next time," highlighting how constructive responses can sustain learners' confidence and perseverance. These perspectives reveal that effective teaching extends beyond the technical delivery of content; it is deeply relational and focused on cultivating students' emotional and intellectual readiness to engage with mathematics.

Motivation as the Driver of Persistence

Teachers uniformly emphasized the centrality of motivation in sustaining students' effort and persistence in mathematics, a subject often associated with anxiety and self-doubt. They identified both intrinsic and extrinsic forms of motivation operating simultaneously in classrooms. Intrinsic motivation derived from curiosity, interest, and enjoyment was viewed as producing deeper, more durable learning, while extrinsic motivation, such as exam pressure, parental expectations, or material rewards, was seen as producing only short-term compliance.

One teacher remarked, "Students who genuinely enjoy solving problems progress the most. They don't give up easily. Even if they fail once, they will try again until they succeed." This account captures how self-driven learners exhibit greater resilience and persistence. In contrast, another teacher pointed out, "Many students work hard only because of board exams or because their parents are strict. They may achieve marks, but their understanding is weaker." These comments

highlight a distinction between surface-level engagement and meaningful learning, echoing research suggesting that intrinsic motivation fosters conceptual mastery, whereas extrinsic pressure often limits learning to rote memorization.

Teachers also noted how motivation interacts with classroom climate and teacher behavior. Encouragement, recognition of effort, and autonomy were cited as powerful motivators. As one participant reflected, "When students feel that their effort is noticed, they try harder. I tell them that mistakes are part of learning." Motivation, in this view, was not simply a psychological variable but a social construct shaped by teacher-student interaction. Another teacher linked motivation directly to active participation: "Motivated students ask more questions. They don't sit silently when they are confused. This attitude leads them towards better performance." The testimonies collectively reveal that motivation functions both as a driver of persistence and as an indicator of classroom climate—when learners feel supported, they sustain effort even in the face of challenge.

The Reciprocal Cycle of Effectiveness and Motivation

A recurring insight across the interviews was the reciprocal relationship between teaching effectiveness and student motivation. Teachers perceived these two factors not as isolated influences but as interdependent forces that continually reinforce one another. Effective teaching methods were said to ignite student motivation, which in turn inspired teachers to refine and improve their instructional practices. This dynamic interplay was described as a self-sustaining cycle that enhanced both learning outcomes and professional satisfaction.

One teacher articulated this synergy clearly: "If my teaching is engaging, students respond with attention and interest. Their response gives me energy, and I prepare even better for the next class." Another framed it as an ongoing loop of mutual reinforcement: "Teaching well motivates students, and their motivation motivates me. It becomes a continuous circle of improvement." This sentiment illustrates the affective and professional reciprocity inherent in teaching—a process where students' enthusiasm validates the teacher's efforts, while teachers' success in motivating learners enhances their own sense of efficacy.

Several participants described how motivated students stimulated their creativity and commitment to pedagogical innovation. As one teacher reflected, "When students appreciate my effort, I feel proud as a teacher. Their enthusiasm makes me want to innovate and try new methods." Such experiences fostered a sense of professional identity rooted in responsiveness and growth. Teachers viewed effective teaching not as a static set of competencies but as an evolving process continually shaped by feedback and student engagement. This reciprocal cycle illustrates that motivation and teaching effectiveness are not merely correlational variables but co-constructive forces in educational practice—each amplifying the other in ways that sustain both learning and teaching vitality.

Systemic Constraints Undermining Pedagogy and Motivation

Despite their commitment and reflective practices, teachers candidly acknowledged a range of systemic constraints that limited their ability to sustain both pedagogical effectiveness and student motivation. The most frequently cited barriers included large class sizes, exam-oriented curricula, inadequate resources, and inconsistent parental support. These structural factors often disrupted individualized instruction and undermined teachers' efforts to foster conceptual understanding.

Large classes were repeatedly described as impeding personalized attention. One teacher lamented, "With sixty or seventy students, individual attention is impossible. Many students get lost in the crowd, and their motivation drops." This challenge reflects broader systemic

inefficiencies in public education, where over-enrollment and limited staffing compromise instructional quality. The pressure of board examinations was another persistent frustration. "Board exams force us to focus on memorization and shortcuts, which kills creativity and motivation. Students only want formulas to pass, not understanding." Such comments underscore the tension between policy-driven accountability systems and pedagogical goals centered on critical thinking and conceptual mastery.

Resource scarcity further constrained innovative teaching. "Sometimes I want to use visual aids or activities, but there are no materials. Even basic calculators or charts are missing. This affects both my teaching and students' interest," shared a participant. Teachers also pointed to the inconsistent role of parents, noting that excessive pressure or lack of involvement both contributed to student disengagement. "Some parents put pressure only for marks, not for understanding. Others don't support their children at all. Both extremes make it harder to keep students motivated," observed one teacher. These reflections highlight how institutional, material, and socio-cultural factors intersect to shape the learning environment.

Despite these barriers, teachers displayed remarkable adaptability, often compensating for deficiencies through improvisation, peer collaboration, and emotional labor. Their narratives reveal a strong moral commitment to their students' success and a persistent belief in the transformative power of teaching, even under constraining conditions. However, they also call attention to the urgent need for systemic reforms smaller class sizes, resource provision, teacher development, and curricular redesign, that would enable educators to teach more effectively and nurture lasting motivation among learners.

Overall, the findings demonstrate that teacher effectiveness and student motivation are deeply intertwined processes, each amplifying the other to influence academic performance in mathematics. Yet, their full potential is frequently curtailed by systemic limitations that call for institutional and policy-level interventions.

Discussion on Findings

The findings of this study highlight that teachers view their own effectiveness as the foundation of students' success in mathematics. They emphasized that being an effective teacher goes beyond knowing the content; it involves explaining complex ideas clearly, using assessments strategically to guide learning, and fostering a supportive classroom where students feel confident and encouraged. This resonates with prior research showing that teacher effectiveness influences not only academic performance but also students' motivation, engagement, and self-efficacy (Blazar & Kraft, 2017). Evidence also underscores the importance of formative assessment and professional reflection in improving learning outcomes (Klute et al., 2017), while instructional clarity and a well-managed classroom climate have been linked to higher student achievement (Berger et al., 2023; Wang & Degol, 2016). Together, these studies confirm that teaching effectiveness is multifaceted, encompassing pedagogical skill, relational awareness, and reflective practice.

The present study highlighted that teachers perceive motivation as a critical driver of students' persistence and effort in mathematics, a subject often associated with anxiety and self-doubt. Participants emphasized that intrinsic motivation—stemming from curiosity, enjoyment, and interest—encourages deeper, more durable learning, whereas extrinsic motivation—such as parental expectations, examinations, or material rewards—tends to produce short-term compliance. Teachers' reflections suggest that motivation, in its multiple forms, serves as both the engine and the sustaining force behind students' engagement and achievement in mathematics.

These perceptions are strongly supported by empirical evidence. Adamma et al. (2018) demonstrated that both intrinsic and extrinsic motivation significantly influenced pupils' mathematics performance, reinforcing the view that motivated students are more likely to persist and succeed. Similarly, Zarif et al. (2024) showed that teaching strategies, such as the use of flashcards, enhanced both intrinsic and extrinsic motivation, leading to improved engagement and learning outcomes. These findings align with teachers' emphasis on the necessity of fostering both forms of motivation to sustain effort over time. The role of intrinsic motivation, in particular, has been highlighted in multiple contexts. Orta and Çetin (2023) found that students' interest in mathematics, a key component of intrinsic motivation, was significantly associated with higher academic achievement, confirming that curiosity and enjoyment drive persistent learning behaviors. Likewise, Iyamuremye et al. (2023) reported that self-determined motivation, encompassing both intrinsic and career-oriented motivations, positively predicted students' mathematics performance, suggesting that internal drivers strongly shape students' engagement and achievement. Collectively, these studies underscore the importance of cultivating intrinsic motivation as a long-term driver of persistence, while recognizing that extrinsic motivators can complement and reinforce engagement, especially in the context of structured classroom activities.

The study also revealed that, despite their commitment and reflective practices, teachers face a range of systemic constraints that limit their ability to sustain both pedagogical effectiveness and student motivation. Participants identified large class sizes, exam-oriented curricula, inadequate resources, and inconsistent parental support as key structural barriers. These factors were reported to disrupt individualized instruction, constrain interactive teaching methods, and undermine efforts to foster deep conceptual understanding in mathematics. Teachers' reflections suggest that classroom-level innovations alone may be insufficient unless broader structural reforms accompany them.

These findings are corroborated by multiple empirical studies. Abuhasanein et al. (2025) highlighted similar challenges in Northern Tunis, where overcrowded classrooms, limited mathematics laboratories, inadequate reward and discipline systems, and insufficient parental involvement hindered effective mathematics teaching and individualized instruction. Yan et al. (2021) reinforced these conclusions in a systematic review, showing that large class sizes, exam-oriented curricula, and inadequate resources are consistently linked to diminished teacher motivation and instructional quality. Collectively, these studies emphasize that systemic constraints are not merely logistical challenges but central determinants of teacher effectiveness and student learning outcomes.

Additional research supports the broader implications of these structural barriers. Waswa and Al-Kassab (2022) reported that large class sizes and resource shortages limit active learning opportunities and reduce meaningful teacher–student interaction. Halai (2020) noted that structural deficiencies in Pakistan's education system, including rigid curricula and insufficient institutional support, compromise mathematics learning outcomes. Kim et al. (2019) demonstrated that teacher well-being, closely tied to empathy and conscientiousness, suffers under stressful working conditions, which in turn negatively affects instructional effectiveness. Similarly, Sortwell et al. (2024) emphasized that formative assessment and student-centered pedagogies can only flourish when systemic conditions provide adequate time, training, and manageable workloads for teachers.

Conclusion

This study underscores the profoundly interdependent relationship between teacher effectiveness and student motivation in shaping academic performance in mathematics. Through teachers' voices, the research illuminated how pedagogical quality and learner engagement are mutually reinforcing processes, each catalyzing the other in a continuous cycle of growth, effort, and achievement. Teacher effectiveness was conceptualized as a multifaceted construct encompassing content mastery, clarity of instruction, formative assessment, constructive feedback, and relational sensitivity. These dimensions collectively enabled teachers to build trust, reduce mathematics anxiety, and promote a culture of intellectual curiosity within the classroom.

Equally significant was the central role of motivation, particularly intrinsic motivation, in sustaining persistence and engagement. Teachers' narratives revealed that students who approached mathematics with curiosity and enjoyment demonstrated deeper understanding and greater resilience when faced with challenges. Conversely, extrinsic motivators such as examinations, grades, or parental pressure, though capable of eliciting short-term effort, often resulted in superficial learning that dissipated once the external incentive was removed. These findings reinforce the distinction between surface and deep learning orientations and affirm that authentic engagement in mathematics is best nurtured through meaningful and supportive pedagogical interactions.

A defining insight from this study was the recognition of a reciprocal cycle between teaching effectiveness and motivation. Effective teaching was found to ignite motivation, while motivated students, in turn, reinvigorated teachers' enthusiasm, creativity, and commitment. This dynamic reflected a relational and constructivist view of learning where knowledge is not merely transmitted but co-constructed through interaction, empathy, and shared purpose. Teachers described this synergy as both professionally rewarding and pedagogically transformative. However, the study also brought to light significant systemic barriers that impeded the realization of this ideal. Large class sizes, exam-driven curricula, limited teaching resources, and inconsistent parental involvement collectively constrained teachers' capacity to sustain engagement and innovation. These structural challenges often forced educators to prioritize content coverage over conceptual understanding and assessment over curiosity.

The findings underscore the urgent need for professional development programs that equip teachers with strategies to foster both cognitive understanding and emotional engagement. Training should emphasize learner-centered pedagogy, formative feedback, and motivational techniques that support autonomy and competence. At a policy level, addressing systemic constraints, reducing class sizes, diversifying assessment systems, and improving resource provision are critical for enabling teachers to enact effective and motivating instruction. Sustainable improvements in mathematics achievement will therefore require a dual strategy: empowering teachers pedagogically while creating structural conditions that nurture enduring motivation among students.

Beyond its immediate implications, the study opens pathways for future inquiry. Comparative research that incorporates both teacher and student perspectives would yield a more comprehensive understanding of how motivation and teaching effectiveness interact across different contexts. Longitudinal studies could trace how these reciprocal dynamics evolve over time and respond to educational reforms, revealing the long-term effects of interventions aimed at enhancing teacher quality or student motivation. Furthermore, cross-cultural investigations would help determine whether the cyclical patterns identified in Pakistan resonate within other educational systems, particularly in developing nations where resource disparities and exam-oriented cultures are prevalent.

In essence, this study highlights that mathematics achievement is not solely a product of individual effort or instructional technique, but rather the outcome of a relational ecosystem sustained by mutual respect, inspiration, and shared endeavor. Teacher effectiveness and student motivation should thus be understood as complementary forces, each nurturing the other in the collective pursuit of learning.

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