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Empowering Secondary School Teachers and Students with Effective Mathematics Teaching and Learning Strategies

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ABSTRACT

Many students today show low motivation toward learning mathematics. A key factor contributing to this issue is the reliance on traditional teaching methods in schools. While some conventional strategies remain useful, they should be enhanced with modern approaches to increase student engagement and promote active learning. This study investigates effective strategies to foster interest in mathematics by strengthening both teaching and learning practices. It provides practical guidance for designing interventions that improve mathematics instruction and create a more supportive learning environment. The study also offers valuable insights for teachers seeking to adapt their teaching methods to better meet the needs of Generation Z learners.

Keywords: *21st century teaching skills, communication skills, critical thinking skills, learning styles, mathematics, motivation, strategies*

INTRODUCTION

In Malaysia, mathematics is a compulsory subject for all primary and secondary school students (Wong & Wong, 2019). Despite its importance, many students show low interest and motivation in the subject. Research indicates that student motivation strongly influences academic performance (Azmidar et al., 2017). A key issue contributing to low motivation is the overuse of traditional, teacher-centered methods that fail to consider students' diverse learning needs (Muhamad, 2023). Although various studies have explored student motivation or learning styles individually, few have holistically examined how these factors interact particularly in the Malaysian secondary mathematics context. Therefore, this study aims to fill this gap by investigating how students' motivational challenges and preferred learning styles can inform more effective teaching strategies, specifically within mathematics education.

Research Objectives:
1. To identify the main factors causing students' lack of motivation in mathematic
2. To determine students' preferred learning styles.
3. To propose effective teaching strategies based on students' learning preferences.

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Research Questions:
1. What are the primary factors that cause secondary school students to feel demotivated in learning mathematics?
2. What are the preferred learning styles of these students in relation to mathematics instruction?
3. How can teachers use these insights to design more effective and engaging mathematics teaching strategies?

LITERATURE REVIEW

Theoretical Framework: VARK and 21st Century Competencies

The literature supports the integration of learning style models and 21st century teaching frameworks as effective strategies to address motivational challenges in mathematics education. A widely recognized model is the VARK framework (Aprita & Sari, 2014), which classifies learners into four types: visual, auditory, reading/writing, and kinesthetic. When instruction aligns with these learning preferences, students demonstrate greater engagement and comprehension (Escuardo, 2023).

The 4Cs Critical Thinking, Communication, Collaboration, and Creativity proposed by the Partnership for 21st Century Learning are essential competencies for modern education (Battelle for Kids, 2019). Devlin (2019) emphasizes that fostering creativity in mathematical thinking encourages deeper understanding, while Freeman (2014) argues that student-centered instruction enhances autonomy and motivation. Setiawati et al. (2024) further highlight that integrating audio-visual tools enhances conceptual understanding, especially among kinesthetic and auditory learners.

Learning Styles in Mathematics Education

Students' motivation to learn mathematics is deeply influenced by their preferred learning styles. The VARK model provides a framework to tailor instructional methods that align with individual preferences. Visual learners benefit from diagrams, color-coded materials, and interactive tools like GeoGebra and Desmos, which can visualize equations, functions, and geometric shapes. According to Cheema, Ampadu, and Pears (2023), such technologies significantly improve students' mathematical fluency and shift their attitudes positively toward the subject.

Auditory learners absorb information best through listening and discussion. Instructional methods such as oral explanations, group discussions, and verbal feedback help these students process mathematical content more effectively. Khoo et al. (2024) reported that students with auditory learning preferences tend to experience varying levels of mathematics anxiety, suggesting that alignment between teaching styles and learning preferences can reduce stress and improve performance. Mursidik et al. (2024) also found that auditory learners often possess self-regulatory skills, including goal-setting and monitoring, contributing to their academic success.

Reading/writing learners engage most effectively with written explanations, structured notes, and opportunities for reflection. These students benefit from detailed instructions, textbooks, and guided note-taking. Barkley (2023) emphasizes that reflective writing deepens understanding by prompting learners to organize their thoughts and articulate their reasoning, which in turn promotes metacognitive awareness.

Kinesthetic learners grasp abstract concepts best through physical engagement and hands-on activities. Strategies such as using manipulatives, math stations, and real-world applications like budgeting or measuring enhance retention and application. Oladele (2024) found that activities involving movement and real-life problem-solving significantly improved students' ability to understand and remember mathematical concepts.

Understanding and catering to diverse learning styles not only promotes deeper learning but also creates a more inclusive and motivating environments for all learners.

Post-Pandemic Challenges in Mathematics Teaching

The transition back to face-to-face teaching after prolonged periods of online learning presented significant challenges. Cheema (2021) observed that students experienced difficulties adjusting to in-person instruction due to learning gaps and reduced stamina. This study echoes those concerns and emphasizes the need for engaging flexible strategies to revitalize motivation.

Teachers are now expected to facilitate environments that balance academic rigor with emotional support. The gap created during online learning demands innovative strategies to rebuild foundational understanding and classroom interaction.

The Role of the 4Cs in Effective Mathematics Instruction

Teachers must not only develop the 4Cs in students but also practice them professionally. Insorio and Librada (2021) highlighted the value of problem-based learning for developing critical thinking skills in mathematics. Teachers must evaluate resources, adapt instruction, and guide students in applying logic to complex problems.

Effective communication is essential for explaining abstract mathematical concepts clearly. Teachers must also be active listeners who respond to students' needs and foster a positive learning environment. Sword (2020) emphasized that strong communication skills sustain engagement, foster empathy, and support learning across diverse student profiles.

Collaboration among teachers and students enhances professional development and student engagement. Activities like group problem-solving and peer tutoring build teamwork skills and reinforce conceptual understanding.

Creativity allows teachers to design dynamic, differentiated lessons that accommodate various learning styles. Devlin (2019) asserts that creative instruction helps overcome student resistance to mathematics by making content more relevant and enjoyable.

By applying these competencies, teachers can restore confidence and motivation in mathematics learning and empower students to take ownership of their educational journey.

METHODOLOGY

Research Design

This study employed a descriptive quantitative survey design to gather data on students' motivation and learning preferences.

Participants

The sample consisted of 187 Form 4 students from SMK Putrajaya Presint 18(1). A purposive sampling method was employed to target students actively enrolled in mathematics classes. The inclusion criteria focused on diversity in academic performance and balanced gender representation. The selected school was chosen based on accessibility and administrative approval.

Although the sample was drawn from a single school, it included students from multiple classes and backgrounds, reflecting a range of academic abilities and experiences. This approach provides a

degree of representativeness for urban secondary school settings in Malaysia. However, generalizations beyond this context should be made with caution.

Instrumentation

The data collection instrument was a structured questionnaire developed based on validated constructs from previous studies (Aprita, 2014; Khoo et al., 2024). It comprised three main sections:

Section A: Demographic information (e.g., age, gender)

Section B: Causes of motivation and demotivation in learning mathematics (6 items on a 5-point Likert scale)

Section C: Preferred learning styles aligned with the VARK framework (5 items on a 5-point Likert scale)

Items were adapted from published surveys measuring similar constructs and refined through a content validation process. Two education lecturers with expertise in pedagogy and educational measurement reviewed the questionnaire for face and content validity. A pilot test involving 30 students from a comparable demographic group was conducted to examine internal consistency and clarity. The reliability analysis yielded a Cronbach's alpha value of 0.81, indicating acceptable internal consistency.

Sample items included:

"I find mathematics boring because of the way it is taught." (motivation)

"I benefit from visual aids such as diagrams and graphs in understanding mathematics." (learning style)

Each item was rated on a 5-point Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree).

Data Collection Procedure

After obtaining approval from the school administration, the questionnaire was administered electronically using a secure online platform during scheduled class periods. Participation was voluntary. Prior to participation, students and their parents were provided with an information sheet and consent form, emphasizing anonymity, data confidentiality, and the right to withdraw at any time. The survey took approximately 15–20 minutes to complete, and all responses were automatically anonymized to protect participants' identities.

Data Analysis

Descriptive statistics, including means and standard deviations, were used to analyze the responses. This approach was chosen to identify patterns in students' motivational challenges and learning preferences. Inferential statistical analysis was not conducted, as the aim of the study was exploratory in nature to describe trends rather than test specific hypotheses.

RESULTS AND DISCUSSION

The findings from this study offer valuable insights into the factors that influence students' motivation and learning preferences in mathematics. As shown in Table 1, the most significant demotivating factor is a lack of understanding or difficulty with mathematical concepts (M = 3.73, SD = 1.203). This aligns with Davadas and Lay (2021), who emphasize that content comprehension is essential in reducing

student anxiety and promoting engagement. Without a strong conceptual foundation, students are more likely to disengage, underscoring the need for scaffolded instruction and differentiated teaching strategies.

Table 1: Causes of Students' Lack of Motivation in Learning Mathematics

Causes Lack of Motivation	N	Mean	Std. Deviation
1. Lack of understanding or difficulty with mathematical concepts	187	3.73	1.203
2. Boredom with the way mathematics is taught	187	3.05	1.258
3. Lack of confidence in my mathematics abilities	187	3.62	1.187
4. Feeling pressure to perform well in mathematics	187	3.59	1.285
5. Feeling distracted when learning mathematics for too long	187	3.42	1.286
6. Lack of relevance of mathematics to my future goals	187	2.32	1.518
Total		N	N

Another key factor is students' lack of confidence in their mathematical abilities (M = 3.62, SD = 1.187), which reflects broader issues of self-efficacy. When students perceive themselves as incapable, their motivation and participation decline. Teachers can address this by fostering a growth mindset, celebrating small academic successes, and providing positive feedback to help students rebuild confidence. Closely related is the pressure to perform well (M = 3.59, SD = 1.285), which may stem from academic expectations and standardized assessments. This pressure can induce math anxiety and shift the focus from learning to performance. Supportive learning environments, including formative assessments and low-stakes practice, may help reduce this stress.

Boredom with teaching methods (M = 3.05) also emerged as a moderate concern. This suggests that some students may find traditional, lecture-based instruction misaligned with their learning preferences, particularly those who benefit more from kinesthetic or collaborative strategies. Instructional variety, such as problem-based learning and real-world applications, can make mathematics more engaging and relevant. Additionally, distractions during prolonged instruction (M = 3.42, SD = 1.286) point to the importance of incorporating brain breaks and active learning strategies to maintain attention and reduce fatigue.

Interestingly, the belief that mathematics is not relevant to students' future goals had the lowest mean score (M = 2.32) but the highest standard deviation (SD = 1.518). This indicates a diverse range of views among students. While many recognize the importance of math, others struggle to connect it to their personal interests or career aspirations. Teachers can bridge this gap by contextualizing lessons with real-life applications and highlighting mathematics' role across professions and industries.

In terms of learning preferences, as summarized in Table 2, the results show a clear inclination toward multimedia and auditory approaches (M = 3.94, SD = 0.890), followed closely by peer interaction (M = 3.88, SD = 0.893) and visual learning (M = 3.79, SD = 0.918). These preferences suggest that students benefit from dynamic, technology-enhanced instruction and collaborative learning environments. Setiawati et al. (2024) and Westomi et al. (2024) support the use of audio-visual tools to improve conceptual understanding and reduce math anxiety. In practice, this could involve using educational videos, podcasts, or simulations to present concepts in engaging ways.

Table 2: Learning Style Preferences

Learning Styles	N	Mean	Std. Deviation
1. I prefer hands-on or experiential learning	187	3.74	1.102
2. I benefit from visual aids approach in learning	187	3.79	.918
3. I find self-paced learning more effective	187	2.81	1.185
4. I learn best through discussions and interactions with peers	187	3.88	.893
5. I benefit from multimedia or auditory approach in learning	187	3.94	.890
Total		N	N

Hands-on or experiential learning also ranked highly (M = 3.74), highlighting the importance of engaging students with tangible, real-world tasks. Activities such as using manipulatives, conducting experiments, and integrating project-based tasks can increase retention and build practical problem-solving skills. Conversely, self-paced learning received the lowest preference (M = 2.81, SD = 1.185), indicating that while autonomy may work for some, most students still rely on structured guidance and interaction. Teachers should be mindful when assigning independent work, ensuring it is scaffolded and paired with support mechanisms

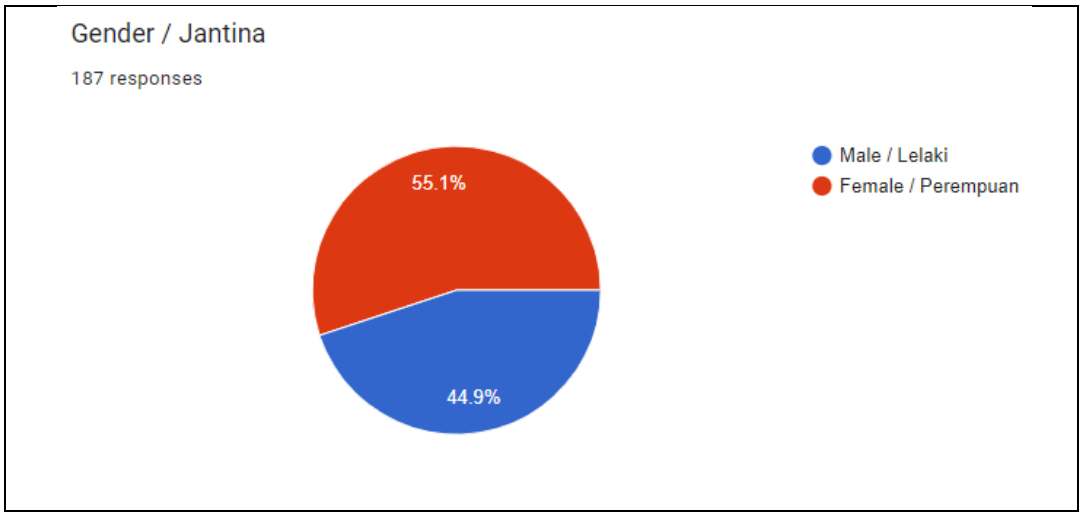

Figure 1: Pie Chart of Gender Distribution

The gender distribution of the respondents, as illustrated in Figure 1, shows a nearly balanced representation (55.1% female, 44.9% male), which supports a comprehensive examination of motivation and preferences across genders. Previous research (e.g., Wong & Lim, 2020) suggests that female students tend to favor collaborative and auditory-based instruction, which aligns with the findings of this study. This pattern suggests that differentiated instructional strategies, sensitive to gender-based learning tendencies, may enhance classroom engagement and outcomes.

Finally, the post-pandemic learning environment has intensified challenges for both students and teachers. The transition back to in-person classes has exposed gaps in foundational knowledge and reduced classroom stamina (Cheema, 2021). Teachers must adapt by incorporating the 4Cs Critical Thinking, Communication, Collaboration, and Creativity not only as student outcomes but as guiding principles in their own practice. For instance, encouraging peer dialogue supports communication, while integrating group-based problem-solving builds collaboration. Creative digital tools and open-ended investigations can also reignite students' curiosity in mathematics.

In conclusion, these findings underscore the importance of addressing both cognitive and emotional factors in mathematics education. Teachers are encouraged to diversify their instructional strategies, align lessons with students' preferred learning styles, and provide supportive learning environments that foster resilience, engagement, and long-term academic success. By embedding frameworks such as VARK and the 4Cs into daily classroom practice, educators can respond to diverse learner needs and rebuild positive attitudes toward mathematics particularly in the aftermath of disrupted schooling.

CONCLUSION

Motivating learners and accommodating their diverse learning styles are essential strategies for enhancing mathematics education, especially in the post-pandemic era. By applying the VARK model, teachers can tailor their instruction to meet the visual, auditory, reading/writing, and kinesthetic preferences of students. This makes mathematical concepts more accessible, engaging, and meaningful. Additionally, the integration of the 4Cs Critical Thinking, Communication, Collaboration, and Creativity not only improves teaching effectiveness but also fosters a dynamic and supportive classroom environment.

Critical thinking promotes analytical problem-solving; communication enhances clarity and engagement; collaboration encourages teamwork and peer support; and creativity makes learning more enjoyable and relevant. Together, these competencies help address the current challenges faced by students and boost their confidence and interest in mathematics.

This study has highlighted key factors that influence student motivation and learning preferences, as well as challenges faced by teachers. The findings offer valuable insights for educators, school leaders, and policymakers to enhance mathematics teaching and learning. Moving forward, future research should expand upon these findings and explore innovative instructional strategies that align with students' evolving needs. By addressing the identified challenges and implementing targeted teaching practices, educators can create enriched learning environments that empower both teachers and students to succeed in mathematics.

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Anis Zulaikha Syaiful Azuan and Nur Syazana Rosly jointly conceived and designed the research. Anis Zulaikha Syaiful Azuan was responsible for preparing the questionnaires and collecting all relevant data for this study. She also carried out the interpretation and analysis of the results. Furthermore, Nur Syazana Rosly contributed by reviewing and verifying the data and results to ensure the coherence and accuracy of the information. Anis Zulaikha Syaiful Azuan took the lead in writing the manuscript. Both authors provided critical feedback and contributed to refining the research, analysis, and final manuscript.

CONFLICT OF INTEREST DECLARATION

We certify that the article is the Authors' and Co-Authors' original work. The article has not received prior publication and is not under consideration for publication elsewhere. This manuscript has not been submitted for publication, nor has it been published in whole or in part elsewhere. We testify to the fact that all authors have contributed significantly to the work, validity and legitimacy of the data and its interpretation for submission to Jurnal Intelek.

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