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Exploring Mathematics Teacher Awareness and Responses to Gender-Based Classroom: A Qualitative Study in Australian Secondary School

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Abstrak

Studi kualitatif ini menjelaskan perbedaan dalam interaksi di kelas dan hasil belajar antara kelas matematika yang hanya terdiri dari siswa laki-laki dan kelas matematika yang hanya terdiri dari siswa perempuan, dengan fokus khusus pada kesadaran guru dan strategi pengajaran adaptif di sekolah menengah Australia yang multikultural. Data dikumpulkan melalui observasi etnografis dan wawancara dengan guru matematika selama satu semester. Hasil penelitian menunjukkan pola yang jelas berdasarkan gender dalam partisipasi dan pendekatan pemecahan masalah. Siswa laki-laki diamati lebih mudah terlibat dalam proses kognitif tingkat tinggi. Sebaliknya, siswa perempuan cenderung mencari klarifikasi tentang konsep dasar sebelum mencoba tugas. Sebagai tanggapan, guru menerapkan berbagai strategi responsif gender, termasuk pertanyaan terbuka, aktivitas berbasis interaksi, dukungan satu lawan satu, dan penjelasan. Penelitian ini juga mengkaji pengaruh keragaman budaya, menemukan bahwa siswa dari latar belakang yang beragam berinteraksi dengan lancar dan tidak ada kelompok yang secara konsisten menunjukkan prestasi lebih tinggi daripada kelompok lain dalam konteks kelas yang diamati. Temuan ini menunjukkan bahwa lingkungan kelas dan praktik pengajaran di sekolah ini berhasil mendukung partisipasi siswa dari latar belakang yang beragam.
***Kata Kunci**: pengajaran matematika; interaksi di kelas; berbasis gender; keragaman budaya; sekolah menengah Australia.*

Abstract

This qualitative study explains differences in classroom interaction and learning outcomes between male students' only and female students' only mathematics classes, with a particular focus on teacher awareness and adaptive instructional strategies in a multicultural Australian secondary school. Data were collected through ethnographic observation and interview with the mathematics teacher over one term. The result revealed clear gender-based patterns in participation and problem-solving approaches. Male students were observed to engage more readily in higher-order cognitive processes. In contrast, female students tended to seek clarification on basic concepts before attempting tasks. In response, the teacher implemented a range of gender-responsive strategies, including open-ended questioning, interaction-based activities, one-on-one support, and explanations. The paper also explored the influence of cultural diversity, finding that students from diverse backgrounds interact smoothly and no group consistently demonstrates higher achievement than others in the observed classroom context. These findings suggest that the classroom environment and teaching practices at this school successfully support the participation of students from diverse backgrounds.
Keywords: mathematics teaching; classroom interaction; gender-based; cultural diversity; Australian secondary school.

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I. INTRODUCTION

A classroom is a dynamic space where various social and cognitive interactions take place. The dynamics that occur in the classroom play an important role in the learning process, especially through the relationships formed both between teachers and students and among students themselves. The interactions that take place in the classroom, whether in the form of communication, behavior, or emotional expression, greatly influence students' motivation to actively participate in learning activities (Kopparla & Saini, 2022). In the context of mathematics learning, which is often considered challenging, a teacher's effectiveness depends not only on their mastery of the materials, but also on their ability to understand, manage, and engage students with diverse backgrounds and characteristics (Ahmed, 2024).

One important aspect of this diversity is gender differences. Understanding how female and male students differ in mathematics learning such as their ability to interpret, communicate, represent, and problem-solve mathematically is essential when examining the impact of teacher actions, which can, either favorably or not, influence students' development and achievement. A number of studies have shown a gender gap in mathematics learning, particularly in terms of students' attitudes, confidence, and participation. For example, male students tend to show a more positive attitude towards mathematics and have a higher level of participation in advanced subjects than female students (Hall, 2012). Social, cultural, and stereotypical factors regarding mathematical ability between males and females further reinforce this gap.

In addition to gender, cultural diversity is also a challenge and an opportunity in the context of education in Australia. Schools in Australia are known to have a very diverse student population in terms of ethnicity, language, and culture. This diversity enriches learning perspective, but also necessitates teachers to demonstrate cultural sensitivity and inclusive learning strategies to ensure all students feel valued and have equitable access to learning opportunities (Wong, 2025)

Although there has been much research highlighting gender gaps and cultural diversity in mathematics learning, few studies have discussed how teachers respond to these differences in the classroom. Understanding teachers' strategies and reflections in dealing with students' gender and cultural differences is crucial to creating a fair, supportive, and effective learning environment. Therefore, this study aims to provide an empirical description of how mathematics teachers respond to gender-based interaction dynamics in culturally diverse classrooms and to identify good practices that can be developed to improve the mathematics learning experience for all students.

Against this background, we investigated the following Research Questions (RQ):

RQ1: What are the differences in classroom interaction between male students' and female students' mathematics classes as observed in this study?

RQ2: How does the teacher adapt teaching strategies to address the gender-based differences in students' engagement and learning behavior?

RQ3: How does the teacher perceive and respond to the cultural and gender diversity among students in these classes?

Situated Expectancy-Value Theory (Eccles & Wigfield)

The Situated Expectancy-Value Theory (SEVT) by Eccles & Wigfield (2020) offers a comprehensive framework for understanding motivation, achievement-related choices, and classroom engagement. According to SEVT, students' motivation and participation are driven by their expectations of success (expectancy beliefs) and the subjective value they place on learning tasks (task values), which are deeply shaped by situational, cultural, and social factors. These values include interest (intrinsic value), perceived importance (attainment value), practical benefits (utility value), and perceived costs (Eccles & Wigfield, 2020). In practice, teachers can influence learners' motivation by providing relevant feedback, linking content to students' lives, and supporting self-efficacy. SEVT stresses that these motivational components are dynamic and context-dependent, shifting according to the classroom environment and social cues.

Interest Theory (Schiefele)

Schiefele's Interest Theory (1991) asserts that students' academic engagement and performance are closely tied to their situational and personal interest in learning content. Interest is seen as a vital motivational resource, fostering deeper processing, persistence, and enjoyment in learning mathematics. Effective instructional practices can cultivate interest by connecting mathematical concepts to students' daily experiences and providing opportunities for choice and autonomy. Teachers who recognize and stimulate students' interests, especially in underrepresented groups, contribute to more equitable and motivating classroom experiences.

Gender-Based Classroom Interaction Theory

Classroom interaction is shaped by gender dynamics, which influence communication patterns, participation, and learning styles. Research shows that teachers, whether consciously or unconsciously, tend to treat male students and female students differently, such as providing more questioning opportunities or feedback to male students (Gajda et al., 2022). Recent studies confirm that male students are generally more likely to initiate verbal exchanges and receive greater attention from teachers, while female students often experience "silent participation" and may feel less empowered to voice questions, especially in STEM lessons (Aguillon et al., 2020).

Gender-Responsive Pedagogy

Gender-responsive education emphasizes the importance of recognizing, understanding, and addressing the unique needs and potential of students according to their gender, without incorporating negative stereotypes. Gender-responsive pedagogy emphasizes the importance of recognizing, understanding, and addressing students' unique needs and potentials according to their gender, without reinforcing negative stereotypes. Aguillon et al. (2020) highlight that strategies such as open-ended questioning, balanced group discussions, and emotionally relevant scaffolding can enhance active participation in STEM subjects, particularly mathematics. Teachers are expected to build a safe space in which all students, regardless of gender, can confidently express their ideas and engage in the lesson (Aunzo Jr., 2025).

In this study, these theories collectively frame the analysis of classroom observations and teacher interviews, thereby providing insights into how gender-responsive strategies, motivational dynamics, and cultural diversity interact to shape mathematics learning in a multicultural Australian secondary school context.

II. Method

A qualitative instrumental case study design was adopted to explore the gender-based classroom, interaction in mathematics learning. In accordance with methodological guidance (Miles et al., 2014), this study adopted a qualitative descriptive approach using classroom observation and ethnographic interview as the primary sources of data. The research was conducted over one academic term (ten weeks), from July to September 2025 at school in a co-educational secondary school in Australia that organises students into single-sex classes across all subjects with diverse background focusing on mathematics lessons only.

Observations were conducted four times a week in each class, for a total 36 sessions, each lasting 50 minutes. This was aligned with the school's productive mathematics schedule in order to capture representative learning dynamics.

This study focused on Year 9 mathematics classes that were separated by gender. Participants were selected through convenience sampling, one class has 24 female students and the other class has 21 male students, all aged between 14 and 15 years, with the school chosen based on its willingness to facilitate and the availability of resources to apply innovative teaching approaches. A single mathematics teacher, professionally trained in active learning strategies and technology integration, taught both classes and took part in the study.

The study's multicultural context is characterized by a significant representation of South Asian and Middle Eastern diasporas. This composition is vital as it introduces diverse gender role expectations into the classroom. Consequently, teacher responses are not only shaped by the students' gender but are also intersected with the students' cultural heritage and linguistic proficiency.

Data collection was conducted through multiple sources to ensure a comprehensive understanding of the impact of the innovative teaching methods. The primary data sources consisted of classroom observations, field notes, and a semi-structured interview with the mathematics teacher.

Classroom observations were guided by a semi-structured observation instrument designed to capture key aspects of gender-based classroom interaction in mathematics learning. Specific indicators included the presence of active learning elements, verbal exchanges between teacher and students, level of student engagement, questioning strategies, and instructional differentiation. These observations were documented through detailed field notes recorded during each lesson, allowing the researchers to capture both structured indicators and emergent classroom phenomena.

An informal semi-structured ethnographic interview was conducted with the mathematics teacher to complement the observational data. An interview guide consisting of open-ended questions was developed to explore the teacher's perceptions of classroom dynamics, student engagement, instructional challenges, and potential gender-based learning differences. The semi-structured format allowed flexibility for the teacher to elaborate on personal teaching experiences while ensuring alignment with the study's research focus. The interview was audio-recorded and transcribed verbatim for analysis.

Data were analyzed using thematic analysis, which is described as "an accessible and flexible method to analyze qualitative data collected in natural classroom settings" (Xu & Zammit, 2020), and enables researchers to systematically identify recurring patterns and themes across complex qualitative datasets in education. The analysis was conducted in several stages. First, the researchers familiarized themselves with the data by repeatedly reviewing observation notes and interview transcripts. Second, initial codes were generated to represent meaningful units of data related to student engagement, classroom interaction, and instructional practices. Third, these codes were organized into broader categories and potential themes. The themes were then reviewed and refined to ensure coherence and consistency with the original data. Finally, the themes were clearly defined and interpreted to explain patterns in classroom engagement, teacher perceptions, and instructional responses.

Table 1.
An Overview of Data Sources

Data Source	Main Indicator	Theoretical Framework	Research Question
Classroom observations	Classroom interaction patterns; student participation (verbal and non-verbal); engagement during problem-solving; questioning strategies; differentiation of instruction in male and female classes	Gender-Based Classroom Interaction Theory; Situated Expectancy-Value Theory (SEVT); Interest Theory	RQ1
Field notes	Student engagement behaviors; learning approaches (risk-taking vs. error-avoidance); problem-solving strategies; collaborative interaction; cultural inclusivity	Situated Expectancy-Value Theory (SEVT); Interest Theory	RQ1
Teacher semi-structured interviews	Teacher awareness of gender-based differences; perceptions of student engagement and mathematics anxiety; adaptive instructional strategies; reflections on cultural diversity	Gender-Responsive Pedagogy; Gender-Based Classroom Interaction Theory; Situated Expectancy-Value Theory (SEVT)	RQ2 & RQ3

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These emergent categories were used to interpret the effectiveness of innovative teaching approaches and highlight potential areas for improvement. Key categories included differences in participation or engagement between male and female students' classes, teacher awareness of these differences, and instructional or behavioral strategies used by the teacher in response. Triangulation between observation and interview data was employed to enhance the trustworthiness of findings, ensuring interpretations remained consistent with both observed practices and reflective teacher accounts (Meydan & Akkaş, 2024).

The study's methodology was reviewed and approved by senior study program members of the Faculty of Mathematics and Natural Sciences at Universitas Negeri Semarang, Indonesia. International ethical standards for educational research were followed, including the use of information strictly for research purposes and the preservation of participant anonymity and data confidentiality (British Educational Research Association, 2024). Informed consent was obtained from all participants, including students and teachers. Participants were assured that any details that might identify them or their school would be kept confidential, and all data were stored securely. They were also informed that the study results posed no potential harm.

Because the study involved a single teacher and two classes within one school, results cannot be generalized to all Australian mathematics classrooms. The findings describe a specific context and should be interpreted as exploration rather than representative of national practice. Nevertheless, they offer in-depth insight into gender-based interaction patterns and teacher responsiveness in a multicultural educational setting.

III. Result and Discussion

A. Result

Australia's education system is structured to provide a continuous learning pathway from early childhood to tertiary education. The pathway begins with preschool and primary school (typically ages 5–12), followed by lower and senior secondary education (ages 12–17). The system's flexibility allows for academic and vocational options, supported by the Australian Qualifications Framework (AQF), which integrates all levels from school to university. PISA 2022 shows that Australia's average performance in mathematics, reading, and science is above the OECD average; in mathematics, Australia scored 494 points (OECD average 472), performing higher than 59 participating countries and lower than 9, placing it around the top 10 systems globally (OECD, 2023). Approximately 74% of Australian students reached at least Level 2 proficiency in mathematics (OECD average 69%), and 12% were top performers at Level 5 or 6 (OECD average 9%), while the gap between the lowest and highest performing students was 261 points, larger than the OECD average of 235 points, indicating substantial internal variation in mathematics achievement. These patterns of high average performance with wide internal gaps mirror analyses of quality and equity in Australian mathematics education, which highlight enduring disparities despite relatively strong overall results (De Bortoli & Underwood, 2025).

Australian education places a strong emphasis on diversity and inclusion, with national and state-wide policies supporting equitable access for all learners, regardless of background. This commitment is reflected in curriculum design, teacher professional standards, and school culture that promote multiculturalism, gender equity, and participation of students from culturally and linguistically diverse (CALD) communities. National initiatives such as the Pathway to Diversity in STEM Review and the Advancing Women in STEM Strategy explicitly aim to broaden participation and address gendered and structural barriers in STEM education, including school mathematics. Recent reviews show that, although patterns in upper secondary mathematics are approaching gender parity in some regions, but achievement and participation gaps, particularly at advanced levels, remain a policy issue requiring sustained and data-driven interventions (Mannix, 2023).

Within this systemic framework, teacher adaptation to diverse student needs is evident in everyday pedagogy. An audit trail linking data sources, excerpts, initial codes, and themes was established to enhance analytical transparency (see Table 2).

Table 2.
A Summary of Codes

Data Source	Data Excerpt	Initial Code	Type of Code	Theme
Classroom observation	"Male engaged quickly in problem-solving tasks, often experimenting independently and attempting higher-order reasoning before seeking assistance."	Independent problem-solving behavior	Deductive	Gender-based learning engagement
Classroom observation	"Female students tended to ask for clarification about basic concepts before attempting tasks and carefully followed the teacher's instructions to avoid making mistakes."	Cautious learning approach	Inductive	Gender-based learning engagement
Classroom observation	"During discussions, male students more frequently volunteered responses, whereas female students waited to be invited to speak."	Uneven voluntary participation	Inductive	Classroom participation patterns
Teacher interview	"In the girls' class, students are usually attentive and focused, but they often hesitate to answer unless they feel completely confident."	Hesitant verbal participation	Inductive	Learner affects and confidence
Teacher interview	"Students in the boys' class are more willing to try even if they are unsure, and they tend to learn from their mistakes."	Risk-taking learning behavior	Deductive	Learner affects and confidence
Classroom observation	"The teacher adapted questioning strategies by using more guided prompts and one-on-one support in the girls' class."	Gender-responsive questioning	Deductive	Instructional responsiveness

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Data Source	Data Excerpt	Initial Code	Type of Code	Theme
Teacher interview	"I adjust my explanations depending on the class, especially when I notice different levels of confidence or anxiety."	Adaptive instructional practice	Deductive	Teacher awareness and responsiveness
Field notes	"Students from diverse cultural backgrounds interacted smoothly, and no cultural group consistently outperformed others."	Inclusive classroom interaction	Inductive	Multicultural classroom dynamics
Field notes	"Technology-supported and interactive activities increased engagement across both classes."	Technology-enhanced engagement	Deductive	Engaging learning strategies

As observed in this study, mathematics teachers employed differentiated strategies based on classroom gender composition: in female students' classes, teachers more frequently solicited student input, posed open-ended questions, and scaffolded problem-solving step by step, whereas in male students' classes, students tended to experiment independently with problem-solving and requested guidance only after attempting several approaches. These practices align with the notion of responsive teaching and differentiated instruction, in which teachers adjust content, process, and support to students' readiness, interests, and profiles. International research in mathematics education shows that a responsive approach based on a thorough assessment and reflection process can strengthen participation (Haara et al., 2020). However, its implementation is limited by time and the diverse needs of students in the classroom (Madriaga & Cajandig, 2025).

The context of general education in Australia therefore provides both opportunities and challenges for understanding gender-based classroom interaction in mathematics: system-wide policies and international benchmarks shape teacher expectations and student performance, while persistent internal achievement gaps and the lived realities of diversity highlight the need for continued inquiry into how equity, gender, and inclusion are enacted in day-to-day classroom practice.

Teachers' Recognition of Differences in Male and Female Student Interaction

In ethnographic interviews, teachers noticed significant differences between classes consisting of female only students and classes consisting of male only students in terms of interaction and mathematics learning outcomes. Based on classroom observations, it was found that male students showed more proactive involvement in the mathematics learning process. They often asked questions ranging from basic to complex aspects, resulting in more intensive discussions and deeper understanding of the materials. On several occasions, the questions asked by male students were already related to the real-world topics that had not yet been taught. For example, when they started the quadratic equation material, one of the male students asked, "what is the point of calculating this thing?". The other one asked a question when the teacher moved the topic from algebraic form to geometry of quadratic equation, "what is the use of this graph?". These quotations indicated a high level of enthusiasm and curiosity. On the other hand, female students tended to be more passive in their verbal participation where they listened to the teacher's explanations quietly without asking many questions, except when there were obvious errors. This condition had the potential to reduce the level of participation of female students, both from the teacher's side and among students, because there was a perception that the material had been explained thoroughly and thus did not require further discussion. As a result, female students experienced difficulties because crucial aspects supposedly required detailed discussions were not explored in depth in the learning process.

This phenomenon has been documented in various recent studies. Research by (Demalata et al., 2024) found that male students consistently participated more actively than female students in various categories of classroom interaction. Other studies reinforce that male students have higher levels of confidence in mathematics, which encourages them to be more involved in discussions and ask questions, while female students tend to be passive and show higher levels of anxiety in mathematics learning. Several studies also document female students' perceptions of an unsupportive classroom environment, which tends to inhibit their active involvement (Samuelsson & Samuelsson, 2016). However, other research shows that there are not always significant differences between male and female student participation, making the social context and teaching approach of the teacher important factors in mediating the responses and participation of both.

The teacher initially attributed these differences to puberty, suggesting that earlier pubertal onset among female students leads to more intense and prolonged emotional and social changes than in their male peers. While this explanation reflects a common belief among practitioners, it also risks simplifying complex classroom dynamics into biologically driven "drama" and may inadvertently reproduce gendered stereotypes. From an analytical standpoint, the observed tendency for some female students to engage in emotionally charged and interpersonally sensitive interactions can be understood not only in terms of developmental change, but also as a product of peer culture, classroom norms, and broader societal expectations about how girls should express emotions and manage relationships. In this context, the teacher's efforts to understand students' perspectives and position herself as part of their social world illustrate an attempt at empathetic, relationship-based pedagogy. However, such interpretations require cautious reflection so that gendered patterns are not essentialized as inherent traits of female students, but recognized as emerging from the interaction between individual, social, and institutional factors.

On the other hand, teachers explained that male students also experience puberty, but its manifestations are different, especially in terms of their need for physical activity and energy expression.

Teachers stated that if these physical needs can be channeled, male students' readiness to learn is relatively unaffected by puberty and classroom social dynamics.

These findings are consistent with recent research highlighting that gender differences in adolescent development and social interactions directly influence students' learning patterns and academic achievement in mathematics classes. For example, a study confirmed that female students tend to experience emotional and social challenges that can affect their overall participation and achievement in mathematics (Justicia-Galiano et al., 2023). Similar research in Malaysia proves that male students, although less vulnerable to emotional dynamics, have a higher need for physical stimulation in the learning environment, which, if accommodated, can improve their focus and academic achievement (Abdullah et al., 2024). However, recent studies in India reveal more complex dynamics by showing that emotional support and adaptive pedagogical responses from teachers are important for encouraging engagement and mathematical achievement in both female and male classrooms. Consequently, gender stereotypes related to adolescents' learning needs warrant more critical examination (Rakshit & Sahoo, 2023).

Teachers also noted that in classes comprising female students, there were typically small groups of high-performing students (3 to 5 students) and small groups of very low achieving students, with the majority clustered within the mid-range of performance. In contrast, the range of achievement differences in male classes was less pronounced. Although some students demonstrated outstanding performance, overall variability among students was narrower. This resulted in higher average performance compared to female classes. However, when comparing the top performers between female and male classes, the achievement of outstanding female students was consistently higher and more stable than that of their male counterparts. These observations align with findings by Pajares, (1996) who asserted that gifted female students performed better than gifted male students in mathematical problem solving. In addition, in the recent study by Marifa et al. (2025) reported no statistically significant gender differences in mathematics performance overall yet noted that individual variability and the consistency of high achievement can differ by gender, often influenced by classroom environment, societal expectations, and teacher support.

Classroom observations revealed clear differences in the ways male students and female students approach mathematics problem-solving tasks, which can be interpreted through the lens of Bloom's Taxonomy. In many cases, male students tend to experiment directly with higher-level cognitive processes, such as analyzing (C4) and evaluating (C5) in a word problem, by attempting to solve problems independently, even with the risk of making mistakes. They would often work through the entire problem, even if their approach was initially incorrect, and only ask for help after trying several strategies.

In contrast, female students were more likely to seek clarification on basic knowledge (C1–C2) before attempting to solve the problems, indicating a preference for carefully understanding instructions and avoiding errors at the early stages. For example, female students often asked about the correct way to separate brackets, how to deal with factorized forms when the result was a fraction i.e $(3x-1)(x+3)=0$, or checked accuracy when multiplying, focusing on steps previously discussed in class. This pattern aligns with findings by Kuncoro et al. (2022), who observed that female students often demonstrate stronger attribution and organizational skills in mathematical tasks, excelling at checking their reasoning and seeking guidance to ensure accuracy, while male students are more likely to experiment and take risks, learning through their mistakes.

These behaviors are also related to mathematics anxiety levels, which tend to differ by gender. Based on a study by Ulfah et al. (2023), when students encountered difficulties and did not know where to begin, female students $(\bar{x}=3.59)$ reported significantly higher levels of anxiety than their male peers $(\bar{x}=3.31)$. This tendency to seek reassurance and minimize mistakes at early stages may reflect an underlying anxiety toward mathematical tasks, in line with broader international findings that females often experience greater levels of mathematics anxiety despite comparable abilities.

Even though some male students sometimes mixed-up problem-solving steps or overlooked details ("bridges") in multi-step problems i.e $3(x-4)=x(x+20)$, they remained actively engaged and frequently asked follow-up questions in class, indicating a willingness to persist despite initial confusion. This supports the notion that female students might require more step-by-step scaffolding, while male students benefit from opportunities to experiment freely and reflect on their errors. Such findings are consistent with research suggesting that gender can influence problem-solving pathways and cognitive engagement (Schreiber & Ashkenazi, 2024).

During the final week of term, students participated in a major group project requiring intensive preparations and discussions. It was observed that female students were notably more efficient and generated a greater diversity of ideas during these collaborative activities, aligning with research indicating female students often display higher engagement and organizational skills in group-based mathematical tasks. This has been proven by the study by Abdullah et al. (2024) that female students benefited from teaching methods that emphasize collaborative discussions. In contrast, male students tended to take on influential roles and reported feeling more empowered in shaping group content and more participatory in classroom group works (Samuelsson & Samuelsson, 2016).

Adaptation of Teaching Strategies: Concrete examples of changes or methods implemented by teachers based on shadowing observations

Broadly, in the female students' class, the teacher primarily solicited student input during lessons, whereas in the male students' class, students independently identified and emphasized key aspects of the learning materials. To support female students' engagement, teachers implemented interaction-based teaching strategies in classes such as composing open-ended questions, connecting new materials to previous lessons, and providing additional stimulation to encourage active responses from female students. Teachers also implemented a one-on-one approach to support female students who tended to be shy and reluctant to ask questions in class forums. There were once where when the teacher asked, "Is there anyone who is struggling?" no students volunteered to answer the questions at that time. Subsequently, the teacher addressed a specific student by name who appeared to have difficulty with the materials. When the female student confirmed she had not yet understood the concept, the teacher proceeded to re-explain the lesson content. This approach was applied particularly to key mathematical concepts that serve as foundations for subsequent materials. The teacher then worked through another example collaboratively with the entire class. This cycle of targeted questioning and guided practice continued until most of the students demonstrated the ability to discern the underlying pattern. By applying these strategies, it is hoped that female students can more clearly identify the parts of the material that they understand and those that require additional explanation.

Interview with the teachers reveals that the use of these strategies had helped female students increase their class participation and learning achievement. Various research findings support the effectiveness of interactive teaching strategies, where the application of active learning methods has been proven to increase female students' performance, thereby narrowing the achievement and participation gaps between male and female students in mathematics (Ballen et al., 2019; Salter & Persaud, 2003). A study by Kim & Evans (2025) reinforces that preferences for collaboration and engagement in mathematics learning are influenced by gender factors. However, in certain contexts, these differences may be minimal. Therefore, pedagogical approaches must be dynamically adjusted to meet the specific needs of each class. This classroom management adaptation is consistent with research suggesting differentiated strategies are required to foster effective participation among male and female students in mathematics.

Furthermore, subtle instructional biases became evident during test preparation, and these can be further analyzed using Bloom's taxonomy levels. When male students asked questions, teachers often provided strategic hints and prompts aimed at triggering recall or previously learned concepts (C2–C3), thereby encouraging students to engage in independent problem-solving and higher-order thinking (C5-C6), even if their initial approach was trial-and-error. In contrast, when female students sought clarification, teachers typically gave more step-by-step detailed explanations, ensuring a thorough understanding of foundational concepts before allowing students to proceed (C1–C2). This differentiation not only reflects the inclusive and supportive teaching practices widely adopted in Australian schools, but also aligns with findings that female students often prefer more careful, guided scaffolding, while their male counterparts benefit from exploratory and risk-taking opportunities (Kuncoro et al., 2022).

Such differentiated responses have rational foundations: female students experience greater mathematics anxiety or lower self-confidence than male students despite similar abilities, which several Australian educators and studies have attributed to enduring stereotypes and classroom norms (Siti, 2025). While teacher bias, conscious or otherwise, support students who need extra scaffolding. It can also inadvertently reinforce gendered expectations and limit autonomy. The highest effectiveness is demonstrated by teachers who maintain a gender-neutral position (Megalokonomou, 2021).

This series of findings confirms that differences in student participation and responses in class require teachers to be adaptive in applying gender-responsive learning strategies to optimize the academic potential of all students.

Analysis of effectiveness and teacher self-reflection

In reflecting on the effectiveness of implemented classroom strategies, the teacher recognized that one-on-one assistance, while beneficial for supporting students having trouble, posed distinct time management challenges. To prevent loss of class momentum and ensure overall learning objectives were met, the teacher voluntarily utilized break times to provide targeted instruction to students needing additional support. This approach allowed the teacher to maintain instructional pacing for the majority while creating opportunities for individualized remediation, a finding echoed in recent international studies showing that time constraints remain a major barrier to effective differentiation and personalized learning (Lavania & Nor, 2020).

Research by Leek et al. (2024) and Hofman (2023) reveals that teachers embrace dynamic time management practices and prioritize their focus to balance whole-class progress with targeted interventions. Skilled classroom management, enhanced through professional development, is linked to greater student enjoyment and relational closeness in mathematics learning. Effective teachers develop nuanced observation techniques to identify students who may require assistance, relying not only on direct questioning but also on monitoring subtle behavioral cues and learning habits. These skills are further honed through ongoing professional development and lesson study activities, which encourage educators to continually reflect on and adapt their teaching practice.

From a classroom management perspective, the teacher understood the importance of maintaining focus and momentum when the majority of students have grasped the material, while simultaneously ensuring that the remaining students are sufficiently supported. To assess class-wide understanding, the teacher occasionally selected students who appeared to struggle-based on evidence from observation, gestures, or work habits as a purposeful means to check for learning gaps and foster engagement. This attentive approach aligns with recommendations from Yilmaz & Yetkin Ozdemir (2023), who emphasizes the value of teacher perceptiveness and diagnostic skill in promoting inclusive mathematics learning environments.

Overall, the teacher's adaptability and commitment to professional growth. Such as engaging in supplemental professional development and dedicating extra time outside of lessons reflect best practices found in contemporary mathematics education literature. These practices support effective classroom management and differentiate instruction, enabling all students to progress regardless of their starting point.

Teacher's Perception of Cultural Diversity

The third research question explores teacher perceptions in a multicultural setting, premised on the assumption that cultural diversity among students, especially in the Australian context, shapes classroom experiences. However, classroom observations revealed no significant differences attributable to cultural background. While some research emphasizes that knowledge and mathematical understanding are influenced by cultural frameworks (Rosa & Orey, 2011), the present study did not find evidence that students' diverse cultural backgrounds affected their classroom interactions or learning processes. Despite originating from various countries and representing a range of cultural and linguistic backgrounds, students were able to collaborate effectively, with no obvious barriers to classroom participation or communication during mathematics lessons. Within the scope of this study, no group was observed to consistently outperform others based on cultural or ethnic background in mathematics achievement. This shows that in this particular school, the classroom environment and teacher practices were effective in navigating and accommodating diversity so that students from different backgrounds could participate and learn together. A more in-depth cultural analysis, however, may reveal subtler forms of cultural influence that were beyond the focus and methodological limitations of the present study.

IV. CONCLUSION

This study concludes that distinct gender-based interaction patterns exist within the mathematics classroom, where female students exhibit more passive verbal participation while their male counterparts tend to be more proactive. In response, teachers adapt their pedagogical strategies by fostering open-ended questioning in female classes and maintaining structured guidance in male classes. Despite the multicultural setting, no significant cultural barriers were identified, suggesting that effective classroom norms and teacher practices can successfully mitigate visible cultural obstacles. However, more subtle cultural dynamics may remain and warrant further investigation.

Given its qualitative case study design, limited to a single school and teacher, these findings are exploratory and cannot be generalized across all contexts. Consequently, future research should employ mixed-methods designs with larger, more diverse samples. Subsequent inquiries should prioritize gender-responsive teaching practices and explore individual factors, such as mathematics anxiety, alongside innovative collaborative models to further enhance inclusivity and active learning in diverse mathematics classrooms.

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