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Original Article

Challenges and Learning Strategies in General Mathematics: Analyzing Student Competency Development and Effective Approaches

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Abstract. This study examined the challenges students face in learning General Mathematics and the strategies used to address them. Using a descriptive-correlational design and one-stage cluster sampling, the study involved 136 Grade 11 students from two public schools in Valencia, Negros Oriental. Validated questionnaires were administered, and data were analyzed using the mean, Spearman's Rank Order Correlation, and the Kruskal-Wallis Test. Findings revealed that students experience moderate difficulty in solving problems involving functions, rational functions, and rational inequalities, but face high difficulty when applying these concepts to real-life situations. Approximately 42.6 percent of students reported high to very high difficulty in real-life applications. Students reported a high level of use of learning strategies such as peer tutoring, collaborative learning, independent learning, and video tutorials, while the use of technological tools remains moderate. Results showed a positive, significant relationship ($p < .001$) between challenges and the use of learning strategies. A significant difference was found in the use of video tutorials ($p = 0.004$), with outstanding students utilizing this strategy more frequently.

Keywords: *General Mathematics; Independent learning; Learning strategies; Peer tutoring; Challenges; Video tutorial.*

The decline in mathematics achievement has become a critical global concern, with the 2022 Programme for International Student Assessment (PISA) reporting a worldwide drop of 15 points in mathematics compared to 2018 (OECD, 2024). Global declines noted by Engzell et al. (2021) reflect persistent learning losses following the pandemic, which particularly widened educational disparities among disadvantaged learners. In the Asia-Pacific region, students frequently struggle with reasoning and problem-solving, often relying on rote memorization rather than conceptual understanding (Jalil & Osman, 2020). These trends underscore an urgent need to strengthen numeracy foundations and promote equitable, effective mathematics instruction worldwide to ensure learners can navigate increasingly complex quantitative demands.

The Philippines mirrored this global trend, with its PISA results remaining among the lowest worldwide despite a marginal increase from 353 in 2018 to 355 in 2022 (Chi, 2023). This continued underperformance has raised significant concerns regarding the effectiveness of the spiral progression approach in the K to 12 curriculum, which faces challenges such as content overlap, insufficient teacher training, and limited instructional materials (Perez et al., 2020). Furthermore, unequal access to resources continues to hinder mathematical proficiency, especially within under-resourced public schools (DepEdPH, 2024; Radiamoda, 2023). Such systemic challenges underscore the need to improve instructional quality and strengthen institutional support systems to bridge the gap in mathematics education.

While most research in this field explores teacher-led strategies, curriculum development, and technology integration (Pearson, 2024; OECD, 2024; Safi et al., 2022), little is known about how students personally address their learning hurdles. Existing literature often focuses on institutional interventions rather than individual coping mechanisms. For instance, while some studies found that students rely on reactive strategies like repetitive practice (Vidad & Quimbo, 2020; Gallos, 2021), others noted that collaborative learning and peer tutoring can improve confidence (Celedonio & Elicay, 2024). However, a significant research gap exists regarding how students independently manage their learning in General Mathematics, a core subject that demands high levels of abstract reasoning and self-regulation. This gap may be understood through Jean Piaget's Constructivist Learning Theory, which explains how limitations in cognitive readiness contribute to difficulties in abstract mathematical reasoning, and Albert Bandura's Social Learning Theory, which highlights how students cope with these difficulties through observation, modeling, and strategy adoption (McLeod, 2025). Together, these theories provide a lens for examining both the sources of students' challenges and the mechanisms they use to navigate learning demands in General Mathematics.

Drawing from Piaget's Constructivist Learning Theory, this study examines how students' cognitive readiness contributes to difficulties in abstract General Mathematics competencies, such as functions and rational inequalities. Complementarily, Bandura's Social Learning Theory informs the investigation of the learning strategies students adopt, particularly peer-based, independent, and technology-mediated approaches to cope with these challenges. Anchored in the Philippine senior high school context, the study is guided by research questions that examine (a) the extent of students' learning challenges in selected General Mathematics competencies, (b) the extent to which they employ various learning strategies, and (c) the relationships among experienced challenges, strategy use, academic performance, and class standing. These research questions establish the conceptual and analytical foundation of the study and directly respond to the identified gaps in the literature on student-centered learning in General Mathematics. The findings provide evidence-based insights for learner-centered instruction, directly aligning with Sustainable Development Goal 4 (Quality Education). Specifically, this research supports Target 4.1 for effective numeracy outcomes and Target 4.5 for reducing learning disparities, ultimately offering a roadmap for strengthening instructional competence and student resilience in mathematics.

Methodology

Research Design

The study utilized a descriptive-correlational design to systematically investigate the challenges students encounter and the learning strategies they employ in General Mathematics. The descriptive component examined the specific difficulties learners experienced and identified the strategies they adopted to support their understanding of the subject. Meanwhile, the correlational component examined the relationship between these challenges and the strategies students used during the First Quarter of General Mathematics. This dual approach enabled a comprehensive analysis of both the current status of students' competencies and the interplay between perceived difficulty and self-regulated learning behaviors.

Research Environment

The study was conducted in two public secondary schools within the District of Valencia, Division of Negros Oriental. These institutions offer academic strands including HUMSS, STEM, and ABM. While classrooms are equipped with electricity and Smart TVs to facilitate technology-aided instruction, internet connectivity remains a challenge for both faculty and students. Both schools provide access to computer laboratories and libraries, which serve as the primary academic hubs for the Grade 11 participants involved in the study.

Research Respondents

The respondents comprised 136 Grade 11 students enrolled in General Mathematics at two public secondary schools in the District of Valencia, Division of Negros Oriental, during the 2025–2026 academic year. The participants represented three academic strands: Humanities and Social Sciences (HUMSS), Science, Technology, Engineering, and Mathematics (STEM), and Accountancy, Business, and Management (ABM). A one-stage cluster sampling technique was used to select four of the five existing sections. One HUMSS section from one of the participating schools (n = 30) was excluded from the final count as it was utilized for the dry run to establish the validity and reliability of the research instrument.

Research Instrument

The study utilized a validated four-part survey questionnaire designed to measure students' challenges and learning strategies in General Mathematics. The instrument was constructed through a systematic operationalization of variables grounded in the existing literature on mathematics learning difficulties and self-regulated learning strategies. The first part contained a disclosure statement that ensured informed consent and the confidentiality of responses. The second part gathered respondents' profile data, specifically their first-quarter General Mathematics grade. The third part assessed students' challenges in General Mathematics across five competency domains: (1) problems involving functions, (2) intercepts of rational functions, (3) zeroes of rational functions, (4) asymptotes of rational functions, and (5) rational inequalities. This section consisted of 25 items using a five-point Likert scale ranging from Very Low (1) to Very High (5). Sample items included: "I encountered difficulty in identifying the domain and range of functions" and "I encountered difficulty in distinguishing between vertical and horizontal asymptotes in rational functions." The fourth part examined the learning strategies students employed to address these challenges. It covered five domains: peer tutoring, collaborative learning, independent learning, video tutorial use, and technological tools and applications. This section consisted of 25 items, also measured using a five-point Likert scale. Sample items included: "I consult my peers whenever I encounter difficulties in understanding the lessons" and "I use technological tools such as graphing calculators or GeoGebra to understand abstract mathematical concepts better."

Overall, the questionnaire contained 50 scaled items, excluding profile information. The conceptual basis for item construction was anchored on theories of mathematics learning difficulties and self-regulated learning, particularly the framework of cognitive competency development and strategic learning approaches. The domains for challenges were derived from key competency areas specified in the General Mathematics curriculum guide. In contrast, the learning strategy domains were informed by literature on collaborative learning, independent learning, and technology-assisted instruction.

To establish content validity, the instrument was evaluated by three experts in Mathematics education who assessed item clarity, relevance, and alignment with the study variables. Their feedback led to revisions in wording, item specificity, and domain representation. A pilot test was conducted with 30 Grade 11 students who were not part of the actual study sample. Reliability analysis using Cronbach's alpha yielded coefficients greater than 0.70 across all domains, indicating acceptable internal consistency and confirming the instrument's suitability for research use.

Research Procedures

Approval to conduct the study was obtained from the appropriate educational authorities, including the Schools Division Office and school administrators. After securing authorization, coordination was conducted with the Grade 11 advisers and General Mathematics teachers for the identified academic strands. The validated questionnaire was administered to respondents after the purpose of the study was explained and their consent obtained. Completed questionnaires were collected immediately after administration. The gathered data were encoded in Microsoft Excel and subsequently subjected to appropriate statistical analyses using JAMOVI software to address the objectives of the study.

Statistical Treatment of Data

Descriptive statistics, including mean and median, were used to describe the extent of students' challenges and the level of learning strategies employed in General Mathematics. Spearman's rank-order correlation was applied to examine the relationship between students' challenges and the strategies employed, considering the ordinal nature of the data. The Kruskal–Wallis H test was performed to determine significant differences in strategy utilization across class standings. To aid interpretation, mean score ranges were used to categorize the extent of challenges and strategy utilization into five levels: very low (1.00–1.80), low (1.81–2.60), moderate (2.61–3.40), high (3.41–4.20), and very high (4.21–5.00).

Ethical Considerations

The researchers adhered to strict ethical standards throughout all phases of the research process. Prior to data collection, the researchers complied with all required research protocols. Before administering the questionnaire, ethical approval was obtained from the Ethics Committee of Foundation University. During data collection, appropriate measures were implemented to ensure the respondents' rights were protected. Confidentiality and anonymity were strictly maintained, and respondents were assured they could withdraw from the study at any time without consequences. The respondents of this study were Grade 11 students, most of whom were minors. Therefore, written informed consent was obtained from parents or legal guardians prior to participation. In addition, student assent was obtained by clearly explaining the purpose of the study, the procedures involved, the expected duration, and the participants' rights. Only students who voluntarily agreed to participate and returned signed consent forms were included in the study. Participation in the research was entirely voluntary. To minimize potential pressure from authority figures such as teachers or school personnel, the researchers informed participants that their decision to participate or decline would not affect their grades, academic standing, or relationship with the school.

After data collection, all completed questionnaires were carefully collected, coded, and securely stored to prevent unauthorized access. Electronic data were password-protected, while printed materials were kept in a locked storage area accessible only to the researchers. The identities of the respondents were removed during data encoding to ensure anonymity in the analysis and reporting of findings. To enhance the grammar, clarity, and overall readability of the manuscript, the researchers utilized artificial intelligence (AI) tools such as ChatGPT, Gemini, and NotebookLM. These tools were used solely for language editing purposes. All AI-generated outputs were critically reviewed and revised by the researchers to ensure accuracy, originality, and adherence to scholarly integrity. No personal, confidential, or sensitive participant data was shared with these tools. This reflects the researchers' commitment to ethical research conduct and the responsible use of AI in academic work.

Results and Discussion

Extent of Challenges in Solving Problems

Involving Functions

Table 1 presents the extent of challenges students experienced when solving problems involving functions, yielding a composite mean of 3.16, indicating a moderate level of difficulty in this mathematical domain.

Table 1. *Extent of Students' Challenges in Solving Problems Involving Functions (n=136)*

I encountered the following challenges to a certain extent:	$\bar{x}$	EoC	SD	% (VH-H Responses)
1. Identifying the domain and range of functions.	2.97	M	0.93	27%
2. Distinguishing different types of functions (rational, inverse, exponential, etc.).	3.01	M	0.90	30%
3. Solving problems involving functions.	3.20	M	0.90	38%
4. Applying functions to real-life word problems.	3.26	M	0.87	41%
5. Solving word problems that involve functions.	3.34	M	0.86	41%
Composite	**3.16**	**M**	**0.89**	**36%**

Note: Extent of Challenge (EoC); 4.21–5:00, Very High (VH); 3.41–4.20, High (H); 2.61–3.40, Moderate (M); 1.81-2.60, Low (L); 1.00-1.80, Very Low (VL)

Beginning with the items showing the lowest difficulty, identifying the domain and range ($\bar{x}$=2.97) and distinguishing different types of functions ($\bar{x}$=3.01) reflect that while students can determine fundamental features, challenges arise when these concepts are applied to non-standard or complex functions. This difficulty aligns with the findings of Trujillo et al. (2023), who explain that learners often struggle to transfer procedural knowledge to conceptual reasoning when tasks move beyond routine examples. Furthermore, a lack of deep conceptual fluency prevents students from differentiating the unique characteristics of varied functions, a challenge similarly noted by Maidiyah et al. (2024).

As the level of difficulty increases, students report moderate challenges in solving functional evaluations ($\bar{x}$=3.20) and applying functions to real-life situations ($\bar{x}$=3.26). According to Bandura's Social Learning Theory, this pattern suggests that students may not consistently receive modeled demonstrations or opportunities to observe expert reasoning, which in turn affects their self-efficacy and accuracy in performing such tasks (Zain et al., 2021). Additionally, Tokuhama-Espinosa (2023) asserts that contextual applications are cognitively demanding, requiring integrated mental processes and sustained practice to bridge the gap between abstract theory and real-world utility.

The greatest difficulty is reported in solving word problems that involve functions ($\bar{x}$=3.34), indicating that translating verbal narratives into mathematical representations poses the most substantial challenge. Komiljon (2024) explains that word problems require higher-order reasoning because students must first extract and conceptualize narrative relationships before applying procedures. In line with Piaget's Constructivist Theory, such tasks generate "cognitive disequilibrium," requiring learners to reorganize their thinking frameworks. Without adequate scaffolding, this process remains inherently overwhelming for students transitioning to formal operational reasoning (McLeod, 2025).

Synthesizing these findings, a clear pattern emerges where application-based tasks are significantly more challenging than foundational or definitional tasks. This is further supported by the observation that 41% of students report high difficulty in solving word problems and real-life applications. These results affirm Piaget's view that learners require structured, meaningful experiences to move confidently from concrete to abstract reasoning. Likewise, Bandura's emphasis on modeling highlights the importance of explicit instruction in strengthening student self-efficacy. Ultimately, while students possess a procedural baseline, they require targeted support to master the contextualization and extension of functional concepts.

Involving the Intercepts, Zeroes, and Asymptotes of Rational Functions

Table 2 presents the extent of the challenges students experience when solving problems involving the intercepts, zeroes, and asymptotes of rational functions. The three domains reflect comparable levels of moderate difficulty.

Table 2. *Extent of Students' Challenges in Solving Problems Involving the Intercepts, Zeroes, and Asymptotes of Rational Functions (n=136)*

I encountered the following challenges to a certain extent:	x̄	EoC	SD	% (VH-H Responses)
Intercepts of Rational Functions				
1. Identifying the intercepts (both x and y) for rational functions.	3.13	M	0.97	38
2. Solving problems involving the determination of intercepts for rational functions.	3.15	M	0.91	35
3. Solving word problems that require finding intercepts in rational functions.	3.18	M	0.85	36
4. Distinguishing different methods for finding intercepts of rational functions (e.g., factoring, using the quadratic formula, etc.).	3.22	M	0.90	40
5. Applying methods for determining intercepts to real-life problems involving rational functions.	3.27	M	0.87	41
Composite	**3.19**	**M**	**0.90**	**38**
Zeroes of Rational Functions				
1. Solving word problems that involve determining the zeroes of rational functions.	3.10	M	0.92	32
2. Solving problems that involve finding the zeroes of rational functions.	3.12	M	0.90	35
3. Identifying the zeroes of rational functions and understanding how many times each zero occurs.	3.12	M	0.83	29
4. Distinguishing different methods for determining the zeroes of rational functions (e.g., factoring, using the quadratic formula, etc.).	3.15	M	0.93	33
5. Applying techniques for finding zeroes to real-life problems involving rational functions.	3.26	M	0.94	42
Composite	**3.15**	**M**	**0.90**	**34**
Asymptotes of Rational Functions				
1. Distinguishing between vertical and horizontal asymptotes in rational functions.	3.07	M	0.88	33
2. Identifying the values of x that result in vertical asymptotes in rational functions.	3.21	M	0.92	40
3. Solving problems involving the identification of asymptotes of rational functions.	3.25	M	0.91	38
4. Applying methods to find and interpret asymptotes in real-life problems involving rational functions.	3.25	M	0.88	38
5. Solving word problems that require determining asymptotes of rational functions.	3.27	M	0.94	40
Composite	**3.21**	**M**	**0.91**	**38**

Note: Extent of Challenge (EoC); 4.21–5:00, Very High (VH); 3.41–4.20, High (H); 2.61–3.40, Moderate (M); 1.81-2.60, Low (L); 1.00-1.80, Very Low (VL)

The composite means ranging from 3.15 to 3.21 suggest that students encounter systemic hurdles across these foundational concepts. In the intercepts domain, lower mean scores for identifying ($\bar{x}$=3.13) and solving problems to determine intercepts ($\bar{x}$=3.15) imply that while students can perform basic algebraic procedures, difficulty arises when tasks require selecting a strategic method or demonstrating contextual understanding. Items such as distinguishing methods ($\bar{x}$=3.22) and applying these to real-life problems ($\bar{x}$=3.27) reinforce this pattern. Students tend to falter when connecting procedural skills to graphical interpretation or real-world contexts, aligning with literature that emphasizes the need to link algebraic manipulation with functional meaning (Balantes & Tonga, 2020; Magayon & Tabuzo, 2024). Notably, 40% of students reported significant challenges in distinguishing methods, while 41% struggled with real-life applications.

For the zeroes of rational functions, the greatest difficulty arises in applying techniques to real-life situations ($\bar{x}$=3.26), suggesting that contextualized tasks pose more challenges than isolated algebraic manipulation. Research attributes this struggle to the abstract nature of algebraic representations and difficulties in shifting between process and object interpretations of zeroes (Kop, 2022; Obersteiner et al., 2019). Although items show moderate challenge overall, 42% of students experience high to very high difficulty when applying methods to authentic problems, underscoring the gap between procedural proficiency and applied understanding.

In the asymptotes domain, identifying vertical asymptotes ($\bar{x}$=3.21) and distinguishing them from horizontal ones ($\bar{x}$=3.07) indicates that conceptual differentiation remains a common stumbling block, particularly regarding how undefined points influence graph behavior. Solving and applying asymptote-related problems ($\bar{x}$=3.25–3.27) remain moderately challenging, with approximately 39% of students reporting high difficulty. These patterns are consistent with Piaget's constructivism, which posits that students require scaffolded support to transition to graphical reasoning, and with Bandura's social learning framework, which emphasizes teacher modeling and peer demonstration to strengthen mastery and self-efficacy (Zain et al., 2021; Kop, 2022).

Involving Rational Inequalities

Table 3 presents the extent of challenges students experienced when solving problems involving rational inequalities, yielding a composite mean of 3.30, indicating a moderate overall level of challenge. While the domain is classified as moderately challenging, variations across item means reveal where students struggle the most.

Table 3. *Extent of Students' Challenges in Solving Problems Involving Rational Inequalities (n=136)*

I encountered the following challenges to a certain extent:	x̄	EoC	SD	% (VH-H Responses)
1. solving problems involving rational inequalities and determining the range of solutions.	3.21	M	0.91	38
2. identifying critical values and intervals for solving rational inequalities.	3.21	M	0.84	34
3. distinguishing the appropriate method for solving rational inequalities.	3.28	M	0.93	42
4. solving word problems that require analyzing and solving rational inequalities.	3.37	M	0.85	45
5. applying methods for solving rational inequalities to real-life situations and interpreting their solution sets.	3.45	H	0.94	49
Composite	**3.30**	**M**	**0.89**	**41**

Note: Extent of Challenge (EoC); 4.21–5:00, Very High (VH); 3.41–4.20, High (H); 2.61–3.40, Moderate (M); 1.81-2.60, Low (L); 1.00-1.80, Very Low (VL)

Solving problems involving rational inequalities, determining range ($\bar{x}$=3.21), and identifying critical values ($\bar{x}$=3.21) shows that students experience moderate difficulty with fundamental procedures. These tasks require identifying restrictions, constructing intervals, and testing values—skills students perform without full confidence. More complex tasks exhibit higher difficulty; distinguishing appropriate solution methods ($\bar{x}$=3.28) and solving word problems ($\bar{x}$=3.37) indicate that challenges increase during strategy selection and contextual reasoning. This reflects a demanding shift from procedural execution to conceptual decision-making.

The most significant challenge is applying methods to real-life situations and interpreting solution sets ($\bar{x}$=3.45), which is classified as high. This signifies that students struggle most when transitioning from symbolic manipulation to interpreting the meaning of solution sets in practical scenarios. This aligns with literature identifying common errors in inequality direction, domain restrictions, and the difficulty of moving between algebraic solutions, interval notation, and number line representations (Cetin, 2022; Tran, 2025). Furthermore, over 40% of students reported high to very high levels of challenge in distinguishing methods, solving word problems, and applying solutions to real-life contexts. These results signify that while procedural skills are moderately established, application and interpretation remain significant hurdles for the majority of learners.

Extent of Students' Employment of Strategy

Peer Tutoring

Table 4 shows the extent to which students use peer tutoring as a learning strategy in General Mathematics. The composite mean of 3.59 indicates that students rely heavily on peer tutoring, aligning with Bandura's Social Learning Theory, which emphasizes learning through observation, interaction, and modeling (McLeod, 2025). The highest-rated item, asking classmates to explain difficult ideas ($\bar{x}$=3.80), reflects a high preference for immediate peer clarification. This supports Alegre et al. (2020), who found that peer explanations improve comprehension through accessible language. Similarly, students consult peers frequently when encountering difficulties ($\bar{x}$=3.74), indicating a strong reliance on social support systems, consistent with Bandura's view that social reinforcement enhances motivation and persistence (Sutton, 2025).

Table 4. *Extent of Students' Employment of Peer Tutoring as a Strategy in Learning General Mathematics Subjects (n=136)*

I employed to a certain extent the following learning strategy to address the challenges:	$\bar{x}$	EoE	SD
1. I ask my classmates to explain ideas or methods that I find hard to understand.	3.80	H	0.99
2. I consult my peers whenever I encounter difficulties in understanding the lessons.	3.74	H	1.06
3. I engage in study sessions with my peers to reinforce my understanding of difficult topics.	3.57	H	0.91
4. I discuss difficult topics with my peers to gain different perspectives and solutions.	3.48	H	0.92
5. I seek one-on-one tutoring from peers to solve word problems and better understand the application of concepts.	3.38	M	1.05
Composite	**3.59**	**H**	**0.99**

Note: Extent of Employment (EoE); 4.21–5:00, Very High (VH); 3.41–4.20, High (H); 2.61–3.40, Moderate (M); 1.81-2.60, Low (L); 1.00-1.80, Very Low (VL)

Engaging in peer study sessions ($\bar{x}$=3.57) reflects a high use of collaborative elaboration, consistent with Piaget's idea that cognitive conflict helps refine understanding through differing viewpoints (McLeod, 2025). Students also highly discuss difficult topics with peers ($\bar{x}$=3.48), supporting Yoviyanti et al. (2023), who emphasize that such exchanges deepen conceptual processing. The lowest-rated item, seeking one-on-one peer tutoring for word problems ($\bar{x}$=3.38), shows moderate use, likely because the complexity of word problems prompts students to be more selective in their approach. Generally, the high preference for peer tutoring aligns with literature showing positive effects on mathematical performance and confidence (Hidayat et al., 2023; Arnandiz et al., 2022).

Collaborative Learning

Table 5 shows a composite mean of 3.57, indicating that students engage highly in collaborative learning. This aligns with Piaget's constructivist theory, which posits that learning is strengthened through social interaction and shared meaning-making (Howley-Rouse, 2021). Students highly value collaboration in explaining ideas ($\bar{x}$= 3.65), demonstrating that shared reasoning enhances understanding, consistent with Amo-Asante and Bonyah (2023).

Table 5. *Extent of Students' Employment of Collaborative Learning as a Strategy in Learning General Mathematics Subjects (n=136)*

I employed to a certain extent the following learning strategy to address the challenges:	$\bar{x}$	EoE	SD
1. I work with others to explain ideas or methods that I find hard to understand.	3.65	H	1.01
2. I participate in study sessions with others to reinforce my understanding of difficult topics.	3.61	H	1.00
3. I join groups where the collaboration of ideas is practiced.	3.60	H	0.99
4. I collaborate with others to discuss difficult topics and gain different perspectives and solutions.	3.56	H	0.90
5. I seek one-on-one support from others to solve word problems and better understand the application of concepts.	3.44	H	0.98
Composite	**3.57**	**H**	**0.98**

Note: Extent of Employment (EoE); 4.21–5:00, Very High (VH); 3.41–4.20, High (H); 2.61–3.40, Moderate (M); 1.81-2.60, Low (L); 1.00-1.80, Very Low (VL)

Furthermore, frequent participation in study sessions ($\bar{x}$=3.61) supports Siller and Ahmad's (2024) conclusion that group study promotes stronger mathematics achievement than individual study. Students likewise highly join collaborative groups ($\bar{x}$=3.60), reflecting Bandura's view that learning is shaped by social environments and observation (Loveless, 2024). Their high use of collaboration to gain different perspectives ($\bar{x}$=3.56) aligns with Diaz et al. (2024), who emphasize the importance of cognitive diversity in developing flexible problem-solving skills. Even the lowest-rated item, one-on-one peer support for solving word problems ($\bar{x}$=3.44), still indicates high but comparatively lower use, suggesting students may prefer group interactions over individualized assistance for complex tasks. Generally, the findings confirm past research showing that collaborative learning consistently enhances student achievement, critical thinking, and social skills (Harefa et al., 2025; Abd, 2021).

Independent Learning

Table 6 reflects that students are highly engaged in independent learning with a composite mean of 3.43. This finding aligns with Piaget's view that learners in the formal operational stage naturally exhibit autonomous knowledge construction (McLeod, 2025). The highest-rated practice, seeking additional resources or exercises to better understand concepts ($\bar{x}$=3.61), indicates that students are highly proactive in extending their learning beyond classroom instruction. This supports Amin's (2024) assertion that learner autonomy enhances mathematical comprehension through self-directed engagement.

Table 6. *Extent of Students' Employment of Independent Learning as a Strategy in Learning General Mathematics Subjects (n=136)*

I employed to a certain extent the following learning strategy to address the challenges:	x̄	EoE	SD
1. I seek additional resources or personal practice to solve word problems and better understand how concepts apply.	3.61	H	0.83
2. I spend time looking up and thinking about ideas or methods that I find hard to understand.	3.53	H	0.87
3. I study independently when I encounter difficulties in understanding the lessons.	3.46	H	0.94
4. I work alone to break down difficult topics and develop my own solutions and understanding.	3.30	M	0.98
5. I create my own study sessions to reinforce my understanding of difficult topics.	3.26	M	0.87
Composite	**3.43**	**H**	**0.90**

Note: Extent of Employment (EoE); 4.21–5:00, Very High (VH); 3.41–4.20, High (H); 2.61–3.40, Moderate (M); 1.81-2.60, Low (L); 1.00-1.80, Very Low (VL)

Students are also highly inclined to look up difficult ideas ($\bar{x}$=3.53), demonstrating intrinsic motivation and cognitive curiosity essential to constructivist environments. Similarly, studying independently when faced with difficulties ($\bar{x}$=3.46) reflects high self-regulation, echoing Cardino and Ortega-Dela Cruz's (2020) emphasis on these as core components of independent learning. Conversely, working alone to break down complex topics ($\bar{x}$=3.30) and creating study schedules ($\bar{x}$=3.26) are practiced to a moderate extent. These levels suggest that while students value independence, some still require structured guidance or collaboration when tackling more challenging material. This supports Hafidzah et al. (2021), who argue that independent learning requires significant discipline and self-efficacy—traits still developing among all learners. Overall, the high extent of independent learning indicates growing student ownership of the learning process, an outcome increasingly facilitated by digital platforms (Rizki, 2023; Sipayung et al., 2022).

Video Tutorial

Table 7 indicates that students rely heavily on video tutorials, making it the most widely used strategy across all categories, with a composite mean of 3.67. This strong preference aligns with Bandura's Social Learning Theory, which posits that learners acquire skills more effectively through modeled demonstrations, such as step-by-step explanations typical of instructional videos (McLeod, 2025).

Table 7. *Extent of Students' Employment of Video Tutorial as a Strategy in Learning General Mathematics Subjects (n=136)*

I employed to a certain extent the following learning strategy to address the challenges:	x̄	EoE	SD
1. I watch video tutorials to learn and understand ideas or methods that I find difficult.	3.82	H	0.82
2. I watch Video tutorials when I encounter difficulties in understanding the lessons.	3.69	H	0.93
3. I use Video tutorials to reinforce my understanding of difficult topics by following step-by-step explanations.	3.65	H	0.88
4. I watch Video tutorials to break down difficult topics and develop my own solutions and understanding.	3.63	H	0.89
5. I seek additional Video tutorial resources to solve word problems and better understand the application of concepts.	3.57	H	0.92
Composite	**3.67**	**H**	**0.89**

Note: Extent of Employment (EoE); 4.21–5:00, Very High (VH); 3.41–4.20, High (H); 2.61–3.40, Moderate (M); 1.81-2.60, Low (L); 1.00-1.80, Very Low (VL)

The highest-rated practice is watching video tutorials to learn difficult ideas ($\bar{x}$=3.82), indicating that students rely heavily on multimedia resources when grappling with complex concepts. This aligns with Santos et al. (2022), who emphasize that online video content provides accessible, clear, and learner-paced explanations. Likewise, students rely heavily on videos when encountering difficulties ($\bar{x}$=3.69) and consistently use step-by-step video explanations to reinforce understanding ($\bar{x}$=3.65). These practices align with Rueda et al. (2023), who noted that platforms such as Khan Academy enable personalized, mastery-based learning through structured visual demonstrations.

Students also make extensive use of videos to break down difficult topics ($\bar{x}$ = 3.63), supporting Pashchenko et al. (2024) regarding the role of visual storytelling in simplifying abstract ideas. Even the lowest-rated item—seeking additional video resources for word problems ($\bar{x}$=3.57)—indicates high engagement with visual media, consistent with Kellems et al. (2020) on the value of video modeling in enhancing problem-solving skills. Overall, these consistently high ratings confirm that video tutorials are a preferred strategy, enabling students to visualize procedures, revisit explanations, and maintain a self-directed learning pace.

Technological Tools and Applications

Table 8 shows the extent to which students use technological tools and applications in General Mathematics. The highest-rated item is the use of mobile applications such as Photomath or Math Solver ($\bar{x}$=3.44), indicating that students highly rely on solution-generating apps when encountering difficulties. This reflects a growing trend among modern learners who depend on instant digital scaffolds to provide step-by-step support and immediate procedural guidance during problem-solving.

Table 8. *Extent of Students' Employment of Technological Tools and Applications as a Strategy in Learning General Mathematics Subjects*

I employed to a certain extent the following learning strategy to address the challenges:	$\bar{x}$	EoE	SD
1. I use mobile applications such as Photomath, Microsoft Math Solver, and similar tools when I encounter difficulties solving mathematical problems.	3.44	H	1.02
2. I access online math platforms like Khan Academy or Mathway to review lessons and practice solving problems I find difficult.	3.41	H	1.01
3. I seek out interactive simulations and digital resources to explore different ways to solve problems and apply concepts.	3.35	M	0.90
4. I use technological tools such as graphing calculators or GeoGebra to visualize and better understand abstract math concepts.	3.32	M	1.01
5. I rely on school-provided or teacher-recommended digital tools to reinforce my understanding of challenging topics.	3.30	M	0.98
Composite	**3.36**	**M**	**0.98**

Note: Extent of Employment (EoE); 4.21–5:00, Very High (VH); 3.41–4.20, High (H); 2.61–3.40, Moderate (M); 1.81-2.60, Low (L); 1.00-1.80, Very Low (VL)

Students report high access to online platforms such as Khan Academy ($\bar{x}$mean = 3.41), indicating meaningful engagement with structured lessons. This is consistent with Rueda et al. (2023), who emphasize the value of guided video modules and practice exercises. Conversely, the remaining items fall under the moderate category: seeking interactive simulations ($\bar{x}$=3.35), using graphing tools such as GeoGebra ($\bar{x}$=3.32), and relying on school-recommended digital tools ($\bar{x}$=3.30). This pattern aligns with Pratama and Hendriana (2023), who noted that while digital resources enhance understanding, many learners lack the confidence to engage in independent exploration. Piaget's theory explains that the transition from concrete to abstract thinking requires guided exploration; thus, students may need stronger teacher modeling before they can fully and confidently utilize technological tools in mathematics learning.

Relationship Between the Extent of Challenges and Strategies Employed in Learning General Mathematics

Table 9 reveals a significant overall relationship between students' challenges and their use of learning strategies in General Mathematics (rs = 0.367, p < .001). This positive relationship signifies that as students encounter more challenges, they are more likely to employ multiple learning strategies. This aligns with Piaget's Constructivist Learning Theory, which explains that when learners experience cognitive conflict or disequilibrium, such as difficulties in mathematical procedures, they naturally seek strategies to restore equilibrium (McLeod, 2025). The findings also support Bandura's Social Learning Theory, suggesting that facing difficulties increases students' motivation to observe, imitate, and adopt effective strategies modeled by peers, teachers, or digital sources (Loveless, 2024).

Table 9. *Relationship Between the Challenges Experienced by the Students and the Strategies Employed in Learning General Math (n=136)*

Variables	r_s	*p*-value	Decision	Remark
Overall Challenges and Peer Tutoring	0.299	<.001	Reject H_{o1}	Significant
Overall Challenges and Collaborative Learning	0.294	<.001	Reject H_{o1}	Significant
Overall Challenges and Independent Learning	0.325	<.001	Reject H_{o1}	Significant
Overall Challenges and Video Tutorial	0.135	<.001	Reject H_{o1}	Significant
Overall Challenges and Tech. Tools and Applications	0.303	<.001	Reject H_{o1}	Significant
Overall Challenges and Overall Strategies	0.367	<.001	Reject H_{o1}	Significant

Note: Spearman's Rank-Order Correlation (r_s) at 0.05 Level of Significance

Analysis reveals a significant positive correlation between overall challenges and peer tutoring (r_s=0.299, p<.001), indicating that students facing mathematical difficulties frequently seek peer help. This is consistent with Alegre et al. (2020) regarding reduced anxiety and reflects Bandura's observational learning through peer modeling (Sutton, 2025). Similarly, the correlation with collaborative learning (r_s=0.294, p<.001) suggests that struggling students negotiate meaning through group interaction, supporting Piaget's view on cognitive restructuring (Howley-Rouse, 2021) and the findings of Siller and Ahmad (2024).

Challenges also correlate significantly with independent learning (rs = 0.325, p < .001), indicating that learners in the formal operational stage adopt autonomous strategies, such as practicing alone, to reconstruct knowledge (McLeod, 2025; Amin, 2024). Furthermore, video tutorials (r_s=0.135, p<.001) support Bandura's framework of attention, retention, and reproduction, offering visual clarity for abstract concepts (Santos et al., 2022). The use of technological tools (r_s=0.303, p<.001) provides essential scaffolding for complex procedures, serving as external aids between concrete and abstract reasoning (Pratama & Hendriana, 2023).

The overall significant correlation (*rs = 0.367, p* < .001) suggests that students integrate personal effort, social reinforcement, and digital tools to meet cognitive demands (Zakariya, 2022). This proactive shift aligns with Piaget's theory of restoring equilibrium in the face of cognitive disequilibrium (McLeod, 2025) and with Bandura's focus on modeled behaviors to enhance self-efficacy (Zain et al., 2021; Sutton, 2025). Ultimately, these hurdles prompt students to adopt adaptive strategies to manage cognitive load and improve performance (Polo & González, 2021; Yayuk et al., 2020).

Difference in the Strategies Employed by Students when Grouped According to Class Standing

Table 10 presents a comparison of learning strategies across three class standing groups: Outstanding, Very Satisfactory, and Satisfactory. Results show no significant difference in peer tutoring among these groups (H=0.411, p=0.814). All three groups share an identical median score (3.60), indicating that peer tutoring is utilized equally across all performance levels. This uniformity aligns with Bandura's concept of observational learning, suggesting that students, regardless of class standing, consistently rely on peer models for clarification, practice, and motivation.

Literature supports that peer tutoring benefits students across a range of achievement levels by promoting shared understanding and engagement (Moliner & Alegre, 2020). Since mathematical difficulties are common across performance groups, all students use peer assistance as a compensatory strategy, consistent with Piaget's view that social interaction aids the resolution of cognitive conflict (Howley-Rouse, 2021).

Table 10. *Difference in the Strategies Employed by Students When They are Grouped According to Their Class Standing (n = 136)*

Strategies	Median	H	p	Decision	Remark
Peer Tutoring					
Outstanding (O)	3.60	0.411	0.814	Fail to reject H_{o2}	Not Significant
Very Satisfactory (VS)	3.60				
Satisfactory (S)	3.60				
Collaborative Learning					
Outstanding (O)	3.40	2.535	0.282	Fail to reject H_{o2}	Not Significant
Very Satisfactory (VS)	3.90				
Satisfactory (S)	3.60				
Independent Learning					
Outstanding (O)	3.60	2.124	0.346	Fail to reject H_{o2}	Not Significant
Very Satisfactory (VS)	3.40				
Satisfactory (S)	3.40				
Video Tutorial					
Outstanding (O)	4.00	10.835	0.004	Reject H_{o2}	Significant
Very Satisfactory (VS)	3.60				
Satisfactory (S)	3.40				
		Post Hoc Analysis **Class Standing Comparison** O vs. VS: p = 0.011 (significant) O vs. S: p = 0.032 (significant) S vs. VS: p = 0.786 (not significant)			
Technological Tools and Applications					
Outstanding (O)	3.20	6.789	0.034	Reject H_{o2}	Significant
Very Satisfactory (VS)	3.60				
Satisfactory (S)	3.60				
		Post Hoc Analysis **Class Standing Comparison** O vs. VS: p = 0.089 (not significant) O vs. S: p = 0.078 (not significant) S vs. VS: p = 0.774 (not significant)			

Note: Kruskal-Wallis (H) Test at 0.05 Level of Significance

Collaborative learning similarly showed no significant difference (H=0.282, p=0.596), with medians of 3.40 (Outstanding), 3.90 (Very Satisfactory), and 3.60 (Satisfactory). This supports Piaget's belief in the co-construction of knowledge and aligns with Abd (2021), who noted that collaboration enhances reasoning regardless of prior achievement. Bandura's model further explains that students learn vicariously in group settings, leading to comparable usage across standings. Independent learning also showed no significant difference (*H*=2.124, *p*=0.346), with medians of 3.60 (Outstanding) and 3.40 (VS and S). This reflects Piaget's formal operational stage, where learners engage in self-regulated learning, a strong predictor of success (Purwanto et al., 2022), and even students with lower standing use it to bridge conceptual gaps (Apriani & Khaulah, 2021).

Conversely, video tutorial use showed a significant difference (*H = 10.835, p = 0.004*). Outstanding students reported the highest median (4.00), followed by Very Satisfactory (3.60) and Satisfactory (3.40) groups. Post hoc analysis confirms that Outstanding students differ significantly from the VS (*p*=0.011) and Satisfactory groups (*p*=0.032), suggesting they use videos as enrichment tools to deepen their understanding. This pattern aligns with Bandura's theory regarding high self-efficacy and mastery-enhancing strategies, supported by Jamil et al. (2022). Video tutorials facilitate revisiting complex steps, consistent with Piaget's view on scaffolding via external supports (Insorio et al., 2023). Finally, employment of technological tools showed a significant difference (H=6.789, p=0.034), with the Very Satisfactory and Satisfactory groups sharing a median of 3.60, while Outstanding students reported a lower median (3.20). While technology is widely used, Santos et al. (2022) and Bandura's theory suggest that high-mastery students may rely less on external digital supports. In contrast, those striving for improvement may rely more on guided digital tools for procedural compensation.

Conclusion

The findings expose a pronounced gap between students' procedural competence and their ability to apply mathematical concepts to real-world contexts. While students encounter only moderate difficulty with routine procedures, they struggle significantly with conceptual understanding and knowledge transfer. This pattern suggests that mathematics instruction remains overly procedure-focused, emphasizing formulas over authentic, contextualized problem-solving. Consequently, the weak ability to transfer learning indicates limited development of higher-order thinking skills, highlighting a critical need for pedagogical shifts that connect abstract concepts to practical applications.

Despite being "digital natives," students exhibit lower confidence in using interactive mathematical technologies to enhance conceptual understanding. This suggests insufficient guidance on the use of specialized tools and potential disparities stemming from the "digital divide." While students actively engage in collaborative learning and video tutorials—strategies utilized most effectively by high-achieving learners—the limited use of interactive simulations underscores a need to strengthen digital literacy. Ultimately, mathematics education must transition toward conceptual clarity, multisensory learning, and guided technological integration to foster meaningful, transferable learning.

Contributions of Authors

Marcela O. Catalbas: conceptualization of the study, research design, data collection, data analysis, and drafting of the manuscript
Brando A. Piñero: supervision of the research, validation of methodology, drafting of the manuscript
Maria. Chona Z. Futalan: interpretation of results, critical review, and revision of the manuscript for intellectual content

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References

Abd Algani, Y.M. (2021). The effect of the collaborative learning technique on students 'educational performance in math. Journal for the Mathematics Education and Teaching Practices, 2(2), 93–103.
Alegre, F., Moliner, L., Maroto, A., & Lorenzo-Valentin, G. (2020). Academic achievement and peer tutoring in mathematics: A comparison between primary and secondary education. Sage Open, 10(2). https://doi.org/10.1177/2158244020929295
Amo-Asante, K., & Bonyah, E. (2023). Building students' conceptual understanding of operations on fractions using manipulatives: A Junior High School perspective. Mediterranean Journal of Social & Behavioral Research, 7(3), 151-159. https://doi.org/10.30935/mjosbr/13381
Arnandiz, O., Moliner, L., & Alegre, F., (2022). When CLIL is for all: Improving learner motivation through peer-tutoring in Mathematics. System. https://doi.org/10.1016/j.system.2022.102773
Balantes, C.M., & Tonga, D. (2020). Lessons in Grade 11 mathematics using graphing calculator applications. People International Journal of Social Sciences, 5(3), 793–813. https://doi.org/10.20319/pijss.2020.53.793813
Cardino, J., Jr., & Ortega-Dela Cruz, R. (2020). Understanding of learning styles and teaching strategies towards improving the teaching and learning of mathematics. LUMAT: International Journal on Math, Science and Technology Education, 8(1), 19–43. https://doi.org/10.31129/LUMAT.8.1.1348

Celedonio, A.A., & Elicay, R. (2024). Reciprocal peer tutoring strategy on students' anxiety, self-efficacy, and mathematics performance. International Journal on Emerging Mathematics Education, 8(2), 13–30. https://doi.org/10.12928/ijeme.v8i1.28393
Cetin, O.F. (2022). The awareness of difficulties in solving rational inequality and a solution proposal. Pedagogical Research, 7(4). https://doi.org/10.29333/pr/12392
Chi, C. (2023). Philippines still lags behind world in math, reading and science — PISA 2022. Philstar.com. https://tinyurl.com/mtz67ptn
Delos Santos, K., Eduarte, A., Juaban, J.K., Abdul, R., Najimin, L., & Alviar, J. (2022). Effects of video tutorials on the mathematics achievement of students in modular distance learning. International Journal of Multidisciplinary Research and Publications (IJMRAP), 5(2), 150–155. https://tinyurl.com/a9h7yjjr
Department of Education. (2024). Republic Act 10533: Enhanced Basic Education Act of 2013. DepEd PH. https://tinyurl.com/5xke8fc
Díaz, V., Hernández-Díaz, A., & Oval, C. (2024). Didactic strategy of linear algebra with collaborative learning in mathematics pedagogical training. Journal on Mathematics Education. https://doi.org/10.22342/jme.v15i3.pp925-944
Engzell, P., Frey, A., & Verhagen, M. (2021). Learning loss due to school closures during the COVID-19 pandemic. Proceedings of the National Academy of Sciences, 118(17), e2022376118. https://doi.org/10.1073/pnas.2022376118
Gallos, D. (2021). Difficulties and coping mechanism in learning mathematics of the Grade 6 students in Carmundo Elementary School. www.academia.edu.
Hafidzah, N.A., Azis, Z., & Irvan, I. (2021). The effect of open ended approach on problem solving ability and learning independence in students' mathematics lessons. IJEMS Indonesian Journal of Education and Mathematical Science, 2(1), 11-18. https://doi.org/10.30596/ijems.v2i1.6176
Harahap, A. (2024). The impact of student learning independence on the learning outcomes of Class X students of SMK Al-Bukhori Rantauprapat. International Journal of Humanities Education and Social Sciences, 3(4). https://doi.org/10.55227/ijhess.v3i4.879
Harefa, D., Sarumaha, M., Fau, A., Telaumbanua, T., Hulu, F., Telambanua, K., Sari Lase, I.P., Ndruru, M., & Marsa Ndraha, L.D. (2025). Implementation of cooperative learning method in enhancing collaboration and communication of 12th-grade students at SMA Takhassus Al-Quran. International Journal on Education Issues, 1(1), 40–44. https://doi.org/10.59966/f5fjb137
Hidayat, R., Nasir, N., Asiah, S., Syahirah, N., Najiha, N., Yii, V., Husna, N., & Shabirah, A. (2023). Peer tutoring learning strategies in mathematics subjects: Systematic literature review. European Journal of Educational Research. https://doi.org/10.12973/eu-jer.12.3.1409
Howley-Rouse, A. (2021). Piaget's theory of education. The Education Hub. https://tinyurl.com/2x4y86mh
Insorio, A., Villanueva, Z., & General, D.E., III. (2023). Video lessons as mathematics supplementary learning materials for struggling students in online distance learning. Contemporary Mathematics and Science Education, 4(1), ep23008. https://doi.org/10.30935/conmaths/12818
Jalil, N.A., & Osman, K. (2020). Students' difficulties in mathematical problem-solving: A cross-national comparison. International Journal of Instruction, 13(3), 65–80. https://doi.org/10.29333/iji.2020.1335a
Jamil, H.A.H., Halun, R.A., & Rendiza, A.A. (2022). YouTube tutorial videos and mathematics performance. Asian Journal of Advanced Multidisciplinary Researches, 2, 1–4. https://tinyurl.com/22yk6wxp
Kellems, R., Eichelberger, C., Cacciatore, G., Jensen, M., Frazier, B., Simons, K., & Zaru, M. (2020). Using video-based instruction via augmented reality to teach mathematics to middle school students with learning disabilities. Journal of Learning Disabilities, 00(0), 1–15. https://doi.org/10.1177/0022219420906452
Komiljon, U. (2024). Effect of using modern methods in explaining the topic of functions from mathematics to students. Western European Journal of Linguistics and Education, 2(11), 216–220. https://tinyurl.com/5b2tzfz8
Kop, C. (2022). Modeling middle grade students' algebraic and covariational reasoning using unit transformations and working memory (Doctoral dissertation). Virginia Tech. https://tinyurl.com/7w2t4e28
Loveless, B. (2024). Bandura's social learning theory in education. Education Corner. https://tinyurl.com/24jkwrwj
Magayon, V., & Tabuzo, V. (2024). Least mastered skills and effective instruction in teaching general mathematics in the Philippines. Cypriot Journal of Educational Science, 19(4), 333-354. https://doi.org/10.18844/cjes.v19i4.9010
Maidiyah, E., Hasibuan, M.S., Mailizar, M., & Harnita, F. (2024). Analysis of students' difficulties in solving function composition problems. In 2nd Annual International Conference on Mathematics, Science and Technology Education (AICMSTE 2023) (pp. 160–171). Atlantis Press. https://doi.org/10.2991/978-2-38476-216-3_17
McLeod, S. (2025). Piaget's theory and stages of cognitive development. Simply Psychology. https://tinyurl.com/yv76n9eh
Moliner, L., & Alegre, F. (2020). Effects of peer tutoring on middle school students' mathematics self-concepts. PLOS One, 15(4), e0231410. https://doi.org/10.1371/journal.pone.0231410
Novianti, Apriani, W., & Khaulah, S. (2021). The influence of the AMONG system-based mathematics learning model towards the students' ability in learning independence at elementary school students. In the 1st International Conference on Research in Social Sciences and Humanities (ICoRSH, 2020) (pp. 457–463). Atlantis Press. https://tinyurl.com/2vrpradx
Obersteiner, A., Reiss, K., Van Dooren, W., & Van Hoof, J. (2019). Understanding rational numbers – Obstacles for learners with and without mathematical learning difficulties. In: Fritz, A., Haase, V.G., Räsänen, P. (eds) International Handbook of Mathematical Learning Difficulties. Springer, Cham. https://doi.org/10.1007/978-3-319-97148-3_34
OECD. (2024). An evolution of mathematics curriculum: Where it was, where it stands, and where it is going. OECD Publishing. https://doi.org/10.1787/0ffd89d0-en
Pashchenko , O., Skorupska , O., & Zhuravel , A. (2024). The role of technology in math education. Collection of Scientific Papers «SCIENTIA», (November 1, 2024; Lisbon, Portugal), 168–176. https://tinyurl.com/7v38erke
Pearson, N. (2024). Pearson's explicit plea: Roll out direct instruction to all classrooms. The Australian. https://tinyurl.com/sdy3xyf9
Perez, J.C., Bongcales, R.C., & Bellen, J. (2020). A scoping review on the implementation of the spiral progression approach. Journal of Academic Research, 5(3), 1–16. https://tinyurl.com/3d4ks2fu
Polo-Blanco, I., & González López, E. (2021). Teaching addition strategies to students with learning difficulties. Autism & Developmental Language Impairments, 6, 1–14. https://doi.org/10.1177/23969415211045324
Pratama, S., & Hendriana, B. (2023). Utilization of website-based learning videos for mathematics learning. Mathline: Jurnal Matematika dan Pendidikan Matematika, 8(1), 86–100. https://doi.org/10.31943/mathline.v8i1.295
Purwanto, J., Rahma, I.N., Gunawan, & Kusuma, J.W. (2022). The effect of mathematics problem-solving ability and learning independence on mathematics learning achievement in online learning. International Journal of Economy, Education and Entrepreneuship, 2(2), 309–316. https://doi.org/10.53067/ije3.v2i2.78
Radiamoda, A. (2023). Difficulties encountered by the students in learning mathematics. International Journal of Educational Research and Technology (IJERT), 14(1), 1–5. https://tinyurl.com/e8cdx49y
Rizki, N., Darmayanti, R., Sugianto, R., Choirudin, & Muhammad, I. (2023). The effectiveness of independent learning on student mathematical learning outcomes in online learning. Jurnal Dimensi Matematika, 6(02), 100–110.
Rueda-Gómez, K.L., Rodríguez-Muñiz, L., & Muñiz-Rodríguez, L. (2023). Performance and mathematical self-concept in university students using Khan Academy. Heliyon, 9, e15441. https://doi.org/10.1016/j.heliyon.2023.e15441
Safi, M., Suh, J., & NCTM. (2022). Equitable integration of technology for mathematics learning. National Council of Teachers of Mathematics. https://tinyurl.com/yc2nbsdb
Siller, H.-S., & Ahmad, S. (2024). Analyzing the impact of collaborative learning approach on grade six students' mathematics achievement and attitude towards mathematics. Eurasia Journal of Mathematics, Science and Technology Education, 20(2), em2395. https://doi.org/10.29333/ejmste/14153
Sipayung, T.N., et al. (2022). An analysis of students learning independence in mathematics based on Google Classroom. Journal of Physics: Conference Series (Vol. 2157, No. 1, p. 012037). IOP Publishing. https://tinyurl.com/4b6hdywv
Sutton, J. (2025). What is Bandura's social learning theory? 3 Examples. PositivePsychology.com. https://tinyurl.com/mwfc3fse
Tokuhama-Espinosa, T., Simmers, K., Batchelor, D., Nelson, A.D., & Borja, C. (2023). A Theory of mental frameworks. Frontiers in Psychology, 14, 1220664. https://doi.org/10.3389/fpsyg.2023.1220664
Tran, C.D. (2025). Math C045: Beginning and intermediate algebra. LibreTexts. https://tinyurl.com/mrxsm2vk
Trujillo, M., Atarés, L., Canet, M.J., & Pérez-Pascual, M.A. (2023). Learning difficulties with the concept of function in maths: A literature review. Education Sciences, 13(5), 495. https://doi.org/10.3390/educsci13050495
Vidad, D.C., & Quimbo, M.A.T. (2020). Students' problem-solving difficulties and coping strategies in mathematics: A model-building study. International Journal of Learning, Teaching and Educational Research, 20(9), 1–22. https://doi.org/10.26803/ijlter.20.9.9
Yayuk, E., Purwanto, A., As'ari, A.R., & Subanji. (2020). Primary school students' creative thinking skills in mathematics problem solving. European Journal of Educational Research, 9(3), 1281–1295. https://doi.org/10.12973/eu-jer.9.3.1281
Yoviyanti, R., Wahyudi, Suhendar, U., & Zuraidah, Z. (2023). The effectiveness of peer tutoring on students' understanding of mathematical concepts. Jurnal Pedagogi Dan Pembelajaran, 6(3), 350–358. https://doi.org/10.23887/jp2.v6i3.65191
Zain, D., Uno, H., & Salim, S. (2021). Modeling learning theory development social Bandura in learning for mathematics Class V students at SDN 30 Paguyaman. JournalNX, 7(1), 376–381. https://tinyurl.com/4ev3n97k
Zakariya, Y. (2022). Integrating personal effort and social reinforcement in mathematics learning. Frontiers in Psychology, 13, 850-865. https://doi.org/10.3389/fpsyg.2022.986622