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Integrating Think–Talk–Write with Realistic Mathematics Education to Strengthen Critical Thinking and Adversity Quotient

P. Ramulu [1] , M. Ramakrishna [2]

[1]Department of Mathematics, Sri Venkateshwara Government Arts & Science College(A), Palem-509215, Nagarkurnool Dist. Telanagna, India.

[2]Department of Mathematics, Government Degree College, Atmakur, Wanaparthy Dist., Telanagna, India

Abstract- This study presents a conceptual analysis of the integration of the Think–Talk–Write (TTW) strategy within the framework of Realistic Mathematics Education (RME) as an approach to enhancing middle school students' critical thinking skills and Adversity Quotient (AQ). In the context of twenty-first-century education, learners are expected not only to demonstrate strong cognitive abilities but also to exhibit resilience and adaptability when facing complex academic challenges. Therefore, the development of both higher-order thinking skills and psychological endurance becomes a fundamental goal of effective mathematics instruction. The present study is based on an extensive review of relevant scholarly literature focusing on instructional strategies, critical thinking development, and resilience in mathematics education. The TTW strategy promotes structured learning through three interconnected stages: individual reflection (think), collaborative dialogue (talk), and systematic written expression (write). These stages encourage students to actively process information, articulate their reasoning, and refine their understanding through communication and reflection. At the same time, the RME approach emphasizes the importance of contextualizing mathematical concepts by linking them to real-life situations that are meaningful and familiar to students. Through processes such as exploration, modeling, and progressive mathematization, RME enables learners to construct knowledge in a way that is both meaningful and applicable. The integration of TTW and RME is conceptualized as a complementary pedagogical framework that combines reflective learning with contextual problem-solving.

Keywords: Think–Discuss–Write Strategy; Realistic Mathematics Instruction; Higher-Order Thinking Skills; Resilience (Adversity Quotient); Mathematics Education.

I. INTRODUCTION

Education in the twenty-first century has undergone a significant transformation, emphasizing not only the acquisition of knowledge but also the development of higher-order thinking skills and adaptive competencies. Among these, critical thinking and resilience have emerged as essential attributes for students to succeed in increasingly complex and dynamic learning environments. Critical thinking enables learners to analyze information, evaluate alternative perspectives, and make reasoned decisions based on logical and evidence-based considerations. At the same time, resilience—often conceptualized as Adversity Quotient (AQ)—reflects students' capacity to withstand challenges, adapt to difficulties, and persist in achieving academic goals despite obstacles. These two dimensions, cognitive and affective, must be developed in an integrated manner to support holistic student growth.

Critical thinking plays a central role in mathematics education, as the subject inherently requires analytical reasoning, abstraction, and systematic problem-solving. Students are expected to interpret problems, identify patterns, formulate strategies, and justify their conclusions logically. However, the development of such competencies remains a persistent challenge in many educational contexts. Numerous studies have indicated that students often struggle with higher-order thinking tasks, particularly when they are required to move beyond procedural knowledge toward conceptual understanding and reasoning. This limitation is frequently associated with traditional teaching practices that emphasize rote learning and algorithmic procedures rather than meaningful engagement and inquiry-based learning.

In addition to cognitive challenges, students also face affective barriers that hinder their learning processes. The concept of Adversity Quotient (AQ) provides a useful framework for understanding students' resilience in academic contexts. AQ encompasses several dimensions, including control (the ability to influence outcomes), origin and ownership (the extent to which individuals take responsibility for challenges), reach (the impact of adversity on other areas of life), and endurance (the perceived duration of difficulties). Students with higher AQ are more likely to persist in solving problems, remain motivated despite setbacks, and approach challenges with a constructive mindset. Conversely, students with low AQ may exhibit avoidance behaviors, reduced motivation, and a tendency to give up when faced with difficulties. Therefore, fostering AQ is crucial for ensuring sustained engagement and success in mathematics learning.

Mathematics, as a discipline, often presents students with complex and abstract problems that require both intellectual effort and emotional resilience. The ability to think critically must be complemented by the capacity to cope with failure, uncertainty, and cognitive struggle. However, existing instructional practices frequently address these dimensions separately, focusing predominantly on cognitive outcomes while neglecting the development of resilience and perseverance. This gap highlights the need for instructional models that can simultaneously promote critical thinking and AQ within a cohesive learning framework.

One instructional model that has shown promise in enhancing students' engagement and reasoning is the Think–Talk–Write (TTW) strategy. This model is grounded in constructivist learning principles and emphasizes the active involvement of students in constructing knowledge through reflection, discussion, and written expression. The think stage encourages students to independently analyze problems and generate initial ideas. The talk stage facilitates collaborative learning through peer discussions, allowing students to exchange perspectives, clarify misconceptions, and refine their understanding. Finally, the write stage requires students to organize their thoughts and articulate their reasoning in a structured manner. Through this sequence, TTW promotes deeper cognitive processing, improves communication skills, and supports the development of logical and coherent thinking.

Another approach that aligns well with the goals of meaningful mathematics learning is Realistic Mathematics Education (RME). Rooted in the idea that mathematics is a human activity, RME emphasizes the use of real-life contexts as the starting point for learning. By engaging with problems that are relevant to their daily experiences, students are able to construct mathematical concepts more meaningfully. The process of mathematization—transforming real-world situations into mathematical representations—enables learners to bridge the gap between concrete experiences and abstract reasoning. RME also encourages exploration, modeling, and reflection, thereby creating a learning environment that is both engaging and intellectually stimulating.

Despite the demonstrated effectiveness of TTW and RME as independent instructional approaches, their combined application remains relatively underexplored. Existing research on TTW has primarily focused on improving students' communication skills and reflective thinking, while studies on RME have emphasized contextual understanding and conceptual development. However, integrating these two approaches offers a unique opportunity to create a comprehensive learning model that addresses both cognitive and affective dimensions of learning. TTW provides a structured framework for reflection and communication, whereas RME offers meaningful contexts that enhance conceptual understanding. Together, they can create a synergistic effect that promotes critical thinking while simultaneously strengthening resilience.

Furthermore, much of the existing literature in mathematics education has concentrated on cognitive outcomes, particularly critical thinking and problem-solving abilities. While these are undoubtedly important, the role of affective factors such as AQ has received comparatively less attention. This imbalance limits the effectiveness of instructional designs, as students' ability to think critically is often influenced by their willingness to engage with challenges and persist in the face of difficulties. Therefore, incorporating AQ into instructional frameworks is essential for achieving more comprehensive and sustainable learning outcomes.

The integration of TTW and RME offers a promising solution to these challenges by combining reflective learning, collaborative interaction, and contextual problem-solving. This approach not only enhances students' ability to analyze and evaluate mathematical problems but also fosters resilience, adaptability, and self-confidence. By engaging students in meaningful learning experiences that require both cognitive effort and emotional perseverance, the TTW–RME framework aligns with the broader goals of twenty-first-century education.

In light of these considerations, this study aims to conceptually examine the integration of the TTW model and the RME approach in mathematics learning and to analyze their potential contributions to the development of students' critical thinking skills and Adversity Quotient. By synthesizing existing literature and proposing a conceptual framework, this study seeks to provide both theoretical insights and practical guidance for educators in designing innovative and holistic mathematics instruction that meets the demands of contemporary education.

II. METHODS

This study employed a qualitative literature review design to systematically examine conceptual perspectives and descriptive findings reported in relevant scholarly publications related to mathematics education. The primary aim of this review was to synthesize existing knowledge on the implementation of the Think–Talk–Write (TTW) learning model and the Realistic Mathematics Education (RME) approach, particularly in relation to the development of students' critical thinking skills and Adversity Quotient (AQ).

The review process followed a structured and systematic procedure to ensure comprehensiveness and analytical depth. Initially, relevant literature was identified through a keyword-based search strategy using terms such as "Think–Talk–Write," "Realistic Mathematics Education," "critical thinking," "Adversity Quotient," and "mathematics learning." These keywords were used individually and in combination to capture a broad range of related studies. Scholarly sources were retrieved from multiple academic databases, including Google Scholar, Scimago, Semantic Scholar, Scopus, and Connected Papers, ensuring wide coverage of peer-reviewed research articles, conference papers, and relevant academic publications.

The selection of literature was guided by specific inclusion and exclusion criteria. Studies were included if they: (1) focused on mathematics education at the secondary or middle school level, (2) discussed or implemented TTW or RME approaches, (3) examined outcomes related to critical thinking skills, resilience, or related constructs, and (4) were published in peer-reviewed academic outlets. Conversely, studies were excluded if they lacked clear methodological descriptions, were not directly related to the research focus, or were considered outdated without significant theoretical contribution. This filtering process ensured that only relevant and credible sources were included in the analysis.

Following the selection of literature, the analytical process involved several stages. First, key findings from each study were identified and categorized based on their focus, such as instructional strategies, cognitive outcomes, and affective dimensions. Second, the methodological characteristics of the studies were examined to understand their strengths and limitations, including research design, sample characteristics, and data analysis techniques. Third, the theoretical frameworks underpinning the studies were analyzed to identify common conceptual foundations and differences in perspective. Finally, gaps in the existing literature were identified to highlight areas that require further investigation, particularly concerning the integration of TTW and RME in a unified instructional model.

To synthesize the data, a content analysis approach was employed. This technique involved systematically coding and grouping recurring themes, patterns, and relationships across the selected studies. The analysis focused on identifying how TTW and RME individually and collectively contribute to the development of critical thinking skills and AQ. Through iterative comparison and interpretation, key themes such as reflective learning, collaborative interaction, contextual problem-solving, resilience development, and student engagement were identified and organized into a coherent structure.

The final stage of the study involved the development of a conceptual framework that illustrates the potential relationship between the TTW model, the RME approach, critical thinking skills, and Adversity Quotient. This framework was constructed based on the synthesis of theoretical insights and empirical findings derived from the reviewed literature. It serves as a conceptual representation of how the integration of TTW and RME can create a holistic learning environment that simultaneously enhances students' cognitive abilities and psychological resilience.

Overall, this qualitative literature review provides a comprehensive and systematic understanding of the potential benefits of integrating TTW and RME in mathematics education. By combining rigorous literature selection, structured analysis, and conceptual synthesis, the study offers both theoretical contributions and practical implications for educators seeking to design effective, reflective, and resilience-oriented learning experiences.

III. RESULTS AND DISCUSSION

The synthesis of the reviewed literature reveals that both the Think–Talk–Write (TTW) learning model and the Realistic Mathematics Education (RME) approach play a substantial role in enhancing students' critical thinking abilities and their Adversity Quotient (AQ). These instructional approaches, when applied systematically, contribute to the development of both cognitive competencies and affective resilience, which are essential for effective mathematics learning.

Implementation of the Think–Talk–Write (TTW) Model

The Think–Talk–Write (TTW) model is a language-based instructional approach that emphasizes structured learning through three sequential stages: individual reflection (think), collaborative

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discussion (talk), and organized written expression (write). Each stage serves a distinct yet interconnected function in promoting deeper understanding and strengthening higher-order thinking skills. The think phase encourages students to independently engage with mathematical problems, analyze given information, and generate initial solution strategies. This stage fosters metacognitive awareness, as students are required to reflect on their own reasoning processes before external interaction occurs.

The talk phase provides opportunities for students to engage in collaborative dialogue, where they exchange ideas, clarify misconceptions, and evaluate alternative approaches. Through peer interaction, students are exposed to diverse perspectives, which enhances their ability to reason logically and justify their conclusions. This social dimension of learning not only supports cognitive development but also contributes to the improvement of communication skills and cooperative learning attitudes. The write phase, as the final stage, requires students to organize their thoughts systematically and articulate their reasoning in a clear and coherent manner. Writing serves as a reflective tool that consolidates understanding and reinforces logical structure in problem solving.

Empirical evidence supports the effectiveness of the TTW model in mathematics education. Studies by Nasrulloh and Umardiyah (2020) and Amaratya (2024) demonstrate that consistent implementation of TTW significantly enhances students' mathematical communication skills and logical reasoning. By encouraging structured argumentation and systematic expression of ideas, TTW helps students develop clarity in thought and precision in explanation. These skills are closely associated with critical thinking, particularly in tasks that require justification, evaluation, and interpretation.

From a theoretical perspective, the TTW model aligns with the broader goal of fostering intellectual autonomy. McPhee and Cox (2025) argue that critical thinking ultimately aims to cultivate individuals who are capable of independent and responsible reasoning. TTW supports this objective by gradually shifting students from guided learning toward self-directed thinking through reflective and communicative practices. Students are not only encouraged to find solutions but also to understand and justify the reasoning behind those solutions.

Furthermore, recent findings by Chen et al. (2024) highlight a common gap in students' learning profiles: while many learners exhibit curiosity and openness to new ideas, they often lack the ability to think independently and critically. The TTW model addresses this issue by providing a structured framework that guides students through the process of independent analysis, collaborative refinement, and reflective articulation. This progression ensures that students are actively involved in constructing knowledge rather than passively receiving information.

In addition to enhancing cognitive skills, the TTW model also contributes to the development of students' Adversity Quotient. Through collaborative discussions and reflective writing, students learn to engage with challenges, accept feedback, and persist in refining their solutions. These experiences foster confidence, adaptability, and perseverance—key components of resilience in learning. As students repeatedly encounter and overcome difficulties within a supportive learning environment, they develop a more positive attitude toward problem solving and a greater willingness to confront complex mathematical tasks.

Overall, the TTW model provides a comprehensive instructional framework that integrates cognitive, social, and affective dimensions of learning. By promoting reflective thinking, meaningful interaction, and structured expression, it plays a critical role in enhancing students' critical thinking skills while simultaneously strengthening their resilience in mathematics learning.

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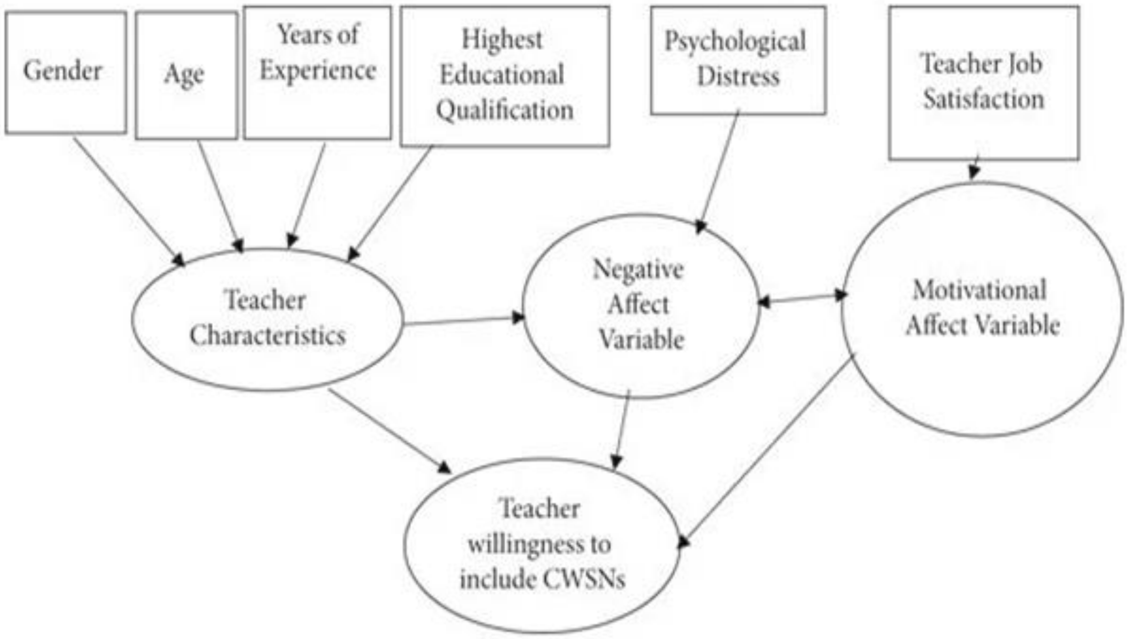

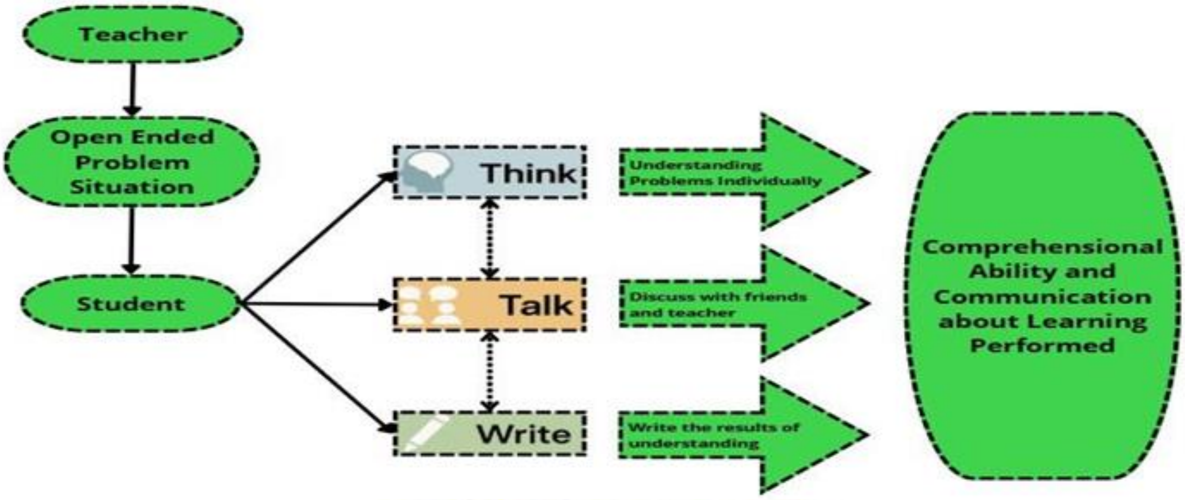

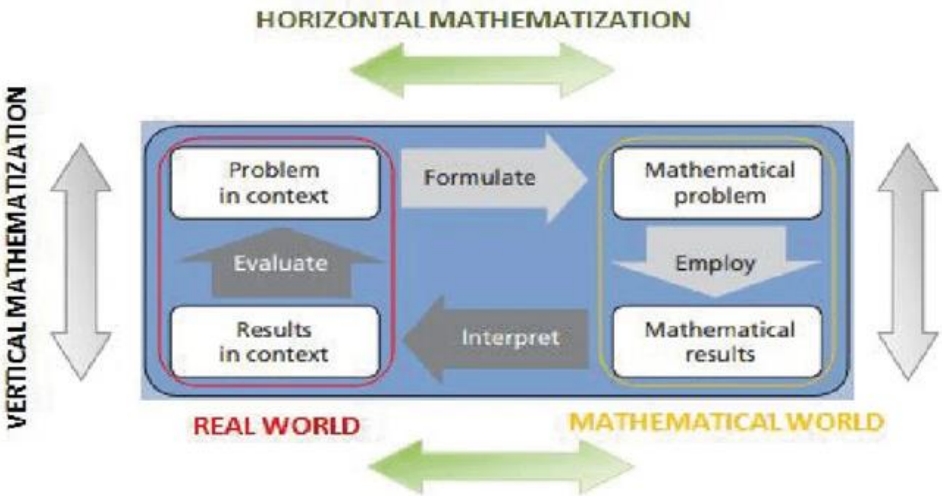

Figure Description (for your paper)

The figure illustrates a conceptual framework showing the integration of the Think–Talk–Write (TTW) model and the Realistic Mathematics Education (RME) approach. The TTW model is represented through three sequential stages—Think, Talk, and Write—which emphasize reflection, collaboration, and structured expression. In parallel, the RME approach is depicted as a contextual learning pathway beginning with real-life problems, followed by exploration, modeling, and progressive mathematization. Both TTW and RME converge into two major learning outcomes:

- Cognitive Domain → Development of critical thinking skills (analysis, evaluation, reasoning, decision-making)
- Affective Domain → Enhancement of Adversity Quotient (resilience, perseverance, adaptability, responsibility)

Arrows in the model indicate the dynamic and reciprocal relationship between reflective learning processes and contextual problem-solving. The integration ultimately leads to holistic student development, aligning with the goals of 21st-century education.

Contextualization through the Realistic Mathematics Education (RME) Approach

The Realistic Mathematics Education (RME) approach emphasizes the importance of grounding mathematical learning in meaningful real-world contexts, using students' everyday experiences as a foundation for conceptual understanding. By connecting abstract mathematical ideas to familiar situations, RME enables learners to construct knowledge in a more meaningful and accessible manner. Empirical studies by Juprijal et al. (2017) and Lestari et al. (2023) indicate that the use of RME-based instructional materials, including contextual worksheets, significantly improves students' critical thinking skills by engaging them in authentic problem-solving activities. A central principle of RME is the process of progressive mathematization, which describes the transition from informal, context-based reasoning to formal mathematical understanding. Van den Heuvel-Panhuizen (2003) explains that this progression is often supported by visual representations, such as bar models, which help students bridge the gap between concrete experiences and abstract concepts. In line with this, Bos et al. (2020) demonstrate that design-oriented learning tasks—such as the "ski jump" problem—allow students to intuitively explore mathematical concepts like slope and curvature. These types of activities not only enhance conceptual understanding but also foster analytical reasoning through visualization and experiential learning.

Further research highlights the role of RME in facilitating gradual knowledge construction through guided reinvention. Serbin et al. (2024) emphasize that students actively reconstruct mathematical concepts by engaging with meaningful problems under teacher guidance, rather than passively receiving information. Innovative implementations of RME, such as the use of realistic educational cartoons in teaching measurement concepts (Çilingir Altiner, 2024), have also been shown to increase student engagement while improving estimation skills and reasoning abilities. Additionally, Sitorus and Masrayati (2016) report that RME supports the development of creative thinking by guiding students through structured stages of problem solving, including orientation, exploration, solution formulation, and verification. From a broader perspective, mathematics is increasingly viewed as a socially embedded human activity rather than a purely abstract discipline. Thanheiser (2023) argues that mathematical understanding is shaped by social interaction and contextual relevance, which aligns closely with the core philosophy of RME. This perspective reinforces the importance of connecting mathematical concepts to learners' lived experiences. Furthermore, Aragón et al. (2024) provide evidence that the ABN (Open Algorithm Based on Numbers) method—rooted in RME principles—more effectively enhances students' spatial working memory and numerical abilities compared to traditional instructional approaches.

Overall, the body of evidence suggests that RME not only strengthens students' conceptual understanding but also promotes higher-order thinking skills, including critical and creative thinking.

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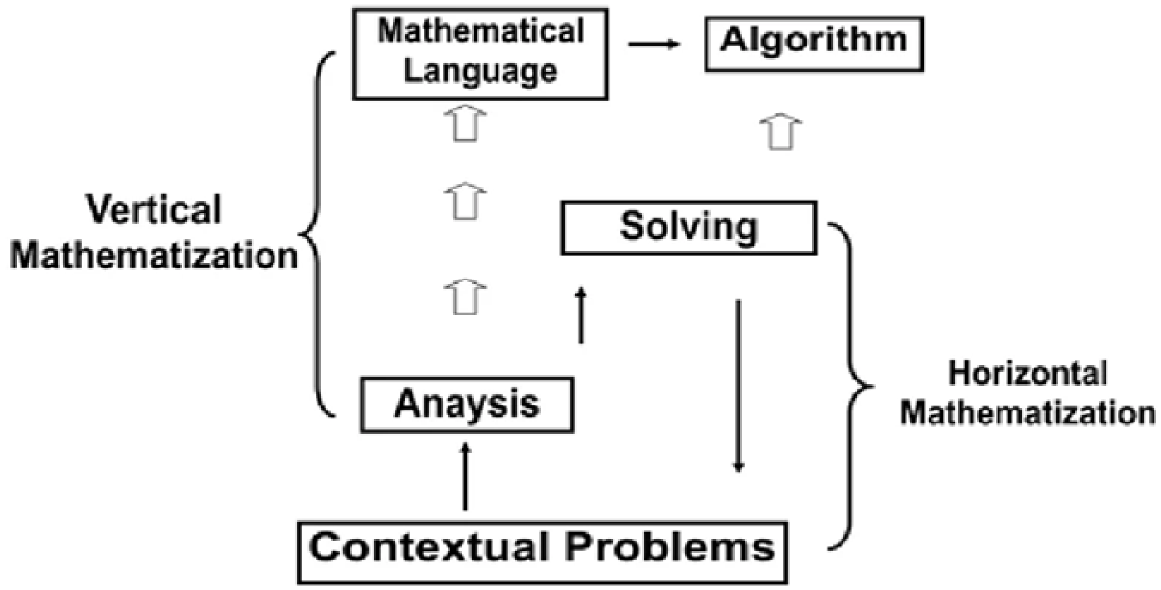
By situating learning within meaningful contexts and encouraging active exploration, RME creates a dynamic and engaging learning environment that supports comprehensive cognitive development. This contextual and student-centered approach makes RME particularly effective in addressing the demands of contemporary mathematics education.



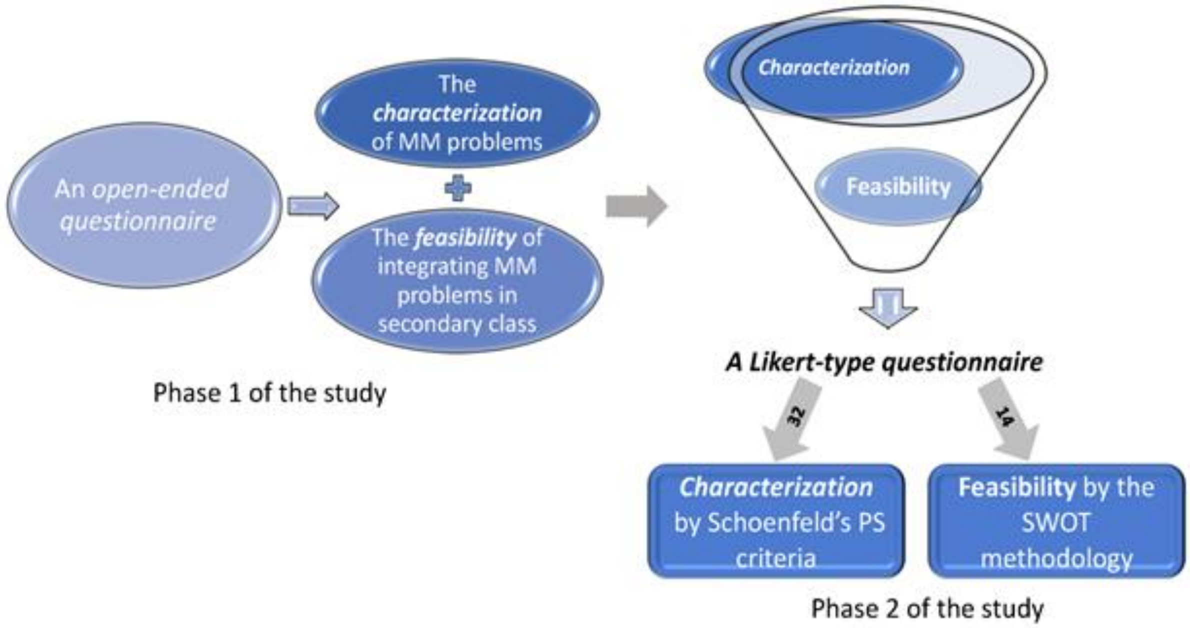


Figure Description

This figure illustrates the core process of the Realistic Mathematics Education (RME) approach, highlighting the transition from real-life contexts to formal mathematical understanding. The model begins with contextual problems derived from students' everyday experiences, which serve as the foundation for learning. Through exploration and representation, students analyze these problems using informal strategies and visual models. This is followed by horizontal mathematization, where real-world situations are translated into mathematical forms. Subsequently, vertical mathematization enables students to refine and generalize these representations into more formal mathematical concepts and procedures.The process culminates in conceptual understanding and application, where learners can apply abstract mathematical knowledge to both academic and real-life situations. The cyclical nature of the model indicates that learning is iterative, allowing students to revisit contexts and deepen understanding progressively.

Overall, the figure demonstrates how RME fosters critical thinking, reasoning, and conceptual clarity through a structured yet contextual learning pathway.

Implications for the Development of Critical Thinking Skills

Critical thinking is a core competency in mathematics education and can be effectively enhanced through the combined application of the Think–Talk–Write (TTW) model and the Realistic Mathematics Education (RME) approach. Within the TTW structure, the think phase plays a pivotal role by encouraging students to engage in independent analysis, explore multiple solution strategies, and perform in-depth reasoning before participating in discussion and written expression. This reflective stage strengthens metacognitive awareness and promotes systematic evaluation of mathematical ideas. In parallel, the RME approach emphasizes that mathematical understanding should originate from meaningful real-life contexts that are relevant to students' experiences. By introducing learning through contextual problems, RME stimulates exploration, critical analysis, and the independent construction of solutions. These processes inherently involve key elements of critical thinking, such as problem identification, strategic planning, information analysis, and logical evaluation of outcomes. The integration of TTW and RME thus creates a balanced and dynamic learning environment that combines contextual exploration with structured reflection.

This synergy provides essential conditions for the development of higher-order thinking skills. Within the RME framework, students are required to interpret contextual problems, identify relevant information, evaluate alternative solution strategies, and make informed decisions. At the same time, the TTW stages ensure that these cognitive processes are articulated, discussed, and refined through collaborative interaction and systematic writing. Empirical studies support the effectiveness of this integrated instructional approach. Wulandari et al. (2020) found that the combination of the DAPIC model with RME resulted in significantly higher improvements in students' critical thinking skills and self-confidence compared to Problem-Based Learning (PBL). Similarly, Toheri et al. (2020) reported that context-based instructional methods were more effective than problem-posing approaches in enhancing students' critical thinking performance.

Moreover, Rattanachaithada et al. (2025), through confirmatory factor analysis, identified key dimensions of critical thinking in mathematics and science education, including problem identification, logical reasoning, information evaluation, inference, and evidence-based argumentation. These dimensions align closely with the characteristics of TTW, which emphasizes structured reasoning and reflective writing, as well as with RME, which promotes contextual understanding and authentic problem-solving experiences.

In conclusion, the integration of TTW and RME offers a coherent and comprehensive pedagogical framework that systematically fosters analytical reasoning, independent judgment, and evidence-based thinking. This approach not only strengthens students' critical thinking abilities but also prepares them to engage more effectively with complex mathematical problems in meaningful and reflective ways.

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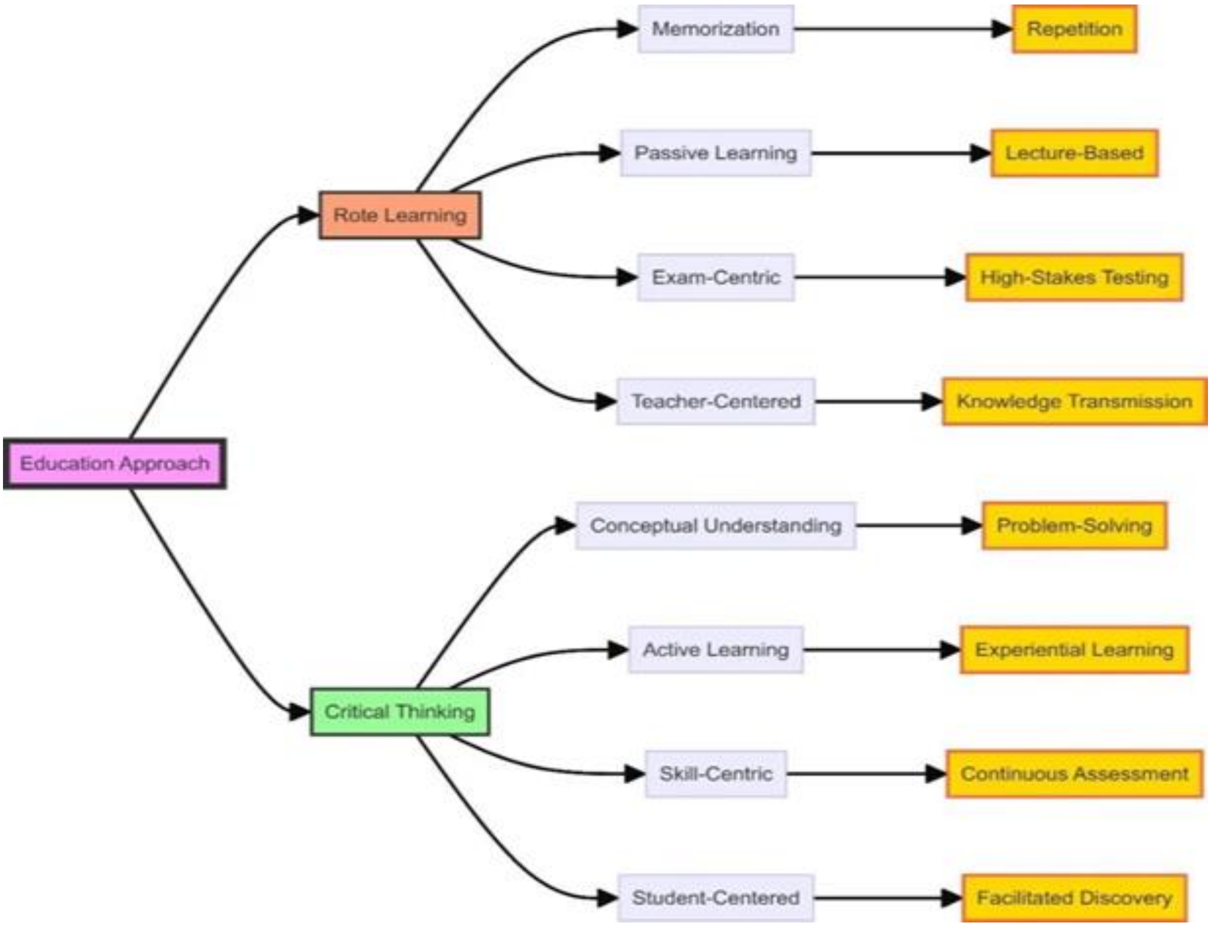

Figure Description

This figure illustrates how the integration of the Think–Talk–Write (TTW) model and the Realistic Mathematics Education (RME) approach facilitates the development of students' critical thinking skills. The TTW process is represented through three sequential stages: Think (individual analysis and reflection), Talk (collaborative discussion and idea exchange), and Write (structured articulation of reasoning). These stages promote metacognitive awareness, logical organization, and clarity in expressing mathematical ideas.

Simultaneously, the RME pathway begins with real-life contextual problems, followed by exploration, modeling, and progressive mathematization. This pathway ensures that students engage with meaningful situations that require interpretation, analysis, and problem-solving.

Both pathways converge into key critical thinking components, including:
- Problem identification
- Logical reasoning
- Information evaluation
- Inference and interpretation
- Evidence-based argumentation

The arrows in the model indicate a dynamic interaction between reflective processes and contextual understanding, leading to the development of higher-order thinking skills. The integration ultimately results in enhanced analytical ability, independent judgment, and systematic decision-making in mathematics learning.

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Implications for the Development of Adversity Quotient

Adversity Quotient (AQ), defined as an individual's ability to להתמודד challenges, adapt to difficulties, and persist in the face of obstacles, represents a critical determinant of academic success—particularly in mathematics education, where learners frequently encounter abstract concepts and cognitively demanding tasks. In such contexts, students are not only required to apply logical reasoning but also to demonstrate resilience when confronted with failure, uncertainty, and complex problem-solving situations. Therefore, instructional approaches that simultaneously cultivate cognitive competence and psychological endurance are essential. The Think–Talk–Write (TTW) model plays a significant role in enhancing AQ, especially through its talk and write phases, which actively engage students in confronting academic challenges rather than avoiding them. During the talk phase, students participate in collaborative discussions that involve exchanging ideas, analyzing different viewpoints, and defending their reasoning with logical arguments. This interactive process exposes learners to constructive criticism and diverse perspectives, encouraging them to reassess and refine their thinking. Such experiences contribute to the development of emotional regulation, openness, and adaptability—key components of resilience. Students learn to manage disagreement, overcome uncertainty, and build confidence in their reasoning abilities.

The write phase further reinforces AQ by requiring students to organize their thoughts systematically and articulate solutions in a clear and structured manner. Writing encourages reflection, self-evaluation, and accountability, as students must justify their reasoning and present coherent arguments. This process strengthens perseverance, responsibility, and independence in problem solving. Over time, repeated engagement in these reflective and structured activities fosters a mindset oriented toward persistence and continuous improvement. Consequently, TTW serves as an effective reflective-collaborative framework for developing resilient learner characteristics.

In addition to TTW, the Realistic Mathematics Education (RME) approach provides a powerful context for nurturing AQ by embedding learning within meaningful real-life situations. RME introduces students to authentic problems that require sustained attention, effort, and strategic thinking. By engaging with contextualized challenges, students encounter situations that may initially seem difficult or unfamiliar, prompting them to experience cognitive struggle. However, through guided exploration and gradual refinement of strategies, learners develop the ability to manage frustration, learn from mistakes, and persist in seeking solutions. This process promotes a growth mindset, where challenges are viewed as opportunities for learning rather than barriers to success.

The learning environment fostered by RME is inherently exploratory and student-centered, encouraging active participation and deep reasoning. As students navigate complex problems, they develop endurance, adaptability, and confidence in their ability to overcome difficulties. These experiences directly contribute to strengthening the core dimensions of AQ, including control over learning processes, ownership of outcomes, and sustained effort in the face of challenges.

The integration of TTW and RME creates a complementary and synergistic framework for AQ development. While TTW emphasizes reflective thinking, communication, and structured expression, RME provides meaningful contexts that challenge students to apply their knowledge in realistic situations. Together, these approaches create a learning environment that balances cognitive engagement with emotional resilience. Empirical studies support this integration, indicating that instructional models incorporating collaborative reflection and contextual problem solving significantly enhance students' learning resilience, particularly when dealing with complex mathematical content (Safi'i et al., 2021; Muarifah et al., 2022). Furthermore, AQ has been identified as a strong predictor of academic and professional success, with perseverance emerging as a key contributing factor (Zhao & Sang, 2023).

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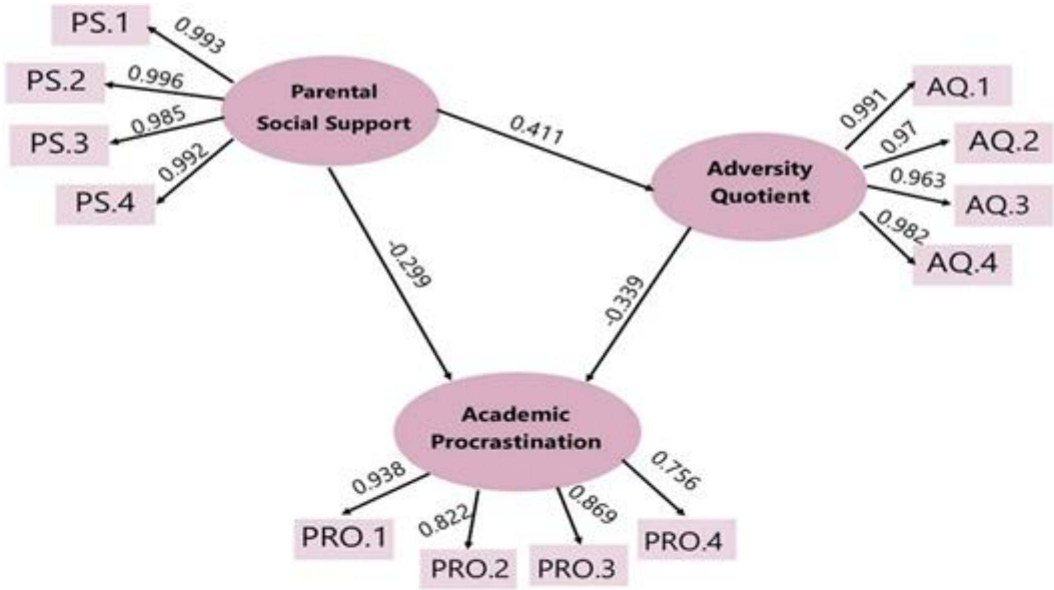
Beyond student outcomes, AQ also has implications for educators. Mwiyanda and Kingi (2019) highlight that teachers' resilience influences classroom dynamics and students' academic performance, suggesting that fostering AQ within educational systems should involve both learners and instructors. Additionally, Fauziah et al. (2020) found that students categorized as "climbers"—those with high AQ—demonstrate stronger divergent thinking abilities, indicating a close relationship between resilience and creative problem solving. AQ also plays a mediating role in intrinsic motivation and self-discipline, which are essential for effective self-regulated learning.

In summary, the integration of TTW and RME contributes significantly to the development of key AQ dimensions, including control, perseverance, responsibility, and endurance. By creating learning environments that emphasize contextual exploration, collaborative interaction, and reflective thinking, educators can foster sustainable and adaptive resilience in students. Such resilience equips learners not only to succeed in mathematics but also to future academic and real-world challenges with confidence, persistence, and a proactive mind-set.



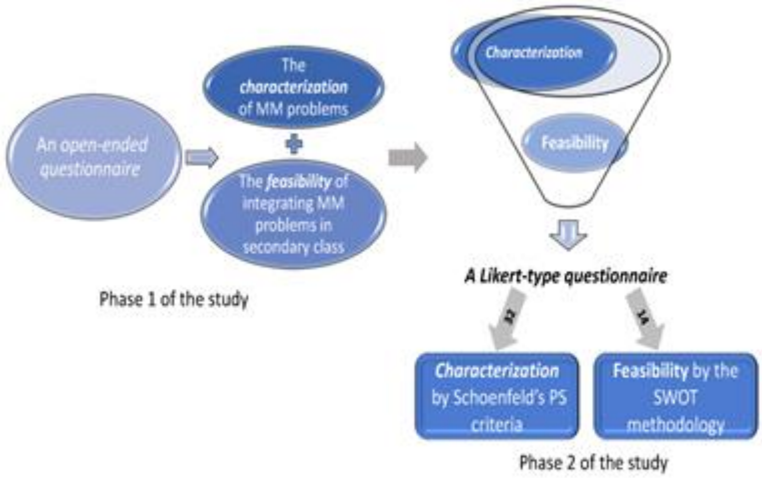


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Figure Description

This figure illustrates how the integration of the Think–Talk–Write (TTW) model and the Realistic Mathematics Education (RME) approach contributes to the development of students' Adversity Quotient (AQ).

The TTW pathway is represented through two key stages influencing resilience:

- Talk → collaborative discussion, exposure to multiple perspectives, acceptance of feedback, and adaptive thinking
- Write → structured reflection, organization of ideas, persistence, and independent problem-solving

These stages foster emotional regulation, responsibility, and perseverance.

The RME pathway begins with real-life contextual problems that require sustained effort and engagement. Through exploration, modelling, and problem-solving, students experience challenge, error correction, and strategy refinement. This process promotes a growth mind-set, adaptability, and endurance.

Both pathways converge into the four core AQ dimensions:

- Control
- Ownership
- Reach
- Endurance

The diagram shows that through continuous interaction between reflective learning (TTW) and contextual challenges (RME), students develop learning resilience, persistence, adaptability, and self-regulation.

Ultimately, the integration leads to enhanced Adversity Quotient, enabling students to effectively manage academic challenges and sustain motivation in complex mathematics learning environments.

Conceptual Model of TTW–RME Integration

Based on the preceding conceptual synthesis, a theoretical model is proposed to illustrate the interrelationship among the Think–Talk–Write (TTW) model, the Realistic Mathematics Education (RME) approach, students' critical thinking skills, and their Adversity Quotient (AQ).

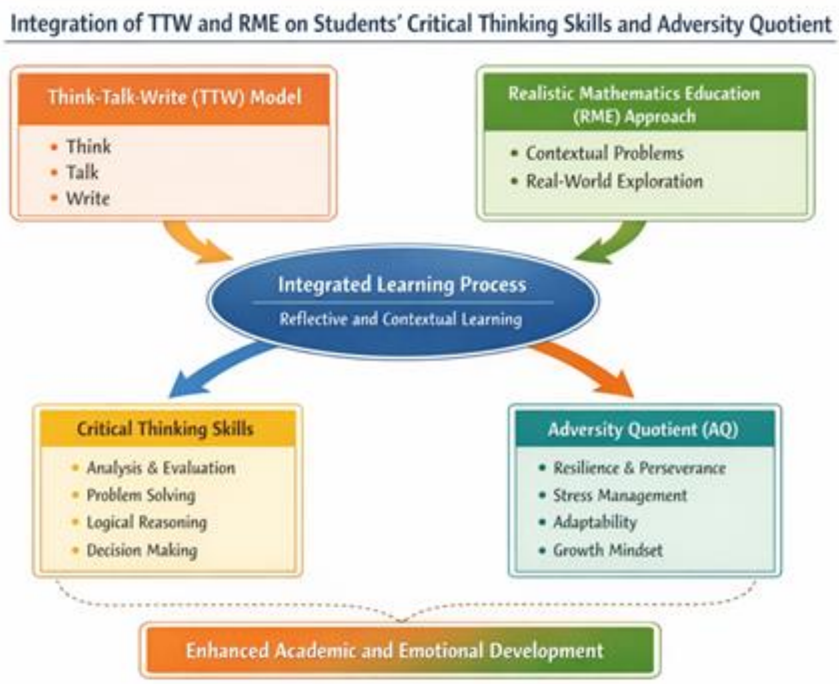

Figure 1. Conceptual Integration of TTW and RME in Enhancing Critical Thinking Skills and Adversity Quotient

The proposed model demonstrates how the concurrent implementation of TTW and RME creates a structured yet contextualized learning process that simultaneously nurtures cognitive and non-cognitive development. The TTW stages—reflective thinking, collaborative dialogue, and systematic writing—function as mechanisms for deep reasoning, metacognitive awareness, and intellectual articulation. In parallel, RME provides meaningful real-world contexts that stimulate exploration, progressive mathematization, and authentic problem solving.

Through this dual mechanism, students' critical thinking skills are strengthened via analytical reasoning, strategy formulation, evaluation, and evidence-based justification. At the same time, their AQ is reinforced through sustained engagement with complex tasks, perseverance in problem solving, responsibility for learning outcomes, and adaptive responses to academic challenges.

The conceptual review findings suggest that integrating TTW and RME contributes significantly to mathematics instructional design by shifting the focus beyond purely cognitive achievement toward the balanced development of intellectual competence and psychological resilience. This approach supports a more holistic educational orientation that aligns with contemporary pedagogical priorities.

Overall, the TTW–RME integrated model not only improves students' academic performance but also enhances their mental preparedness to navigate learning difficulties in dynamic educational environments (Fauziah et al., 2020; Toheri et al., 2020). Consequently, this instructional framework is highly relevant for addressing the competencies required in twenty-first-century education, where critical thinking and resilience are equally essential.

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IV. CONCLUSION

This conceptual study underscores the considerable potential of integrating the Think–Talk–Write (TTW) model with the Realistic Mathematics Education (RME) approach in promoting students' critical thinking skills and Adversity Quotient (AQ) within mathematics learning. The synthesis of existing theoretical and empirical literature indicates that the TTW model enhances reflective reasoning, systematic communication, and independent problem-solving through its structured sequence of thinking, discussion, and writing activities. At the same time, the RME approach anchors mathematical learning in meaningful real-life contexts, thereby facilitating deeper conceptual understanding, analytical reasoning, and engagement with authentic problems.

The combination of TTW and RME offers a comprehensive instructional framework that effectively integrates cognitive and affective dimensions of learning. From a cognitive standpoint, this integrated model strengthens higher-order thinking skills, including analysis, logical reasoning, evaluation, inference, and evidence-based argumentation. From an affective perspective, it supports the development of resilience, perseverance, responsibility, adaptability, and a growth-oriented mindset, which are central components of Adversity Quotient. The synergy between TTW's reflective-collaborative processes and RME's contextual and experiential learning environment creates conditions that encourage sustained engagement, deeper understanding, and active participation in complex mathematical tasks.

Moreover, this integration contributes to a shift in mathematics instruction from a sole focus on academic achievement toward a more holistic approach that values both intellectual and emotional development. In the landscape of twenty-first-century education, where learners are expected to think critically and respond adaptively to challenges, the TTW–RME framework emerges as a relevant and theoretically sound pedagogical alternative. It not only equips students with essential cognitive skills but also prepares them to academic difficulties with confidence and persistence.

Despite its conceptual strength, this study is limited to theoretical analysis and literature synthesis. Therefore, future research is strongly recommended to empirically validate the proposed model through experimental or quasi-experimental designs, particularly in secondary school contexts. Such studies could examine the extent to which the TTW–RME integration influences students' academic performance, critical thinking development, and long-term resilience. Additionally, further investigation into contextual variables, such as teacher practices and classroom environments, would provide deeper insights into the practical implementation of this model.

In conclusion, the integration of TTW and RME represents a promising direction for advancing mathematics education by fostering a balanced development of cognitive excellence and adaptive resilience, ultimately preparing students to thrive in both academic and real-world challenges.

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