



Strengthening Students’ Critical Thinking Skills and Adversity Quotient through the Think Talk Write Model Based on Realistic Mathematics Education

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ABSTRACT

This article conceptually discusses the integration of the Think Talk Write (TTW) model with the Realistic Mathematics Education (RME) approach to enhance the critical thinking skills and Adversity Quotient (AQ) of the middle school students. This study was conducted through a literature review of various relevant scientific articles indexed in Scopus Q1, Q2, and Q3. The TTW model encourages students to think, discuss, and systematically write their mathematical ideas, while the RME approach presents learning contexts that are realistic and closely related to students’ daily lives. The integration of the TTW model and the RME approach is considered capable of creating an active, reflective, and meaningful learning environment, thereby supporting the development of students’ critical thinking skills and resilience in facing complex mathematical problems. The results of the review indicate that the combination of TTW and RME has the potential to become an effective learning model in mathematics instruction to equip students with 21st century skills. This integration is also potentially effective in developing students’ abilities in analysis, interpretation, evaluation, accurate decision-making, and in building strong resilience. Furthermore, this article presents a conceptual framework that illustrates the synergetic relationship between TTW, RME, critical thinking skills, and students’ Adversity Quotient which can serve as a theoretical reference for the future empirical research and as a practical guideline for mathematics educators in designing reflective, contextual, and resilience-oriented learning in response to the demands of 21st century education.

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I. INTRODUCTION

Twenty-first century education requires students to possess higher-order thinking skills and strong learning resilience. The ability to think critically and the capacity to remain resilient in the face of academic challenges are two essential aspects that must be developed in tandem. Critical thinking is required to analyze information, evaluate strategies, and draw conclusions based on logical and objective evidence (Facione, 1990). On the other hand, Adversity Quotient (AQ) determines the extent to which students are able to endure academic pressures, such as failure in solving problems, difficulties in understanding concepts, and the accumulation of academic tasks (Stoltz,

1997). AQ consists of four main dimensions which is control, origin, and ownership, reach, and endurance which collectively form a students’ resilience profile in the learning process. Therefore, critical thinking ability and AQ not only support academic achievement but also shape reflective character traits that align with the demands of contemporary education.

In the context of mathematics learning, the development of critical thinking ability and AQ requires abstraction, logical reasoning, and systematic problem solving. Ideally, mathematics learning should encourage students to recognize patterns, select appropriate strategies, and solve problems in a structured manner. However,

numerous studies indicate that Indonesian students’ critical thinking ability, particularly at the secondary school level, remains low (Juprijal et al., 2017; Lestari et al., 2023). In addition, students’ learning resilience is also relatively weak, as reflected in low motivation, a tendency to give up easily, and limited active participation in classroom activities (Safi’i et al., 2021; Muarifah et al., 2020). These findings highlight the need for learning models that are capable of fostering critical thinking ability and AQ simultaneously.

As a response to the low level of critical thinking ability and AQ, the Think Talk Write (TTW) learning model emerges as an alternative that emphasizes reflective processes and mathematical communication. This model guides students through three stages of learning; independent thinking (think), group discussion (talk), and written expression of understanding (write). In practice, TTW not only helps students understand mathematical concepts but also develops their ability to communicate problem solving strategies in a coherent and logical manner (Nasrulloh & Umardiyah, 2020). Furthermore, TTW has been shown to increase students’ active engagement and their ability to express ideas in a structured way (Amaratya, 2024). Through collaborative and reflective activities, TTW provides opportunities for students to think critically while simultaneously fostering confidence in solving mathematical problems independently.

The Realistic Mathematics Education (RME) approach is also considered relevant for developing students’ critical thinking ability and AQ. RME is rooted in Has Freudenthal’s idea that mathematics is a human activity that grows out of meaningful and contextual experiences (Freudenthal, 2002). This approach begins with real-life problems that are familiar to students and then mathematizes them into formal concepts through two processes; horizontal and vertical mathematization. RME encourages students to construct conceptual understanding gradually by exploring, modelling, and symbolizing the contextual situations their encounter. This approach has been proven effective in creating a reflective, contextual, and engaging mathematics learning environment, while also encouraging students to think logically and remain resilient when dealing with complex problems (Bos et al., 2020).

Previous studies have shown that the TTW model and the RME approach are effective independently in improving the quality of mathematics learning; however, their integration into a single, systematic instructional design remains limited. Research on TTW has generally focused on the development of communication skills and reflective thinking, whereas studies on RME have emphasized conceptual exploration through real-world contexts (Nasrulloh & Umardiyah, 2020; Freudenthal, 2002). In fact, integrating these two approaches has strong potential to enhance the learning process. TTW sharpens students’ thinking processes and articulation of ideas, while RME

provides meaningful contexts that deepen conceptual understanding. Nevertheless, there is still a lack of research that explicitly develops an integrated TTW-RME model to holistically optimize students’ critical thinking ability.

Moreover, most previous studies have primarily focused on cognitive aspects, particularly critical thinking ability (Wulandari et al., 2020; Toheri et al., 2020). Affective aspects such as AQ, which reflect students’ mental resilience in dealing with learning pressures, have received relatively little attention in instructional design. In fact, AQ is a crucial prerequisite for sustainable academic success, as it represents students’ ability to recover from failure and face challenges with a constructive attitude (Stoltz, 1997). Fauziah et al. (2020) found that students with high AQ tend to think more divergently and are better able to develop creative problem solving strategies.

Based on the above discussion, this article aims to systematically examine and synthesize prior empirical studies on the integration of the TTW model and the RME approach, and to conceptually analyze their potential contribution to the development of students’ critical thinking and AQ.

II. METHODS

This study employed a qualitative literature review method by analyzing ideas and descriptive findings from relevant scientific publications. The review focused on synthesizing previous studies on the implementation of the TTW learning model and the RME approach in mathematics education. The analysis involved identifying key findings, examining methodological strengths and limitations, elaborating theoretical frameworks, and identifying research gaps. Data were collected from Scopus-indexed Q1, Q2, and Q3 journals accessed through databases such as Google Scholar, Scimago, Semantic Scholar, Scopus, and Connected Papers. Content analysis was used to identify recurring themes and patterns, resulting in a conceptual framework that highlights the potential contribution of integrating TTW and RME to enhancing secondary school students’ critical thinking skills and Adversity Quotient.

III. RESULTS AND DISCUSSION

The results of the conceptual synthesis of scientific articles indicate that the TTW learning model and the RME approach have a positive contribution to the development of students’ critical thinking ability and AQ.

A. Implementation of the TTW Model

TTW model is a language-based learning model that emphasizes three main stages; personal reflection (think), group discussion (talk), and the articulation of ideas through writing (write). These stages are designed to optimize critical thinking processes through continuous cognitive and social engagement. Studies by Nasrulloh and Umardiyah (2020) and Amaratya (2024) demonstrate that

consistent implementation of TTW can enhance students’ mathematical communication skills and logical thinking by strengthening the structure of reasoning and the systematic expression of ideas.

McPhee and Cox (2025) assert that the ultimate goal of critical thinking is the attainment of intellectual autonomy, defined as the ability to think independently and responsibly. The TTW approach strongly supports this objective by enabling students to develop reflective and communicative thinking. Support for the urgency of implementing TTW is also strengthened by Chen et al. (2024), who found that although students tend to exhibit high levels of openness and curiosity, they often demonstrate weaknesses in independent thinking. Therefore, TTW can serve as an effective instructional strategy for fostering holistic critical thinking development across cognitive, social, and affective dimensions.

B. Contextualization through RME

The RME approach emphasizes the importance of contextualizing meaning in mathematics learning by using students’ real life experiences as the starting point for exploring abstract concepts. Studies by Juprijal et al. (2017) and Lestari et al. (2023) show that the use of RME based instructional materials and student worksheets significantly enhances students’ critical thinking skills through problem solving activities grounded in everyday contexts.

The progression from concrete to abstract understanding in RME is elaborated by Van den Heuvel Panhuizen (2003) through the use of bar models, which facilitate progressive mathematization. This is further supported by Bos et al. (2020), who demonstrated how design-based activities, such as the “ski jump” task, help students intuitively and realistically understand concepts related to curve slopes. These findings indicate that RME not only enriches conceptual understanding but also encourages analytical thinking through visual representations and experiential learning.

Serbin et al. (2024) further note that RME supports teachers and students in gradually constructing abstract conceptual understanding through guided reinvention processes. Innovative applications of RME are also illustrated by Çilingir Altiner (2024), who utilized realistic context educational cartoons to enhance students’ estimation strategies in measurement. This approach proved effective in promoting critical thinking in an engaging and relevant manner. Additionally, Sitorus and Masrayati (2016) highlight that RME supports the development of creative thinking, as students progress through cognitive stages from orientation to solution verification in mathematical problem solving.

Thanheiser (2023) argues that mathematics should be understood as a meaningful human activity with social and identify dimensions rather than merely a collection of

abstract concepts. This perspective aligns with the core principles of RME, which emphasize the connection between mathematics and students’ realities. Aragón et al. (2024) further demonstrate that the ABN (Open Algorithm Based on Numbers) method, rooted in the RME approach, more effectively supports the development of students’ spatial working memory and numeracy compared to traditional methods.

Overall, these findings suggest that RME is not only effective in strengthening conceptual understanding but also in fostering critical thinking, creativity, and other cognitive skills in a more contextualized and meaningful manner.

C. Implications for Critical Thinking Skills

Critical thinking is an essential competency in mathematics learning and can be optimally developed through the integration of the TTW model and the RME approach. The TTW model complements this process through the think stage, during which students reflect on problems, consider multiple approaches, and conduct in depth analyses before engaging in discussion and written expression. RME emphasizes that mathematical understanding should originate from real-life contexts relevant to students’ experiences, encouraging exploration, analysis, and independent solution construction. These processes involve critical thinking activities such as problem identification, strategy formulation, and logical, systematic evaluation of results.

Thus, the integration of TTW and RME provides a balanced space for contextual exploration and personal reflection, both of which are essential prerequisites for developing critical thinking skills. Within the RME framework, critical thinking is required to interpret contextualized mathematical problems, identify relevant information, evaluate alternative solutions, and make independent decisions.

The effectiveness of this integration is supported by Wulandari et al. (2020), who found that the integration of the DAPIC model with RME was significantly more effective than Problem Based Learning (PBL) in enhancing students’ critical thinking skills and self-confidence. Similarly, Toheri et al. (2020) reported that context-based learning outperformed problem posing approaches in developing critical thinking skills.

Rattanachaiyathada et al. (2025), through confirmatory factor analysis, further identify critical thinking in mathematics and science learning as encompassing problem identification, logical reasoning, information evaluation, inference, and evidence-based argumentation. These dimensions align closely with the characteristics of TTW learning, which emphasizes idea exploration and written reflection, as well as the RME approach, which is grounded in contextual understanding and authentic problem solving.

D. Implications for Adversity Quotient

Adversity Quotient (AQ), which reflects individuals’ resilience in facing challenges, is a crucial factor in students’ academic success, particularly in mathematics learning characterized by high levels of complexity. The TTW model contributes to strengthening AQ through the talk and write stages, which encourage students to confront challenges directly. During the talk stage, students engage in peer discussions, explore diverse perspectives, test arguments, and defend their reasoning logically. This interaction helps students learn to accept criticism, manage differing viewpoints, and adapt to others’ thinking, thereby forming the foundation of psychological resilience. In the write stage, students organize their thoughts and construct systematic solutions, fostering perseverance and independence in addressing academic challenges. Consequently, TTW functions as an effective reflective-collaborative learning framework for cultivating resilient character traits.

The RME approach also makes a significant contribution to students’ AQ development by presenting complex, real-world problems that require sustained focus, motivation, and persistence. Through this process, students learn to manage frustration, learn from mistakes, and develop a growth-oriented mindset. The learning environment created by RME promotes active exploration and deep reasoning, ultimately strengthening students’ mental endurance.

The combination of reflective-collaborative learning (TTW) and contextual learning (RME) demonstrates complementary contribution to students’ Adversity Quotient. Safi’i et al. (2021) and Muarifah et al. (2022) confirm that instructional models such as TTW and RME effectively enhance students’ learning resilience, particularly in dealing with complex learning obstacles. These findings are reinforced by Zhao and Sang (2023), who highlight AQ as a critical determinant of academic and career success, with perseverance emerging as a key contributing factor.

Moreover, Mwiya and Kingi (2019) show that AQ is important not only for students but also for teachers, as teachers’ AQ directly influences students’ academic achievement. Fauziah et al. (2020) found that students with a climber AQ profile exhibit higher levels of divergent thinking, indicating a strong relationship between mental resilience and creative thinking capacity. AQ also serves as a mediator in the development of intrinsic motivation and self-discipline, both of which are essential for effective self-regulated learning.

Overall, aspects such as control, perseverance, and responsibility developed through the integration of TTW and RME constitute integral components of students’ AQ. Learning environments that encourage meaning exploration, collaboration, and personal reflection provide a conducive

space for students to develop sustainable and adaptive learning resilience in facing future academic challenges.

E. Conceptual Model of TTW-RME

Based on the above conceptual integration, a conceptual model is developed to represent the relationships among the TTW model, the RME approach, students’ critical thinking skills, and their AQ.

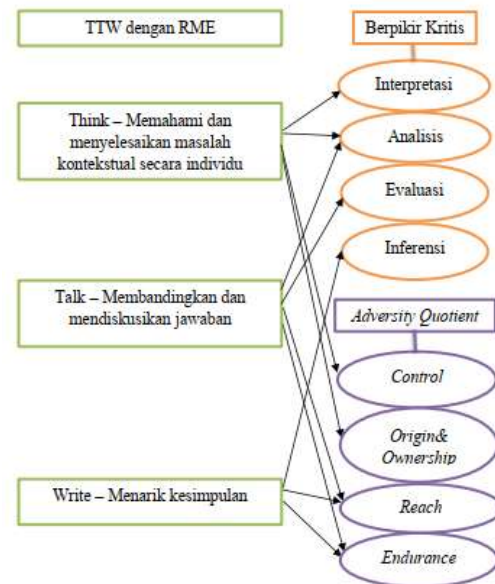


Figure 1. The Integration of TTW and RME on Students’ Critical Thinking Skills and Adversity Quotient

This model illustrates how the simultaneous implementation of the TTW model and the RME approach can facilitate students’ development in both cognitive (critical thinking) and non-cognitive (AQ) dimensions through structured and contextualized learning stages. The results of the conceptual review on the integration of TTW and RME indicate a significant contribution to the design of mathematics instruction that is not solely oriented toward cognitive achievement but also towards the strengthening of students’ non cognitive capacities.

Overall, the integration of TTW and RME not only enhances students’ academic competencies but also improves their mental readiness to cope with learning challenges in the modern educational context (Fauziah et al., 2020; Toheri et al., 2020). Therefore, this integrated instructional model is highly relevant for supporting 21st century learning demands.

IV. CONCLUSION

This theoretical review confirms that the integration of the TTW model and the RME approach has strong potential to enhance secondary school students’ critical thinking skills and AQ. The TTW model guides students’ thinking processes toward meaningful communication and reflection, while RME provides a robust

contextual and constructivist foundation for mathematical learning. The conceptual model developed in this review may serve as an initial reference for the development of more holistic, humanistic, and responsive mathematics learning models that address contemporary educational challenges.

Future research is recommended to empirically examine this conceptual model through experimental or quasi-experimental designs. In addition, the development of standardized assessment instruments to measure critical thinking skills and AQ within the context of TTW-RME based instruction constitutes an important agenda to support the validity of findings and the effectiveness of its implementation in classroom practice.

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