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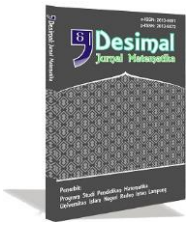

Unveiling the connection: Emotional intelligence and reflective thinking in students' PISA problem-solving

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ABSTRACT

Based on an international survey, Indonesian students face challenges in mathematics, ranking 64th out of 65 countries in 2012 and 72nd out of 79 in 2018. This research investigates how reflective thinking and emotional intelligence impact students' ability to solve math-based problems. PISA. Conducted with 40 eighth grade students from SMP Negeri 2 Selogiri, this study uses qualitative descriptive methods, including emotional intelligence questionnaires, reflective thinking tests with PISA questions, and interviews. Participants were divided into high, medium and low emotional intelligence groups. Findings show that students with high emotional intelligence (NHR) excel in all indicators of reflective thinking (response, elaboration, contemplation). Those with moderate emotional intelligence (TMP) meet the cues for reaction and elaboration but struggle with rumination. Students with low emotional intelligence (FTA) only achieve response indicators, having difficulty with elaboration and reflection. The study suggests that higher emotional intelligence improves reflective thinking and problem-solving skills, highlighting the need for targeted improvements in Indonesia's mathematics education system.

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INTRODUCTION

During the 2012 mathematics comprehension ability survey, Indonesia faced a challenging position, ranking 64th out of 65 countries, as reported by Tang et al. (2023). More recent survey data in 2015 shows that Indonesia's position is slightly better but still low, which is at the 62nd position out of 70 countries, as stated by Hanin & Gay (2023). Furthermore, the report of the Ministry of Education and Culture in 2018 stated that in the PISA study, Indonesia was ranked 72nd out of 79 countries in terms of mathematical comprehension ability. PISA, which Indonesia participated in since 2000, shows that in its seven participations, Indonesia's position is always at the bottom when compared to

other countries. These results reflect the significant challenges Indonesian students face in solving mathematical problems, with results consistently below the international average.

Mathematics, as a basic science, has a very wide reach and important applications in various aspects of daily life, as described by Huang et al. (2024). Mathematics not only requires students to understand basic concepts, such as symbols, tables and diagrams, but also to apply those concepts in real situations and everyday problems. This emphasizes the importance of developing logical, reasoning and argumentation skills, which are important components in solving various problems and supporting technological progress, as stated by Ishartono et al. (2021). Therefore, the process of learning mathematics does not only involve the mastery of the material, but also the practical application of those concepts in solving the problems faced by students in everyday life.

In facing the PISA test which demands high-level thinking skills, reflective thinking becomes a very important skill. Reflective thinking is a thinking process that connects old knowledge with new knowledge to solve existing problems, as explained by Baran Saraç (2021). This process involves the ability to combine learned knowledge with previously existing knowledge, as well as conduct analysis and evaluation to draw appropriate conclusions in solving problems. Muszyński (2020) explains that reflective thinking is a high-level skill that involves the integration of knowledge and deep analysis to reach the best solution. Merma-Molina et al. (2022) adds reflective thinking focuses thought patterns by controlling the mentality to solve specific problems.

Reflective thinking consists of several important stages in the problem-solving process. One of them is the response or initial reaction stage, where students give the first response to the given problem or content. The next stage is elaboration, where students expand on their initial responses by describing feelings, confirming thoughts, giving examples, or referring to other relevant situations. The final stage is contemplation, which involves combining initial reactions and elaboration and deep thinking about the problem at hand. This process helps students to analyze and evaluate various aspects of the problem faced in order to obtain an optimal solution.

However, in the process of thinking and solving mathematical problems, students often face various difficulties that can be categorized as internal and external factors. External factors include influences from outside the individual's control, while internal factors involve elements that are within the individual's own control. This difficulty is not only cognitive but also involves affective aspects. In this case, Intelligence Quotient (IQ) only contributes 20% to success, while the remaining 80% is influenced by other factors, including Emotional Intelligence (EI) (Casino-García et al., 2021). Emotional intelligence plays an important role in the learning and problem-solving process.

According to Daniel Goleman, emotional intelligence includes several important components. Recognizing one's emotions is an important aspect because it allows individuals to control and understand their own feelings, thereby helping them make better decisions. Managing emotions is a process of self-control to achieve balance in life, while self-motivation involves controlling impulses and having positive feelings to achieve goals. The ability to recognize other people's emotions, also known as empathy, allows individuals to be more sensitive to other people's feelings and points of view and to be good listeners. Additionally, building relationships

includes the ability to adapt and communicate well with others.

Maoulida et al. (2023) defines emotional intelligence as the ability of individuals to control their own emotions, understand the emotions of others, and cooperate with others, as explained by Rojas & Benakli (2020). The National Center for Clinical Infant Programs (NCCIP) states that success in school depends not only on reading abilities, but also on emotional and social abilities. The ability to control oneself, be patient, follow instructions, and interact with other students are important factors that influence an individual's success in school (Bicar, 2022).

From this presentation, there is potential to develop further studies on the relationship between reflective thinking and emotional intelligence in solving PISA problems. This research is expected to provide a new insight into how reflective thinking skills and emotional intelligence can affect students' abilities in solving mathematical problems at an international level. Thus, the results of this research can provide valuable suggestions for improvements in the mathematics education system in Indonesia, with the hope of improving Indonesia's position in the international mathematics ability survey in the future.

METHOD

This study uses a qualitative descriptive method that focuses on eighth grade students from SMP Negeri 2 Selogiri. This study used three main instruments: an emotional intelligence questionnaire, a reflective thinking test based on PISA questions, and an interview guide.

The research process in this study is:

1. Subject Selection
   A total of 40 eighth-grade students were selected for the study.
2. Emotional Intelligence Assessment
   Students were evaluated using an emotional intelligence questionnaire, categorizing them into high, medium, and low emotional intelligence groups.
3. Reflective Thinking Test
   Each group was then administered a reflective thinking test based on PISA questions to assess their reflective thinking abilities according to their emotional intelligence levels.
4. Interviews
   After the test, students were interviewed to gather detailed insights into their mathematical problem solving and reflective thinking processes.

To ensure data credibility, the study employed triangulation, as outlined by Van der Beek et al. (2024). This involved cross-verifying student test results with interview data to validate findings and resolve discrepancies, ensuring the accuracy of the collected information.

RESULTS AND DISCUSSION

This study was conducted at SMP Negeri 2 Selogiri class VIII or 40 students. Before conducting the study, the researcher gave an emotional intelligence questionnaire that consisted of low, medium to high levels. To determine the classification, first find the mean and standard deviation for each variable with the results in Table 1.

Table 1. Questionnaire Results

Formulation	Category	Scale score
$x > (mean + 1sd)$	Tall	$X > 127$
$(Mean - 1SD) < x \leq (Mean + 1SD)$	Currently	$98 < X < 127$
$x < (Mean - 1\,SD)$	Low	$X < 98$

Based on Table 1 of the questionnaire obtained from class VIII students at SMP Negeri 2 Selogiri, it was found that 9.3% (5 students) have high emotional intelligence, 18.5% (10 students) medium emotional intelligence, and 72.2% (39 students). with low emotional intelligence.

Then 3 students from three levels of emotional intelligence were obtained to be used as study subjects, namely NHR subjects (high emotional intelligence), TMP subjects (medium emotional intelligence), and FTA subjects (low emotional intelligence) to be given PISA questions and the researcher conducted interviews with these three subjects. After completing the PISA test questions and interviews, the researcher analyzed each subject's answers and interview results based on indicators of reflective thinking ability (Surbeck, Han, and Moyer, 1991). In this study, the researcher used the triangulation technique for data validity. Indicators of reflective thinking ability in this research can be seen in Table 2.

Table 2. Indicators of Reflective Thinking Ability

No	Indicator	Description
1.	Reaction	The student's initial response regarding the given problem (content provided).
2.	Elaboration	Elaboration emerged as the second core category. students develop their first reactions by explaining their feelings, confirming their thoughts, giving examples, or referring to other situations.
3.	Contemplation	Shows initial reactions combined with further elaboration and thoughts about personal, professional, or social/ethical issues

At the reaction stage, NHR subjects can state what is known, mention what is asked, state the relationship between what is asked and what is known, can explain what is known enough to answer what is asked, and mention or explain the method that is considered effective to solve the question. Therefore, it can be said that the NHR subjects met the response indicators.

The results of interviews with NHR subjects provide a deep insight into the understanding and approach used in solving mathematical problems involving a system of linear equations in two variables. When asked about the problem at hand, NHR explained that the problem revolved around Systems of Linear Equations in Two Variables, which is a basic but important topic in mathematics. NHR states that in this problem there are three towers with different heights, which are made up of two shapes namely hexagon and rectangle. One of the specific questions asked was about the height of one of the towers.

The NHR states that he sees a relationship or connection between the information given and the problem that needs to be solved. According to him, the existing information is sufficient to solve the problem, because he is able to use the two-variable linear equation system method to solve it. This shows that NHR is comfortable with the method and confident in its ability to apply it in the given context.

When asked about the most effective method to answer this question, NHR explained its approach in detail. He planned to assume that the rectangular tower would be represented by the variable finding the solution. In this way, NHR shows a good understanding of the methods that will be used and how to apply them to solve the problems faced. This approach not only shows NHR's expertise in applying mathematical concepts but also his ability to analyze and relate available information with relevant methods to solve problems.

Next, at the elaboration stage, the subject can explain the answer to the

problem obtained and connect the problem asked with the problem faced. Therefore, it can be said that the subject of NHR meets the indications of elaboration.

In the results of the interview with NHR subject, when asked about the answer or solution obtained from the problem, NHR explained that he used the method of elimination and substitution and determined the values of X and Y variables to reach the solution. This approach demonstrates a deep understanding of the basic techniques in solving systems of linear equations in two variables. The elimination method, which involves eliminating one variable by combining the equations, and the substitution method, in which one variable is solved from one equation and then used in another equation, are two techniques frequently used in solving systems of equations. By using these two methods, NHR can solve the problem accurately and efficiently, and obtain the values of the variables needed to determine the height of the tower in question.

NHR also revealed that he had faced the same problem before. That experience provides additional insight into how he handles math problems like this. In the former situation, NHR solves the problem by following the same sequence, i.e. starting from the elimination method, followed by substitution, and finally determining the required variable values. This shows the consistency in his approach and his ability to apply the same techniques in a systematic way. This experience not only strengthened NHR's skills in solving systems of linear equations, but also showed that he had developed an effective and reliable strategy for dealing with similar mathematical problems in the future. The structured approach used by NHR highlights a deep understanding of the methods used as well as expertise in applying them to achieve appropriate and accurate solutions.

At the contemplation level, NHR subjects can determine the meaning of the problem and detect the truth in determining the answer. So, the subject of NHR fulfills the indication of contemplation.

In the results of the interview with the NHR subject, when asked about his confidence in the answer obtained, the NHR firmly stated his confidence that the answer was 9 meters. He explained that this belief is based on the method he uses, which is by examining the results of replacing the variables in the equation. NHR explains that by replacing the value of x with 2, it can perform a calculation operation that produces a final result of 9 meters. The process is as follows: if $x = 2$, then the equation used is $2x + y = 2(2) + 5 = 4 + 5$, which results in a total of 9 meters. This explanation demonstrates NHR's deep understanding of the use of substitution methods and how to apply them to obtain accurate results.

In addition, NHR also provides a summary related to the problem solving process. He felt satisfied with his ability to solve math problems correctly, following a predetermined sequence of steps, and finally arriving at the correct answer. This conclusion shows that NHR is not only able to apply relevant mathematical techniques, but also has confidence in the results obtained. This experience reflects NHR's skill in systematically managing the problem-solving process, as well as his ability to analyze and validate final results accordingly. This conclusion confirms that NHR has a good understanding of the mathematical problem solving process and can use the learned techniques to reach the correct solution.

At the reaction stage, TMP subjects can state what is known, state what is asked, state the relationship between what is asked and what is known, can explain what is known enough to answer

what is asked, and mention or explain the method that is considered effective to solve the question. Therefore, it can be said that the TMP subject meets the response indicator.

In an interview with a TMP subject, the discussion started with a question about the TMP's understanding of the problems he faced. TMP explains that the problem is related to Systems of Linear Equations in Two Variables (SPLDV). When asked further about the details of the question, TMP revealed that the focus of the question was to determine the height of the third tower. This shows that the TMP has identified the core of the problem at hand and can extract important information from the given context.

The TMP is then faced with questions related to the relationship or connection between the known information and the question that must be answered. TMP believes that there is a clear connection, as the understanding and ability to solve SPLDV questions will enable the solution of the given problem. According to TMP, this problem can be solved using the SPLDV method, which reflects his confidence in the techniques he learned to deal with this type of problem.

In terms of whether the available information is sufficient to answer the question, TMP believes that the available information is sufficient. TMP plans to use the two-variable linear equation system method as the solution. This shows that TMP feel confident in their skills and knowledge in applying this method to find the right solution.

When asked about the most effective method to answer this question, TMP explained that he would use an approach that assumes that the rectangular tower is denoted by the variable X, while the hexagonal tower is denoted by the variable Y. This approach shows that TMP understands how to model the problem with appropriate variables and use the SPLDV method to find the height of the third tower. This explanation confirms that the TMP has a good understanding of how to apply mathematical methods to solve a given problem, and demonstrates his ability to connect mathematical theory with the practice of real problems.

Next, at the elaboration stage, the subject can explain the answer to the problem obtained and connect the problem asked with the problem faced. Therefore, it can be said that the subject of TMP fulfills the indication of elaboration.

In interviews with TMP subjects, questions about the answers or solutions obtained revealed that TMPs had used elimination and substitution methods to solve problems. TMP explains that by eliminating and substituting existing equations, he can obtain values for the variables .

When asked if TMP had faced the same problem before, TMP stated that he had experienced the same situation. In that case, TMP uses the same approach of elimination and substitution to find the values of X and Y. This experience shows that TMP is not only familiar with the method used, but also consistent in the same approach. problem. In this way, TMP can deal with mathematical problems with methods that have been proven effective in previous experiences. This explanation highlights TMP's skills in applying relevant mathematical techniques in a systematic and organized manner, as well as his ability to solve problems using proven strategies. This reflects TMP's expertise in solving complex mathematical problems using previously acquired knowledge and experience.

At the contemplation stage, TMP subjects are still unable to determine the meaning of the problem and detect the truth in determining the answer. So, the subject of TMP has not met the indication of contemplation.

In an interview with a TMP subject, when asked about confidence in the answers obtained, TMP stated that although he had solved the problem sequentially using the method of elimination and substitution, he still felt worried about the possibility of a calculation error that could affect the final result. . The TMP articulates this concern clearly, indicating that even if the process used is following the correct procedures, uncertainty about the final outcome remains. This reflects TMP's awareness of the importance of accuracy in mathematical calculations and the awareness that small errors in the calculation process can have a large impact on the final result.

When asked to give a summary after getting a solution, TMP admitted that he had concluded the result of the problem being solved. However, TMP also expressed uncertainty regarding the accuracy of the answers given. This feeling suggests that although TMP has followed the correct steps in solving the problem, there is lingering doubt about whether the answer is entirely correct. This shows that the TMP not only considers the settlement process but also pays attention to the importance of verifying the final decision to ensure its validity. This uncertainty reflects TMP's awareness of the need to conduct further checks and re-evaluate the results to confirm their accuracy. In this way, TMP demonstrates its commitment to accuracy and reliability in solving mathematical problems, as well as its willingness to perform additional evaluations to ensure correct results.

At the reaction stage, the FTA subject can state what is known, state what is asked, state the relationship between what is asked and what is known, be able to explain what is known enough to answer what is asked, and state or explain the method that is considered effective to solve question. Therefore, it can be said that the FTA subject meets the response indicator.

In interviews with FTA subjects, when asked about their understanding of the problem at hand, FTA identified the problem as a System of Linear Equations in Two Variables (SPLDV) problem. The FTA explained that the specific question in this issue is about the height of the third tower, which shows that it clearly understands the focus of the issue. When asked about the relationship between what was known and what was asked, FTA felt that there was a significant relationship, given his experience and understanding of SPLDV that had been studied previously. This shows that FTA believes that the knowledge it has can be applied to solve this problem.

FTA further underlined that it believes the information provided is sufficient to resolve the issue. This confidence arises from his ability to remember and follow the sequence of solutions he has learned. According to FTA, memorizing the sequence of SPLDV solution methods allows him to effectively apply the process to a given problem. This shows that FTA feels confident in its ability to use known techniques to find the right solution.

In terms of the method considered most effective to answer this question, FTA suggests an approach that assumes that the rectangular tower is labeled with the appropriate variable and uses the SPLDV method to find the equation needed to determine the height of the third tower. In this way, FTA shows that he has a good understanding of related mathematical techniques as well as the ability to apply them in the context of the given problem. This approach highlights how FTA integrates learned knowledge with practical techniques to solve complex problems.

Next, at the elaboration stage, the subject has not yet been able to explain the answer to the problem obtained and

connect the problem asked with the problem faced. Therefore, it can be said that the subject of FTA has not met the indications of elaboration.

In an interview with FTA subject, when asked about the answer or solution obtained from the problem, FTA revealed that he used an approach by trying to plug numbers into the equation to find the values of X and Y. FTA admitted that although this method may not be completely correct and he feeling completely unsure of the outcome, he chose to use a guessing approach as a solution. This indicates that FTA may not be fully confident in applying more systematic methods or has not yet mastered more formal techniques to solve SPLDV questions.

When asked further about previous experiences with similar issues, FTA confirmed that it had faced this type of issue before. In the previous case, the FTA also used the same method of trying numbers to find a solution. This experience shows that although FTA has faced similar problems in the past, it still feels that a guesswork approach is the method used. This shows that the FTA may not have the full skill in using more structured and effective methods to solve the SPLDV problem. The decision to use this approach may also reflect a lack of confidence or experience in using more formal techniques such as elimination and substitution that are usually more reliable in solving systems of linear equations. These limitations can provide insight into the challenges FTA faces in the process of solving mathematical problems and indicate areas that may require further attention or development.

At the contemplation stage, FTA subjects are still unable to determine the meaning of the problem and detect the truth in determining the answer. So, the subject of FTA has not met the indication of contemplation. In interviews with FTA subjects, when asked about their confidence in the answers obtained, FTA expressed deep uncertainty. FTA explained that he was not sure about the results obtained, because the method used to find the solution was to try and plug numbers into the equation. This feeling shows an awareness of the potential for errors in the approach used and shows that the FTA feels less confident about the accuracy of the answers obtained. This also illustrates the challenges faced in applying more systematic or formal methods in solving problems.

When asked to explain the conclusions reached after getting the solution, FTA realized that the answers given may not be correct. FTA recognizes that while it may have an adequate understanding of theory, applying that theory in practice remains problematic. This realization shows that FTA feels there is a gap between understanding the concept and the ability to apply it effectively in real situations. FTA recognizes that while the theory is understood, the lack of practical application indicates a gap in the operational capabilities required to correctly solve mathematical problems. This highlights the importance of not only understanding theory but also developing practical skills in its application. This conclusion provides an overview of the challenges faced by FTA and shows the need to improve the ability to handle mathematical theory in order to be more effective in solving the problems faced.

Based on the results of the data analysis obtained on the three study subjects, the researcher made a table so that it is easy to determine the mathematical reflective thinking abilities of primary school students in solving PISA questions in terms of the level of emotional intelligence in the Table 3.

Table 3. Results of Analysis of Mathematical Reflective Thinking Ability

Emotional intelligence	Subject	Question items	Indicator 1	2	3
Tall	NHR	1	V	V	V
Currently	TMP	1	V	V	X
Low	FTA	1	V	X	X

The results of the study show that NHR subjects with high emotional intelligence are able to think reflectively, TMP subjects with average emotional intelligence are unable to think reflectively, and FTA subjects with low emotional intelligence are unable to think reflectively. Therefore, individuals with high emotional intelligence are able to think reflectively in solving PISA problems. In line with the results of previous studies, high emotional intelligence is in line with high learning achievement and the ability to think reflectively.

Based on research conducted by Wang et al. (2022) it was found that students who meet the response aspect of the reflective thinking process with PISA standard math questions can mention what is known and asked, explain and connect the answer to the problem that has been obtained, explain the meaning of the problem, and correct mistakes in determining the answer. This is consistent with the results of this study.

Based on the theory expressed by Pratiwi et al. (2020) and the results of research conducted by Bicar (2022) show that students' mathematical inclinations have a positive relationship with students' reflective thinking abilities, where math students are better. tendency, the better their reflective thinking ability.

Research has found that students with low reflective thinking abilities often struggle with self-confidence and motivation, which impacts their engagement with challenging math problems. These students tend to put in minimal effort, focusing only on the simpler aspects of the problem rather than trying to understand it deeply. This observation is in line with Huang et al. (2024) found that low emotional intelligence is associated with low motivation. However, this study extends previous studies by showing how certain components of emotional intelligence, such as self-confidence and motivation, directly affect students' reflective thinking abilities. Unlike previous studies, which may have broadly linked emotional intelligence to overall academic performance, this research highlights the nuanced effects of emotional intelligence on student engagement and problem-solving strategies in mathematics. Future research should further investigate these specific emotional and motivational factors to develop targeted interventions that can improve reflective thinking and problem-solving skills among students.

CONCLUSIONS AND SUGGESTIONS

Analysis of PISA test responses and interviews revealed that students with high emotional intelligence are able to meet all three indicators of reflective thinking—response, elaboration and contemplation—indicating strong reflective thinking skills. Students with average emotional intelligence only achieve indicators of reaction and elaboration, lack reflection, show less developed critical thinking abilities. Those with low emotional intelligence are limited to reactive indicators, struggle with elaboration and reflection, showing underdeveloped reflective thinking skills.

Future research should involve larger and more diverse subject samples to increase the accuracy and generalizability of findings regarding emotional intelligence and reflective thinking. Exploring a wider variety of backgrounds and contexts can provide deeper insight into how different factors influence students' reflective thinking and problem-solving abilities. Additionally, investigating the effectiveness of various

teaching methods and strategies in improving reflective thinking skills can offer valuable suggestions for educational practice.

REFERENCES

Baran Saraç, A. B. (2021). *A study on development of prospective middle school teachers' competence of posing mathematical literacy problems*. Middle East Technical University.

Bicar, V. K. B. (2022). *Fourth industrial revolution skills as influential factors of mathematics performance*.

Casino-García, A. M., Llopis-Bueno, M. J., & Llinares-Insa, L. I. (2021). Emotional intelligence profiles and self-esteem/self-concept: An analysis of relationships in gifted students. *International Journal of Environmental Research and Public Health*, *18*(3), 1006.

Hanin, V., & Gay, P. (2023). Comparative analysis of students' emotional and motivational profiles in mathematics in grades 1–6. *Frontiers in Education*, *8*, 1117676.

Huang, Z., Zhang, J., & Yuan, Z. (2024). What matters for students' learning? the roles of social and emotional skills and the factors affecting these skills. *ECNU Review of Education*, 20965311241227452.

Ishartono, N., Faiziyah, N., Sutarni, S., Putri, A. B., Fatmasari, L. W. S., Sayuti, M., Rahmaniati, R., & Yunus, M. M. (2021). Visual, auditory, and kinesthetic students: How they solve pisa-oriented mathematics problems? *Journal of Physics: Conference Series*, *1720*(1), 12012.

Maoulida, H., Madhukar, M., & Celume, M.-P. (2023). A case study of 21st century cognitive, social and emotional competencies using online-learning. *Journal of Intelligence*, *11*(6), 116.

Merma-Molina, G., Gavilán-Martín, D., & Urrea-Solano, M. (2022). Actively open-minded thinking, personality and critical thinking in Spanish adolescents: A correlational and predictive study. *International Journal of Instruction*, *15*(2), 579–600.

Muszyński, M. (2020). *Validity of the overclaiming technique as a method to account for response bias in self-assessment questions: Analysis on the basis of the PISA 2012 data*.

Pratiwi, K. M., Sudiarta, I. G. P., & Suweken, G. (2020). The effect of guided discovery learning model assisted by open-ended student worksheets towards mathematical problem solving ability reviewed of student's emotional intelligence. *Journal of Physics: Conference Series*, *1503*(1), 12014.

Rojas, E., & Benakli, N. (2020). Mathematical literacy and critical thinking. *Teaching College-Level Disciplinary Literacy: Strategies and Practices in STEM and Professional Studies*, 197–226.

Tang, Y., Zhang, S., Sun, M., Wen, Y., An, S., & Liu, Q. (2023). Understanding student teachers' reflective thinking using epistemic network analysis and fine-grained trace data. *Thinking Skills and Creativity*, *48*, 101301.

Van der Beek, J. P. J., Van der Ven, S. H. G., Kroesbergen, E. H., & Leseman, P. P. M. (2024). How emotions are related to competence beliefs during mathematical problem solving: Differences between boys and girls. *Learning and Individual Differences*, *109*, 102402.

Wang, G., Kang, Y., Jiao, Z., Chen, X., Zhen, Y., Zhang, D., & Su, M. (2022). Development and application of intelligent assessment system for metacognition in learning mathematics among junior high school students. *Sustainability*, *14*(10), 6278.