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Analysis of Grade X MA Students' Mathematical Difficulties in Solving SPLTV Contextual Problems through Group Discussion

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Abstract

Students' mathematical difficulties in solving contaxtual problems on the topic of Systems of Linear Equations with Three Variables (SPLTV) remain an issue theat requires further study, particularly as viewed through the lens of the group discussion process undertaken by students. This study aims to analyze the types and characteristics of mathematical difficulties experienced by 10th-grade students in solving contextual problems involving SPLTV, as observed through homogeneous and hererogeneous group discussions. The study employed a descriptive qualitative approach with 21 student from MA Hasyim Asy'ari Lbruk Kidul Lumajang as subjects, divide into six discussion groups: three homogeneous groups (low, moderate, and high difficulties categories) and three heterogeneous group. Data were collected through the Contextual Probblem Solving (TPK), in depth interviews, observations, and documentation, and were then analyzed through data reduction, data presentation, and drawing conclusions. The results showed that students experienced three types of mathematical difficulties: conceptual, procedural, and representational. The group with active discussion experienced only mild representational difficulties, where as the group categorized as having high difficulty scores-whose discussions were less active-experienced all three types of difficulties are more influenced by the quality of their enggagement in group discussions than by their initial ability categories; thus,active group discussions play a crucial role in reducing students' mathematical difficulties with the SPLTV matrial.

Keywords Contextual Problems; Group Discussion; Mathematical Difficulties; SPLTV

INTRODUCTION

Mathematics is a field of study that plays a crucial role in education because it supports the development of logical, systematic, analytical, and critical thinking skills. Through mathematics instruction, students are trained to understand abstract patterns and relationships that can be applied in everyday life (Zubaidah, 2016). Ideally, mathematics instruction should not only emphasize computational procedures but also conceptual understanding and high-order thinking skills, so that students can apply concepts flexibly in various situations (Widodo & Kadarwati, 2013).

However, in practice, mathematics is still often viewed as a difficult subject by some students. Learning that is overly focused on routine, mechanical problem- solving exercises can prevent student from grasping the deeper meaning of concepts (Mislakhudin, 2020), while students who merely memorize solution steps without understanding the underlying concepts will struggle when faced with problems that vary in form or context (Gazali, 2016). This condition is known as mathematical difficulty-that is, students' obstacles in accurately understanding, processing, and applying mathematical concepts-which can arise from the stage of interpreting problem information all the way to determining a solution strategy (Rahmawati et al., 2021). These difficulties are sequential and interrelated, so that obstacles at an early stage will impact subsequent stages of problem-solving (Fitri & Abadi, 2021).

These difficulties become even more pronounced when students are faced with contextual problems-that is, problems that require students to understand real-life issue while relating them to formal mathematical concepts (Hidayat & Sariningsih, 2018). Many students struggle with the stage of transforming a story into a mathematical model because they are not yet accustomed to connecting real-world experiences with abstract concepts (Madia & Halimombo, 2022). One topic frequently presented in the form of contextual problems is Systems of Linear Equations with Three Vareables (SPLTV), which requires students to identify variables, formulate a system of equations, and solve it using the substitution or elemination methods (Surven et al., 2022). This topic involves several algebraic concepts simultaneously, making it highly complex; the difficulty lies not only in the computational process but more often in the stages of planning strategies and interpreting the results within the given context (Halisah et al., 2025).

One strategy believed to help overcome these difficulties is group discussion, which provides a space for students to exchange ideas and explain their their understanding to one another through social interaction (Mulyatna et al., 2023). However, the effectiveness of group discussions in practice is not always consistent: their succes depends heavilt on the active participation of each member, whereas in reality, many students remain passive or rely on more dominant peers within the group. It is this tension between the potential benefits of group discussions and the reality of their implementation in the classroom that necessitates futher examination of their role in addressing students' mathematical difficulties-rather than simply assuming they are always helpful.

Previous research has identified that students' mathematical difficulties are generally related to conceptual understanding, computational accuary, and the ability to interpret

solution results (Lilisantika & Roesdiana, 2023), and has shown tahat these difficulties are still dominated by obstacles in understanding concepts and applying problem-solving procedures (Halisah et al., 2025). Howevwe, these studies have not specifically examined students' mathematical difficulties with SPLTV contextual problems through group discussion process, whether in groups composed of students with similar abilities (homogeneous) or mixing groups (heterogeneous). This gap is the research gap addressed by this study.

Preliminary observatuons at MA Hasyim Asy'ari Labruk Kidul Lumajang indicate that 10th-grade students still face challenges when solving context-based SPLTV problems, ranging from understanding the problem's intent, identifying relevant information, constructing mathematical models, to interpreting solutions in accordance with the problem's context. Based on this description, this study aims to analyze the mathematical difficulties of 10h-grade students-covering conceptual, procedural, and representational aspects in solving SPLTV contextual problems, as viewed through the process of discussions in homogeneous and heterogeneous group. The results of study indicate that students' mathematical difficulties are more strongly influenced by their initial ability levels; thus, active group discussions play a crucial role in helping students reduce conceptual, procedural, and representational difficulties in SPLTV material.

METHODS

This study employed a descriptive qualitative approach to describe students' mathematical difficulties in solving SPLTV contextual prblems as observed through group discussion processes (Creswell, 2017). The study involved 21 10th-grade students from MA Hasyim Asy'ari Labruk Kidul Lumajang, selected through puporsive sampling (Malahati et al., 2023) and categorized based on a pre-test into low, moderate, and high difficulty levels. They were then divided into six discussion group (three homogeneous and three heterogeneous group), but only four discussion groups (three homogeneous and one heterogeneous group) were selected as subject for interviews. Data were collected through the Contextual Problem Solving Test (TPK), in depth interviews, participan observation, and documentation using validated instuments (82-97%). The collected data were analyzed through data reduction, data prsentation, and drawing conclusions (Rijali, 2019), with data validity tested through methodological triangulation and peer discussion.

FINDINGS AND DISCUSSION

Findings

This section presents the original data obtained through preliminary observations, Contextual Problem Solving Tests on the topic of Systems of Linear Equations with Three Variables (SPLTV), observations of group discussions, and interviews with 10^{th}-grade students at MA Hasyim Asy'ari, Labruk Kidul, Lumajang. The research was conducted from April 27 to May 7, 2026. Data were collected through three stages: instrument validation, the

formation of discussion groups based on initial diagnostic tests, and the analysis of students' mathematical difficulties during the group discussions.

Before use, the contextual problem test items and interview guidelines were validated by three validators: two mathematics education lecturers and one mathematics teacher. The validation results are presented Table 1.

Table 1. Instrument Validity Test Results

No	Validator Code	Score Obtained	Maximum Score	Percentage (%)	Category
1	V1	101	104	97	Suitable for use
2	V2	92	104	88	Suitable for use
3	V3	85	104	82	Suitable for use

Source: Ressearch instrument validation data, 2026

All three validators gave ratings in the range of 81%-100%, indicating that the contextual problem test items and interview guidelines are suitable for use without revision. Based on the validated instuments, a diagnostic test was then administered to 21 10th-grade students to categorize their initial levels of mathematical difficulty. The categorization results are presented in Table 2.

Table 2. Categorization of Students' Mathematical Difficulty Levels

No	Category	Score Interval	Number of Students
1	Low	16-20	8
2	Moderate	11-15	6
3	High	5-10	7

Source: Diagnostic test data, 2026

Based on this categorization, the researchers formal six focus groups, consisting of three homogeneous group (each group comprised students from the same difficulty category) and three heterogeneous groups (each group comprised a mix of students from the low, moderate, and high categories). Groups KD 1, KD 2, and KD 3 were homogeneous groups with low, moderate, and high difficulty categories, resprectively, while KD 4 was a heterogeneous group selected as supplementary data for the interview sessions. The group composition is presented in Table 3.

Table 3. Discussion Group Composition

No	Group Code	Group Type	Difficulty Category of Members
1	KD 1	Homogeneous	Low
2	KD 2	Homogeneous	Moderate
3	KD 3	Homogeneous	High
4	KD 4	Heterogeneous	Mixed (Low, Moderate, High)

Source: Research data, 2026

Each group collaboratively worked on SPLTV contextual problem for 30 minutes, followed by in depth interviews with members of KD 1, KD 2, KD 3, and KD 4. Analysis of students' answer sheets, discussion observations, and interview transcripts revealed that

students experienced three interrelated types of mathematical difficulties: conceptual, procedural, and representational whose intensity varied depending on the level of discussion activity within each group. A synthesis of finding across groups is presented in Table 4.

Table 4. Synthesis of Mathematical Difficulties Across Discussion Groups

No	Group	Conceptual Difficulties	Procedural Difficulties	Representational Difficulties
1	KD 1 (Homogeneous-Low)	Minimal; clarified through active questioning	The step to solve the problem are well organized, although there is still some uncertainly about which equation to eliminate first	Simple; the conclusion of the answer is not written in accordance with the context of the question
2	KD 2 (Homogeneous-Moderate)	Minimal to moderate	Steps are less systematic; errors occur during th substitution stage	Complex; results were interpreted inaccurately and answer wee not aouble checked
3	KD 3 (Homogeneous-High)	Most prominent; one of the passive participants admitted to being confused from the start	Most complex; algebraic errors resulted in negative values and the steps were not logical	Most severe; difficulty converting word problems into mathematical models and failing to check answer
4	KD 4 (Heterogeneous)	Active members understood the problem information better than passive members	The solution steps are systematically organized	Minor; similar to KD 1, the conclusion of the answer is not written in a accordance with the context of the problem

Source: Synthesized from test data, observations, and interviews, 2026

The data in Table 4 show a consistent pattern: groups with more active member participation (KD 1 and KD 4) tend to exhibit milder and fewer difficulties across all three aspects, whereas the group with the least active internal interaction (KD 3) despite consisting of students initially categorized as high ability actually exhibits the most complex difficulties.

This indicates that quality of group discussions rather than solely students' initial ability categories plays a more decisive role in the emergence or reduction of students' mathematical difficulties when solving contextual problems in the SPLTV material.

Discussion

This section systematically discusses the research findings based on three research focuses: students' conceptual, procedural, and representational difficulties in solving contextual problems in the SPLTV material, as viewed through the group discussion process. Each finding is interpreted based on the theoritical framework and compared with relevant previous studies.

Conceptual Difficulties as Observed Through the Group Discussion Process

The research results indicate that students still experience conceptual difficulties in understanding contextual problems in the SPLTV material, partucularly in identifying known and unknown information, as well as in determining appropriate variables. Althrough learning took place through group discussions, not all members possessed an equivalents level of conceptual understanding; consequently, some students still relied on explanations from their groupmates. Intrestingly, Group KD 3 composed of students in the high difficulty category actually exhibited the most pronounced conceptual difficulties. Interview results revealed that one member rarely participated in discussions because they felt confused from the start. In contrast, Group KD 1 and KD 2, which engaged in more active discussions, showed relatively minimal conceptual difficulties, as the process of asking and explaining questions helped clarify information that had not yet been understood. The heterogeneous KD 4 group showed a similar pattern, in which members who actively participated in discussions were able to undertand the problem information better than passive members.

The findings align with Fadilah (2024), who states that conceptual dfficulties are characterized by students' inability to understand the information in a problem, identify the concepts involved, and grasp the relationships between variables in mathematical problems. This is also consistent with Siskanti et al. (2021), who explain that conceptual difficulties often arise when students are unable to interpret the information in a problem, thereby hindering the determination of an apropriate solution strategy. Furthermore, the group discussion theory proposed by Andika & Fitri (2021) explains that active interaction among group members can help students build conceptual understanding through the process of exchanging opinions and explanations.

Based on this discussion, it can be concluded that students' conceptual difficulties are not solely caused by weak individual conceptual abilities but are also influenced by the extend to which students are actively enganged in group discussions. Groups in which all members are actively enganged more likely to build conceptual understanding collectively; thus, the quality of group discussions plays a crucial role in supporting students' conceptual understanding of SPLTV material.

Procedural Difficulties as Viewed Through the Group Discussion Process

The research results show that students still experience procedurl difficulties when solving contextual problems in the SPLTV material, as reflected in their inability to systematically organize solution steps, errors in algebraic operations, and a lack of precision in calculations. Alhtough some groups succeeded in forming correct mathematical models, errors still occurred during the solution process, so the final answers obtained did not meet expectations. Group KD 2 exhibited procedural difficulties in form of less systematic stps and errors during the substitution stage, even though their mathematical model was correct, while Group KD 3 demonstrated more complex difficulties, namely algebraic errors resulting in negative velues and non-sequential solution steps; interviews confirmed that group members felt unable to continue the solution process when the results obtained did not meet expactations. In contrast, KD 1 which engaged in active discussion, was able to formulate a coherent sequence of solution steps, although they still experienced uncertainly in determining which equation to eliminate first. The heterogeneous KD 4 group was also able to formulate solution steps effectively, indicating that active discussion contributes to procedural competence regardless of grouping type.

These results align with Juniawan (2021), who states that procedural difficulties are characterized by students' inability to apply solution steps systematically, errors in algebraic operations, and a lack of precision during the problem solving process. Fitri & Abadi (2021) also noted that solving SPLTV problems requires a high degree of precision because each step is interrelated; thus, an errors in one step will affect the subsequent steps. These findings further reinforce the results of Halisah et al. (2025), which indicete that procedural errors ae generally influenced by weak conceptual understanding and a lack pf precision inperforming arithmetic operations. Nurhusain & Hasby (2021) also emphasize that active interaction during group discussions can help students correct each other's procedural errors, thereby making the problem solving process more focused.

Based on this discussion, it can be concluded that procedural difficulties are not solely caused by students' low computational skills but are also influenced by the quality of interaction during group discussions. Active discussions provide students with the opportunity to receive feedback on the procedures they use, allowingerrors to be corrected immediately. Conversely, in groups with passive discussions, procedural erors tend to go uncorrected and persist, leading to incorrect final answers. Thus, group discussions play a crucial role in helping stundents develop more systematic procedural skills in SPLTV material.

Representation Difficulties as Viewed Through the Group Discussion Process

The research results indicate that students still experience representation difficulties in solving contextual problems in the SPLTV curriculum, which are evident when students transform the information in the problem into a mathematical model in the form of the equations, and interpret the solution results in accordance with the context of the problem. Some groups succeeded in obtaining calculation results but were not yet able to explain their

meaning in accordance with the situation described in the problem. All homogeneous groups exhibited difficulties with mathematical representation, albeit at different levels KD 1 experienced only mild dificulties, namely failing to write the conclusion of the answer within the context of the problem; Group KD 2 faced more complex difficulties, namely inaccurately interpeting the results of the solution in the context of the problem and failing to throughly check their answers; and Group KD 3 experienced the most severe representation difficulties, including obstancles in converting word problems into mathematical models,interpreting the results, nd failing to double ceheck teheir answers, with interview results showing that passive members merely copied the work without understanding the representation process being carried out. The heterogeneous KD 4 group exhibited dificulties similar to those of KD 1, namely failing to write conclusions that align with the problem context, indicating that difficulties in interpreting results are a common challenge faced by students in both homogeneous and heterogeneous discussion group.

These findings align with Hanan & Alim (2023), who explain that representation difficulties are characterized by students' inability to tarnsform word problems into mathematical models, present information in symbolic form, and interpret solution results in accordance with the problem's context. Ismiyati et al. (2024) also emphasize that adequate representational skills are necessary for students to connect real world situations with appropriated mathematical models, so that mathematical representations serve as a bridge between conceptual undertanding and the problem solving process. This also reinforces the findings of Lilisantika & Roesdiana (2023) that students often struggle to tarnform contextual probelems into mathematical form, leading to errors in problem solving; this study adds that group discussions can help students develop their representational skills through activities such explaining and justifying the mathematical models they use.

Based on this discussion, the researchers conclude that representational skills do not depend solely on mastery of mathematical concept but are also influenced by the quality of interactions during group discussions. The more actively students discuss and articulate the reasoning behind their mathematical models, the better theirability to model problems and interpret the results of their solutions. Therefore, group discussions play a crucial a role not only in helping students arrive at the final answer but also in buiding mathematical representation skills as one of the key competencies in SPLTV learning.

Overall Discussion

Overall, the three findings indicate that students' conceptual, procedural, and representational difficulties in solving SPLTV contextual problems are hierarchical and mutually influential: unresolved conceptual difficulties tend to lead to procedural errors, which in turn affect the accurarcy of representation and interpretation of the final results. This pattern supports the view of Halisah et al. (2025), who state tahat obstacles at one stage of problem solving will impact the subsequent stages. At the same time, a comparison of KD 1, KD 2, KD 3, and KD 4 consistently shows that the level of engaagement and cooperation

among group members rather than merely students' initial ability level is the more decisive factor in determining the intensity of the difficulties experienced. Group in which all members were actively engaged in discussions tended to demonstrarte a more systematic problem solving process and fewer difficulties, whereas groups that were passive or dominated by a single member exhibited more errors in the problem solving process. This aligns with the findings of Mulyatna et al. (2023) and Alhikma et al. (2025), who emphasize that active engagement in group discussions supports students' mathematical thinking processes through the exchange of information and collaborative problem solving. The practical implication of these findings is that group discussions cannot be treated merely as a classroom learning technique; rather, they need to intentionally designed for example, through role assignment and teacher guidance so that every member is encouraged to participate actively. Otherwise, the use of group discussions alone does not guarantee a reduction in students' mathematical difficulties with SPLTV material.

CONCLUSION

This study shows that 10th-grade students' mathematical difficulties in solving concepual, procedural, and representational contextual SPLTV problems are interrelated in a hierarchical manner, where unresolved conceptual difficulties tend to trigger procedural errors that subsequently affect the representation and interpretation of the final result. More importantly, the intensity of these difficulties was found to be determined not so much by students' initial ability categories but rather by the quality of interactions during group discussions: groups that actively discussed-whether homogeneous or heterogeneous-consistently experienced fewer and less severe difficulties, whereas high ability but passive groups exhibited the most complex difficulties. This suggest that group discussion functions not merely as a learning method but as a corrective mechanism to reduce mathematical difficultis, making the quality of collaboration a more decisive factor than the grouping strategy itself. Since this study was limited to a qualitative descriptive analysis at a single school and on a single subject, future research is recommended to test this pattern on a broader scale-for example, through a mixed methods design and to develop a more structured cooperative learning model with defined member roles and teacher guidance, which the researcher is currently developing as a follow up tothis study.

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