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Characteristics of Problems Presented by Junior High School Mathematics Teachers in Papua within *Problem-Based Learning* (PBL): A *Theory of Didactical Situations* (TDS) Perspective

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ABSTRACT

Problems are central to Problem-Based Learning (PBL), as they trigger students' knowledge construction. However, research on the characteristics of problems designed by mathematics teachers remains limited, particularly in Papua and from the perspective of the Theory of Didactical Situations (TDS). This study aims to analyze the characteristics of problems designed by junior high school mathematics teachers in Papua for PBL implementation through the TDS perspective. A qualitative descriptive approach was employed, involving five mathematics teachers selected purposively. Data were collected through semi-structured interviews, non-participant observations, and documentation, then analyzed through data reduction, data display, and conclusion drawing. Technique triangulation was used to ensure data validity. The findings identify six characteristics: (1) problems have not incorporated Papuan ethnomathematics and local everyday contexts; (2) they are oriented toward learning objectives; (3) they tend to be structured and prescribe specific procedures; (4) they serve as initial learning triggers; (5) most are adapted from existing sources; and (6) they facilitate group discussions and collaboration. From the TDS perspective, problems have been positioned as central elements of PBL; however, the resulting *milieu* does not yet provide sufficient opportunities for independent student interaction with authentic and meaningful situations. These findings highlight the need for contextual and open-ended problems incorporating Papuan ethnomathematics to strengthen didactical situations and support students' mathematical knowledge construction.

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1. INTRODUCTION

According to the 2022 Programme for International Student Assessment (PISA) report published by the Organisation for Economic Co-operation and Development (OECD), Indonesian students'

mathematical performance remains relatively low. Only 18% of Indonesian students reached the minimum proficiency level (Level 2), whereas the OECD average was 69%. At this level, students are expected to interpret and identify mathematical relationships in simple situations without requiring direct guidance. Moreover, no Indonesian students attained the highest proficiency levels (Levels 5 or 6), while the OECD average reached 9%. At these levels, students are expected to mathematically model complex situations and appropriately select, compare, and evaluate problem-solving strategies (OECD, 2023). These PISA findings are consistent with national studies indicating that junior high school students' mathematical problem-solving ability in Indonesia remains relatively low. In general, students are able to identify the given and required information but still encounter difficulties in designing solution strategies, applying mathematical models logically, and reviewing the obtained solutions (Gunawan et al., 2023; Taufiq, 2022). Similar conditions have also been reported in mathematics learning in Papua, where some students have not been able to carry out all stages of Polya's problem-solving process completely, particularly in the stages of planning, implementation, and reviewing the solution (Ismail & Manurung, 2023; Riana et al., 2024)

The low level of students' mathematical problem-solving ability highlights the need for mathematics instruction that promotes logical reasoning, critical thinking, and independent learning through active engagement with various problem situations. Mathematical problem solving is an essential component of mathematical proficiency because it involves not only understanding mathematical concepts and procedures but also selecting and applying appropriate strategies to address unfamiliar problems in different contexts (*Adding It Up*, 2001; National Council of Teachers of Mathematics, 2000; OECD, 2004, 2005). Furthermore, mathematical problem solving requires students to integrate conceptual knowledge, strategic competence, reasoning, and reflective thinking when formulating and resolving mathematical problems (Niss & Højgaard, 2019; Schoenfeld, 2013). In this regard, problem-solving ability should not be viewed merely as the capacity to obtain correct answers but also as the ability to understand problem situations, develop appropriate strategies, justify mathematical procedures, and evaluate the reasonableness of solutions (Lester, 1994; Lester & Cai, 2016). According to (Polya, 1945), problem solving is a fundamental aspect of mathematical activity that involves four major stages: understanding the problem, devising a plan, carrying out the plan, and looking back at the obtained solution. These stages provide a systematic framework for guiding students through the problem-solving process while encouraging them to monitor and reflect on their reasoning. Consistent with this perspective, mathematics instruction should provide meaningful opportunities for students to engage in challenging problems, explore alternative strategies, communicate their reasoning, and develop mathematical understanding through problem-solving experiences (Lester & Cai, 2016; OECD, 2023). Therefore, fostering mathematical problem-solving ability requires instructional approaches that position students as active problem solvers and provide opportunities for them to construct, apply, and evaluate mathematical knowledge independently.

Therefore, mathematics instruction requires learning models that are not only oriented toward conceptual mastery but also provide opportunities for students to actively construct knowledge and develop their ability to deal with problem situations. One learning model that has been widely adopted to meet these needs is Problem-Based Learning (PBL). PBL is an instructional model that places problems as the primary basis of learning to foster understanding through the problem-solving process (Barrows & Tamblyn, n.d.-a; Schmidt, 1983). This model is grounded in constructivist perspectives emphasizing that knowledge is actively constructed by learners through direct engagement in problem-solving activities (Gijselaers, 1996). In this model, the quality of students' learning experiences is highly influenced by the quality of the problems designed by teachers as the starting point of learning. Consequently, the success of PBL implementation depends not only on the instructional stages but also on the characteristics of the problems employed to facilitate students' knowledge construction.

In PBL, the problems employed are authentic and contextual and are presented as learning triggers that serve as the basis for students to construct knowledge and skills through self-directed inquiry followed by group discussions to review and elaborate the acquired knowledge, thereby enabling

understanding to develop through a series of structured learning stages (Arends, 2012; Boud & Feletti, 1998; Petersdorf, 1993a; Wood, 2003). Nevertheless, one of the major challenges in implementing PBL lies in designing problems that are authentic, relevant to learning objectives, and appropriate to students' cognitive levels (Jonassen, 2000; Schmidt et al., 2011). Inappropriate problem design may increase cognitive load, especially for students who are unfamiliar with problem-based learning, thus making the problem-solving process less effective (Hmelo-Silver, 2004a; Kirschner et al., 2006).

These conditions suggest that analyzing the characteristics of problems designed by teachers in PBL is important because the quality of PBL implementation largely depends on the quality of problem design. According to (Savery, 2006), problems in PBL constitute the central element that functions as the starting point of learning and a means of directing students' knowledge construction processes. Therefore, designing problems requires not only alignment with learning objectives but also consideration of complexity, context, and opportunities for students to conduct independent inquiry. Furthermore, (Jonassen, 2000) argued that different problem characteristics lead to different cognitive demands and thinking processes, making teachers' ability to design problems a crucial factor in determining the quality of students' learning experiences. Similarly, (Schmidt et al., 2011) emphasized that successful PBL implementation is determined not only by instructional procedures but also by the quality of the problems used as learning triggers. Hence, investigating how teachers design problems within the context of PBL is essential for understanding the extent to which the developed problems embody characteristics that support students' active engagement in constructing knowledge through problem solving. Consequently, understanding the characteristics of teacher-designed problems is important because different characteristics may generate different forms of interaction and thinking processes during learning.

In problem-based instruction, the quality of learning is strongly influenced by the characteristics of the problems designed by teachers. According to (Jones, 2006), instructional problems should not merely require the application of routine procedures but should also provide opportunities for students to reason, make decisions, and explore alternative solutions. In a similar vein, (Gijselaers, 1996) explained that problems in PBL should be authentic, open-ended, and capable of encouraging students to conduct independent inquiry and construct knowledge through interaction with their learning environment. Furthermore, (Hmelo-Silver, 2004a) emphasized that problems in PBL function as learning triggers that enable students to develop deeper conceptual understanding and problem-solving strategies. Therefore, the characteristics of teacher-designed problems represent one of the critical aspects determining the quality of PBL implementation and students' learning experiences. Nevertheless, problem characteristics should not be understood solely from a pedagogical perspective but also from a didactical perspective to comprehend how such problems create learning situations that encourage students to construct knowledge independently.

In this regard, the characteristics of problems designed by teachers can be examined not only in terms of their authenticity and alignment with learning objectives but also in terms of their cognitive demands and potential to promote students' mathematical thinking, reasoning, and independent knowledge construction (Henningsen & Stein, 1997; Stein et al., 1996; Watson & Ohtani, 2015). This perspective is consistent with the Theory of Didactical Situations (TDS) developed by (Balacheff et al., 2002), which conceptualizes mathematics learning as a system of interactions among teachers, students, and the *milieu*, or learning environment, in which students encounter and engage with mathematical problems. Within this framework, teachers play a crucial role in designing didactical situations by selecting and organizing problems that encourage students to explore, formulate, test, and validate their solution strategies (Sensevy et al., 2005). The quality of mathematical tasks, particularly their cognitive demands, also influences the nature of students' engagement and the extent to which opportunities for higher-order mathematical thinking are maintained throughout instruction (Artigue, 2002; Henningsen & Stein, 1997; Stein et al., 1996). Furthermore, classroom interactions, mathematical argumentation, and the development of sociomathematical norms contribute to students' intellectual autonomy and mathematical knowledge construction (Yackel & Cobb, 1996). The role of problems in

stimulating knowledge construction is also highlighted by the productive failure perspective, which emphasizes the potential of initial problem-solving attempts to prepare students for subsequent conceptual understanding (Kapur, 2008, 2014). Therefore, TDS provides a relevant conceptual framework for analyzing the characteristics of problems designed by teachers in PBL, as both perspectives position problems as central elements that organize students' learning activities, facilitate interaction with the learning environment, and support mathematical knowledge construction.

Previous studies on PBL in mathematics education have generally focused on its effects on problem-solving ability, critical thinking, learning achievement, and other mathematical competencies. Although these studies demonstrate the potential of PBL to enhance learning quality, relatively little attention has been devoted to the characteristics of teacher-designed problems as the primary component of PBL implementation. As emphasized by Hmelo-Silver (2004), problem quality is one of the key factors determining the effectiveness of learning processes in PBL. In addition, studies on problem design in mathematics education have predominantly been conducted from pedagogical and cognitive perspectives, whereas analyses employing the Theory of Didactical Situations (TDS) as a framework for understanding how teachers design problems remain limited. Moreover, most existing studies have focused more on the effects of PBL implementation on students' learning outcomes than on analyzing the quality of teacher-designed problems as the principal component driving the learning process. These limitations are even more apparent in the context of mathematics education in Papua, which has received relatively little attention in the literature. Therefore, there is a need for studies that specifically explore the characteristics of problems designed by junior high school mathematics teachers in Papua within problem-based learning using the Theory of Didactical Situations (TDS) as an analytical framework.

Based on the foregoing discussion, this study aims to analyze the characteristics of problems designed by junior high school mathematics teachers in Papua within Problem-Based Learning (PBL) from the perspective of the Theory of Didactical Situations (TDS). Specifically, this study seeks to reveal how the characteristics of teacher-designed problems can be understood through the concepts of TDS, thereby providing insights into the potential of these problems to create learning situations that support students' mathematical knowledge construction. This study is expected to contribute theoretically to expanding the literature on problem design in PBL from a didactical perspective and practically to assist mathematics teachers in designing problems that create learning situations conducive to students' active and meaningful knowledge construction.

2. METHODS

This study employed a qualitative descriptive design aimed at analyzing the characteristics of problems designed by junior high school mathematics teachers in Papua within Problem-Based Learning (PBL) from the perspective of the Theory of Didactical Situations (TDS). The participants consisted of five junior high school mathematics teachers in Papua who had implemented PBL and were selected using purposive sampling based on the criteria of having experience in teaching mathematics and having previously implemented PBL in their instruction.

Data were collected through semi-structured interviews, non-participant observations, and document analysis. The research instruments included an interview guide, an observation sheet, and a document analysis sheet. Semi-structured interviews were conducted with all five teachers to obtain information regarding the considerations, processes, and strategies used in designing problems for PBL instruction. Non-participant observations were conducted once for each teacher as supporting data to provide an understanding of the relationship between the problems designed by the teachers and their implementation in classroom instruction. The single observation for each teacher was intended to capture the implementation of the problems in an authentic classroom setting while complementing the interview and document data. However, this limited observation frequency restricts the depth to which the dynamics of *milieu* and *devolution* within the Theory of Didactical Situations (TDS) can be interpreted, as these dynamics may vary across different instructional situations. Furthermore, the

presence of the researcher may have influenced teachers' classroom behavior, creating a potential Hawthorne Effect in which teachers may perform more procedurally or differently from their usual practices. Therefore, the observation findings were interpreted cautiously and triangulated with interview and document data rather than being used as the sole basis for interpreting teachers' practices. Document analysis was employed to collect data from lesson modules, student worksheets, and other instructional materials containing the problems designed by the teachers. These three techniques complemented one another in providing a comprehensive understanding of the characteristics of problems designed by junior high school mathematics teachers in Papua from the perspective of TDS.

Data were analyzed qualitatively through the stages of data reduction, data display, and conclusion drawing. Data obtained from interviews, observations, and documents were first reduced by focusing on information related to the characteristics of problems designed by teachers in PBL instruction. Subsequently, the data were presented descriptively to systematically describe the findings. The final stage involved drawing conclusions by interpreting the characteristics of the problems designed by junior high school mathematics teachers in Papua from the perspective of TDS. The analysis utilized concepts from the Theory of Didactical Situations to understand how the characteristics of teacher-designed problems have the potential to create didactical situations that support students' mathematical knowledge construction.

Data trustworthiness was established through technique triangulation by comparing and cross-checking information obtained from interviews, observations, and documents to examine the consistency of the data regarding the characteristics of problems designed by teachers in PBL instruction. In addition, the findings were re-examined using relevant data sources to enhance the credibility of the data. Therefore, the data obtained can be considered trustworthy and provide an accurate description of the characteristics of problems designed by junior high school mathematics teachers in Papua within Problem-Based Learning from the perspective of the Theory of Didactical Situations.

3. FINDINGS AND DISCUSSION

Findings

Problems Designed by Teachers Do Not Integrate Ethnomathematics and the Daily Life Context of Papuan Communities

Based on interviews with the five junior high school mathematics teachers in Papua, it was found that in designing problems for PBL instruction, teachers prioritized alignment with the taught content rather than the use of local contexts. All teachers stated that they had never specifically utilized Papuan culture or the daily activities of Papuan communities as contexts for mathematics problems. Teacher 1 (G1) stated, "I usually take examples from textbooks or the internet. I have never used Papuan culture or community activities as problem contexts." This statement was supported by Teacher 2 (G2), who said, "So far, I have focused more on content alignment. I have not used Papuan cultural contexts specifically." Teacher 3 (G3) indicated that limited references were one of the reasons for not using local contexts: "Papuan culture is actually rich, but I do not yet know how to connect it with mathematics topics, so I usually use available examples." Similar responses were also given by Teacher 4 (G4) and Teacher 5 (G5), who stated that they still relied on textbook examples and had not used contexts such as Honai houses or other Papuan cultural elements.

Non-participant observations conducted once for each teacher showed that the problems used at the beginning of learning were dominated by general contexts. In all observed lessons, teachers introduced problems related to buying and selling activities, plane geometry, arithmetic operations, or variable relationships. No use of Papuan cultural contexts such as Honai houses, noken, tifa, Papuan batik, traditional carvings, traditional markets, marine products, or other local daily activities was identified. Document analysis of lesson plans, student worksheets, and other instructional materials confirmed that the problem contexts were mostly general situations commonly found in mathematics

textbooks. For example, in the topic of systems of linear equations in two variables, a typical problem stated: "The price of 2 notebooks and 3 pencils is IDR 21,000, while the price of 3 notebooks and 2 pencils is IDR 24,000. Determine the price of each item." In plane geometry, a problem stated: "A rectangle has a length of 15 cm and a width of 8 cm. Determine its area." In ratio topics, problems were framed in terms of vehicle speed and travel time. None of these problems were connected to students' local social or cultural environments in Papua. Based on interviews, observations, and documentation, it can be concluded that the problems designed by the teachers had not yet integrated ethnomathematics or the daily life context of Papuan communities.

Problems Are Designed with Consideration of Alignment with Learning Objectives

Interview data indicated that the main consideration in designing problems was their alignment with learning objectives, subject matter, and students' abilities. Teachers emphasized the relationship between problems and competency targets rather than problem complexity or contextual relevance. Teacher 2 (G2) stated, "The most important thing for me is that the problem must align with the learning objectives and the topic being taught." Teacher 1 (G1) added, "I first look at the learning objectives, then design problems accordingly." Teacher 3 (G3) explained, "The problems must help students understand the material being learned." Teachers 4 (G4) and 5 (G5) further noted that the difficulty level of problems was adjusted to students' abilities to prevent excessive difficulty.

Observations showed that teachers consistently linked problems to the lesson content. Before group discussions began, teachers explained the learning objectives and then directed students to solve the provided problems. Document analysis confirmed that problems in lesson plans were clearly aligned with learning objectives. For instance, in linear equations, problems directly guided students to determine unknown variable values, while in solid geometry, problems focused on applying formulas for volume and surface area in accordance with learning indicators. Thus, problem design was primarily oriented toward achieving learning objectives and conceptual mastery.

Problems Tend to Be Structured and Direct Students Toward Specific Procedures

Interview results revealed that most teachers preferred problems with clear solution steps. They believed that overly open-ended problems could confuse students. Teacher 4 (G4) stated, "I usually design problems with clear steps so students are not confused." Teacher 1 (G1) said, "If the problem is too open, students often struggle, so I tend to design problems that lead to a specific solution method." Teacher 2 (G2) also noted, "I usually provide guidance so students can solve the problem more easily."

Observations showed that teachers frequently provided additional hints during learning, such as formulas or procedural steps. Document analysis indicated that most problems had a single correct answer with predictable solution procedures. In some worksheets, guiding questions were included that indirectly directed students toward specific procedures. For example, in systems of linear equations, students were guided to form mathematical models before applying substitution or elimination methods. In area problems, students were directly directed to use known formulas. These findings indicate that the problems tended to be structured with limited solution alternatives.

Problems Function as the Initial Trigger of Learning

All teachers stated that problems were used to initiate learning and attract students' attention. Teacher 1 (G1) said, "I usually give problems at the beginning so students have an idea of the topic." Teacher 3 (G3) added, "Problems are used as the starting point for group discussions." Observations confirmed that all teachers began lessons by presenting problems before formal explanations. Students were then asked to work in groups and present their solutions. Document analysis showed that problems were positioned in the orientation stage of the PBL syntax, functioning as triggers for inquiry and discussion activities.

Problems Are Mostly Adapted from Existing Sources

All teachers reported that they mostly adapted problems from textbooks, the internet, teaching modules, or other available resources. Teacher 3 (G3) stated, "I usually take problems from textbooks or the internet, then adjust them to the topic." Teacher 2 (G2) added, "Most problems come from textbooks and are slightly modified." Observations showed that teachers did not design problems spontaneously during instruction. Document analysis revealed similarities between worksheet problems and textbook examples. Modifications were generally limited to changing numbers, names, or difficulty levels without altering the core structure of the problems. Thus, problem design was dominated by adaptation rather than independent development.

Problems Are Designed to Support Discussion and Group Work

eachers stated that problems were designed to promote student discussion and collaboration. Teacher 5 (G5) said, "I design problems so students can discuss and exchange ideas in groups." Teacher 1 (G1) added, "Through the problems, I hope students can work together in groups." Observations showed that students worked in small groups after receiving the problems and engaged in discussions to find solutions. Group interactions were evident, and several groups presented their results in front of the class. Worksheet analysis also showed instructions encouraging discussion, idea sharing, and group presentation.

Overall, the findings indicate that the characteristics of problems designed by junior high school mathematics teachers in Papua within PBL are characterized by the absence of ethnomathematical and local cultural contexts, strong orientation toward learning objectives, a tendency toward structured and procedure-driven problems, the function of problems as initial learning triggers, dominance of adaptation from existing sources, and the use of problems to support discussion and collaborative work among students.

Discussion

The findings of this study indicate that the problems designed by junior high school mathematics teachers in Papua within Problem-Based Learning (PBL) are characterized by the absence of ethnomathematical and everyday life contexts of Papuan communities, strong orientation toward learning objectives, a tendency toward structured problems, the function of problems as initial learning triggers, dominance of adaptation from existing sources, and the use of problems to support group discussion. These findings suggest that problems occupy a central position in PBL implementation; however, the characteristics of teacher-designed problems still show limitations in creating situations that enable students to construct knowledge independently. The Theory of Didactical Situations (TDS) provides a relevant conceptual framework for understanding how these problem characteristics influence interactions among teachers, students, and the learning environment.

The first finding shows that the problems designed by teachers have not yet integrated ethnomathematics or the daily life context of Papuan communities. Most problems still use general contexts commonly found in textbooks, such as buying and selling, arithmetic operations, and variable relationships. This indicates that the milieu constructed through the problems has not fully utilized the social and cultural realities close to students' experiences. According to (Petersdorf, 1993b), the milieu refers to the environment that interacts with students during the learning process and serves as a source of feedback for their actions. It includes not only mathematical objects but also contexts and situations that enable students to construct knowledge through interaction with the problems they encounter. Therefore, the limited use of contexts close to students' lived experiences may restrict the quality of interaction between students and the milieu.

This finding is consistent with (Margolinas, 2014), who emphasized that the quality of didactical situations is strongly influenced by how teachers organize the learning environment to enable meaningful student interaction with problems. In PBL, authentic and contextual problems play an essential role in encouraging students' engagement in inquiry and knowledge construction processes

(Savery, 2006). Furthermore, (Hmelo-Silver, 2004b) argued that problems in PBL should allow students to connect mathematical concepts with situations close to their daily lives. Thus, the lack of integration of Papuan cultural contexts suggests that the potential of social and cultural environments as part of the milieu has not been optimally utilized in problem design. More specifically, the absence of Papuan ethnomathematical contexts represents an underutilized local resource for developing meaningful mathematical problems. Papuan cultural practices, traditional objects, patterns, and everyday activities can provide relevant contexts through which students explore mathematical relationships and concepts. Integrating these contexts into PBL problems is therefore not merely a matter of adding cultural elements to mathematical exercises, but can support the development of problems that require students to interpret situations, identify relevant information, explore mathematical relationships, and consider different solution strategies. In this way, Papuan ethnomathematics has the potential to serve as a basis for developing more contextual and open-ended problems that provide greater opportunities for students to interact with the milieu and construct mathematical knowledge through inquiry.

The second finding shows that teachers design problems by considering their alignment with learning objectives and instructional content. This indicates a strong emphasis on achieving expected competencies. From a TDS perspective, this reflects teachers' efforts to organize didactical situations so that students can attain targeted knowledge. According to (Petersdorf, 1993b), teachers play a crucial role in designing situations that allow students to acquire knowledge through interaction with the provided problems. Therefore, alignment between problems and learning objectives is an important component in the construction of didactical situations.

This finding is also consistent with (Schmidt, 1983), who stated that problems in PBL serve as the starting point of learning and must have a clear relationship with learning objectives. (Arends, 2012; Delisle, 1997) further explained that problems in PBL should be designed to help students acquire the intended concepts. Thus, teachers' strong orientation toward learning objectives reflects an effort to ensure that problem design supports the achievement of mathematical competencies.

The third finding indicates that the problems designed by teachers tend to be structured and guide students toward specific procedures. Most problems have a single correct answer with predictable solution steps. From a TDS perspective, this suggests that the space for student interaction with the milieu is still limited. According to (Petersdorf, 1993b), an adidactical situation occurs when students can interact independently with the problem without excessive teacher intervention. However, when problems are overly structured and accompanied by procedural guidance, students' opportunities to explore diverse solution strategies become restricted.

This finding aligns with (Jonassen, 2000), who distinguished between well-structured and ill-structured problems. Well-structured problems typically have clear procedures and a single correct answer, whereas ill-structured problems allow multiple solution paths. In PBL contexts, (Savery, 2006) emphasized that problems should encourage inquiry and deeper reasoning. Therefore, the dominance of structured problems indicates that the potential of PBL to develop higher-order thinking skills has not been fully optimized. This characteristic also reinforces the importance of developing problems that provide students with greater opportunities to determine how a problem can be approached and solved rather than simply following predetermined procedures. When combined with relevant Papuan ethnomathematical contexts, more open-ended problem structures may provide a stronger basis for students to explore, reason, and construct mathematical knowledge through interaction with the milieu.

The fourth finding shows that problems are used as the initial trigger of learning. All teachers presented problems at the beginning of instruction before explaining mathematical concepts formally. This reflects one of the core principles of PBL, namely positioning problems as the starting point of learning. According to (Barrows & Tamblyn, n.d.-b, 1980), problems serve as the basis for initiating learning and fostering understanding through inquiry activities. From a TDS perspective, this relates to the process of devolution, in which the teacher transfers initial responsibility to students to interact with the problem (Petersdorf, 1993b).

This devolution process provides opportunities for students to explore the situation before the institutionalization phase, in which the teacher formalizes the knowledge constructed. Thus, the use of problems as initial learning triggers reflects an effort to engage students actively in the learning process.

The fifth finding shows that most problems used by teachers are adapted from textbooks, the internet, or other available learning resources. Modifications are generally limited to changing numbers or contextual details. This suggests that teachers' ability to independently develop problems is still limited. According to (Petersdorf, 1993a), the quality of didactical situations depends on teachers' ability to organize problems and learning environments that enable students to construct mathematical knowledge independently. Therefore, reliance on adapted problems indicates that teachers function more as users of learning resources rather than designers of didactical situations.

This finding is consistent with (Schmidt et al., 2011), who emphasized that PBL effectiveness depends not only on instructional procedures but also on the quality of problems used as learning triggers. (Hmelo-Silver, 2004b) also highlighted that problem quality is a key determinant of PBL effectiveness. Thus, strengthening teachers' ability to design problems independently is essential for improving PBL implementation. In the context of Papua, such capacity should also include the ability to identify relevant local cultural resources and transform them into mathematically meaningful problem situations. This would allow teachers to move beyond modifying existing problems and instead develop problems that are more closely connected to students' social and cultural environments.

The final finding shows that problems are designed to support student discussion and group work. After being given a problem, students are encouraged to discuss, exchange ideas, and present their solutions. This indicates that teachers view problems not only as a means to obtain correct answers but also as a medium for fostering social interaction in learning. From a TDS perspective, such interaction is part of the knowledge construction process that emerges through relationships among students, teachers, and the milieu (Petersdorf, 1993b). Furthermore, during the institutionalization phase, teachers play a role in helping students formalize and validate the knowledge developed.

Overall, the findings indicate that problems designed by junior high school mathematics teachers in Papua have positioned problems as central elements in PBL implementation. However, the characteristics of these problems are still predominantly structured, largely adapted from existing sources, and have not yet incorporated Papuan cultural contexts as part of the learning environment. From the perspective of the Theory of Didactical Situations, this suggests that the milieu constructed by teachers has not fully provided opportunities for students to interact independently with authentic and meaningful problem situations. The findings therefore indicate a need to shift problem design from predominantly procedural and structured problems toward more contextual and open-ended problems grounded in students' local experiences. In this regard, Papuan ethnomathematics can serve as an important resource for connecting formal mathematical concepts with local cultural practices and everyday experiences. Such problems may provide richer opportunities for students to interpret situations, explore mathematical relationships, develop alternative strategies, and take greater responsibility for the problem-solving process. Consequently, the integration of Papuan ethnomathematics is not only relevant for strengthening the cultural context of mathematics learning but also has the potential to enhance the quality of didactical situations in PBL. The contribution of this study therefore lies not only in identifying limitations in teacher-designed PBL problems but also in highlighting Papuan ethnomathematics as a potential basis for developing more contextual, meaningful, and open-ended mathematical problems in Papuan junior high schools.

4. CONCLUSION

The conclusion should answer the objectives of the research and research discoveries. The concluding remark should not contain only the repetition of the results and discussions or abstract. You should also suggest future research and point out those that are underway.

This study aimed to analyze the characteristics of problems designed by junior high school mathematics teachers in Papua within Problem-Based Learning (PBL) from the perspective of the Theory of Didactical Situations (TDS). The findings show that the problems designed by the teachers are characterized by several main features, namely the lack of integration of ethnomathematics and the daily life contexts of Papuan communities, strong orientation toward learning objectives, a tendency toward structured problems that direct students to specific procedures, the use of problems as initial learning triggers, dominance of adaptation from existing sources, and the design of problems to support student discussion and group work.

From the perspective of TDS, these characteristics indicate that teachers have positioned problems as central elements in PBL implementation. However, the milieu or learning environment constructed through these problems has not yet fully provided opportunities for students to interact independently with authentic and meaningful situations. The dominance of structured problems and the absence of Papuan cultural contexts suggest that the potential of social and cultural environments as part of the didactical situation has not been optimally utilized to support students' mathematical knowledge construction.

These findings imply that problem development in PBL should not only consider alignment with learning objectives but also pay attention to problem characteristics that can create richer, more authentic didactical situations that are closer to students' lived experiences. Therefore, mathematics teachers should be encouraged to design more contextual and open-ended problems and to utilize the potential of ethnomathematics and the daily life of Papuan communities as part of the learning environment that supports students' active engagement in knowledge construction.

This study is limited to five junior high school mathematics teachers in Papua and classroom observations conducted only once for each teacher. Therefore, future research is recommended to involve a larger number of participants, conduct more intensive classroom observations, and further investigate the problem-design process by integrating Papuan ethnomathematics and various concepts within TDS, in order to gain a deeper understanding of problem development in problem-based mathematics learning.

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