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Contexts proposed by teachers in Papua for developing mathematics hots assessment instruments: A phenomenological study

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Abstract

The success of a school centers on teachers' ability to create well-aligned educational tools. The Merdeka Belajar curriculum requires adapting assessments, including Higher-Order Thinking Skills (HOTS) questions for real-world problem-solving scenarios. This study explored contexts proposed by teachers in Papua for developing Mathematics HOTS questions. A phenomenological approach within a qualitative framework was employed involving 24 mathematics teachers from public and private schools in focus group discussions. Participants included twenty teachers from Papua, two from Central Indonesia and two from Western Indonesia. Additionally, five teachers from Papua participated in in-depth interviews. Data was analyzed using Creswell's model with Atlas.ti software. Teachers developed HOTS assessment instruments based on daily life, scientific and social contexts. However, no cultural contexts were incorporated into these instruments by the interviewed teachers. This study highlights the importance of teacher preparedness in aligning contextual learning with the Merdeka Belajar curriculum and reveals a significant gap in using cultural contexts for HOTS assessments among teachers in Papua. These insights contribute to the discourse on math education in Indonesia advocating for the integration of cultural elements into the freedom to learn initiative.

Keywords: Contextual learning, Cultural context, HOTS, Mathematics education, Merdeka Belajar curriculum, Papua, Phenomenological study, Qualitative research, Teacher preparedness.

Contents

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Contribution of this paper to the literature
This study emphasizes teachers' pivotal role in adapting educational tools to the Merdeka Belajar curriculum through HOTS assessments. It finds that Papua's teachers prioritize daily life, scientific and social contexts but neglect cultural dimensions. This underscores the need for support to integrate cultural elements into education offering insights for Indonesian educational reform.

1. Introduction

In the 21st century, education must go beyond providing access to information. It should equip students with skills to navigate a complex and ever-changing world (Driscoll, 2020; Waite & McDonald, 2018). Education should nurture creativity, higher-order thinking skills, communication and collaboration essential for the modern workforce, societal engagement and future success (Kolar & Hodnik, 2021; Waite & McDonald, 2018).

Higher-order Thinking Skills (HOTS) are crucial educational objectives for preparing the younger generation for the 5.0 era (Alvarez-Cedillo, Aguilar-Fernandez, Sandoval-Gomez, & Alvarez-Sanchez, 2019). Individuals with HOTS are better equipped to tackle global challenges, analyze real-world problems and apply their knowledge to new situations, thus adapting to society 5.0 achieving HOTS involves the development of foundational cognitive skills including literacy, science and mathematics competencies.

In mathematics education, students frequently meet and get used to contextual situations. It is essential to gather, categorize and select contexts before presenting them to students given the abundance of contextual situations available.

A plethora of daily-life contexts involve mathematics but not all contexts can be employed effectively and efficiently to facilitate the mathematical problem-solving process for students. In selecting a context for mathematics, expert recommendations can be valuable. Heuvel-Panhuizen (2005) identifies three key benefits of context: (1) facilitating problem access, (2) making problems more transparent and adaptable and (3) aiding in the identification of solution strategies. Experts have advised the use of context to instill mathematics with meaning and enhance students' comprehension. However, choosing an appropriate context for teaching mathematical concepts is a complex and multifaceted process (Sullivan, Zevenbergen, & Mousley, 2003). Certain contexts can serve as guides for students to develop and reinvent mathematical tools and concepts (Wijers & de Haan, 2020). Determining the most suitable context for students poses a significant challenge for researchers, teachers, prospective teachers and mathematics subject matter developers.

In the context of mathematics education, students must be equipped with the tools to conceptualize formulas through the chosen context rather than simply memorizing established procedures or deriving formulas devoid of context. Mathematical thinking tools can be explored and naturally emerge from the context itself (Wijers & de Haan, 2020). When thinking tools are developed from the context, they become comprehensible and can be replicated or enhanced by students when faced with similar problems in the future. Considerable research has focused on the utilization of context to facilitate the discovery of mathematical concepts or formulas.

Contexts can be categorized as true, pseudo or fake contexts (Sugiman, 2021). True contexts possess substantial power in inspiring modelling while pseudo contexts are interchangeable with other contexts without diminishing their mathematical relevance. Fake contexts are characterized by contradictions or misinformation, with mathematical contradictions being the primary concern. In Japan, mathematics education commences with a contextual approach. Students are presented with mathematical problems embedded in contexts that frame their learning. Students engage in mathematical learning activities starting from a contextual foundation and employing analogy, inductive, deductive and integrative modes of thinking (Isoda & Olfos, 2021).

The selection of a context for mathematics education is a nuanced process, requiring harmonizing content with the contextual framework. Commencing from a contextual foundation, students can abstractly construct mathematics within their minds. Conversely, when providing context, teachers must contextualize their mastery of formal mathematical knowledge.

Papua known for its cultural richness and unique community activities presents an opportunity to integrate local contexts into mathematics education. This qualitative study aims to investigate the contexts proposed by teachers in Papua in developing Mathematics HOTS questions. Specifically, the following research question is addressed: What contexts do teachers in Papua propose for developing Mathematics HOTS assessment instruments?

This study aims to fill the gap in the use of cultural contexts in the development of HOTS assessments providing insights into how teachers can integrate local cultural elements into mathematics education. Understanding these contexts contributes to the broader implementation of contextual learning in regions with

diverse cultural backgrounds like Papua and the findings can inform policymakers and teachers about the necessary support and resources needed to enhance the effectiveness of HOTS assessments in line with the Merdeka Belajar curriculum.

2. Literature Review

In mathematics education, the classroom context serves as a resource that uses the mathematics workshop environment to make standard mathematics practice come to life. Authentic and multifaceted contexts offer the backdrop for encouraging the use of mathematical models as thinking tools, fostering resilient problem-solving skills and promoting the articulation of mathematical arguments and justifications all of which are integral to nurturing a growth mindset (Fosnot & Uttenbogaard, 2008). The learning context includes all facets of students' surroundings from the classroom to everyday life.

An essential aspect of mathematics learning is the application of mathematical skills to solve problems situated within a specific context. In this sense, context pertains to the real-life scenarios or situations in which mathematical content is applied. The choice of strategy and the appropriate mathematical representation often focus on the context in which a problem is situated. Mathematical contexts can be categorized into four domains: personal, work-related, social and scientific as per the Program for International Student Assessment 2022 Mathematics Framework (OECD, 2022).

HOTS represent cognitive abilities that transcend memorization. HOTS encompasses diverse cognitive processes including analysis, evaluation and creation, all deeply intertwined with the problem-solving process (Schraw & Robinson, 2011). HOTS involves critical and creative thinking demanding active engagement from students (Conklin, 2012; King, Goodson, & Rohani, 2004). Effective learning in mathematics greatly benefits from contextual learning.

HOTS represents advanced cognitive processes. Educational taxonomies such as Bloom's taxonomy and its revisions by Anderson and Karthwol (2014) and Marzano and Kendall (2007) categorize HOTS into stages like analyzing, evaluating and creating (Anderson & Karthwol, 2014; Marzano & Kendall, 2007). Experts agree that HOTS involves reasoning, analysis, evaluation, decision-making and problem-solving (Abdurrahman, Halim, & Sharifah, 2021; Alhassora, Abu, & Abdullah, 2017; Misrom et al., 2020; Yee et al., 2016). Bloom's taxonomy and its revisions are pivotal in classifying HOTS levels. Contextual problems foster critical thinking and encourage environmental consideration (Apino & Retnawati, 2017; Hamdi, Suganda, & Hayati, 2018; Kolar & Hodnik, 2021; Shaheen, 2016; Suhirman, Muliadi, & Prayogi, 2020). Integrating local cultures and contexts into HOTS items enhances students' cultural attachment and highlights the practicality of mathematics in daily life (Fouze & Amit, 2017; Kolar & Hodnik, 2021; Muhtadi, Sukirwan, & Prahmana, 2017; Retnawati, Djidu, Kartianom, & Anazifa, 2018).

Investigating the contexts proposed by teachers in Papua for developing HOTS mathematics assessment instruments is crucial. This research explores how these contexts align with Papua's cultural and educational landscape aiming to enhance HOTS-based mathematics education tailored to this unique region. Mathematics plays a central role in developing competencies needed for the 21st century. Proficiency in mathematics indicates readiness for the society 5.0 era where mathematical understanding and reasoning are increasingly essential in professional and daily-life contexts (Ichsan et al., 2019; Kolar & Hodnik, 2021; Waite & McDonald, 2018). However, persistently low levels of mathematical knowledge among students have drawn significant attention from teachers and researchers (Ichsan et al., 2019). There is an immediate relationship between the degree of learning independence and the ability to collaborate and communicate effectively.

Internationally, evaluations of mathematics education reveal that Indonesian students perform below expectations. Results from the Program for International Student Assessment (PISA) by the Organisation for Economic Co-operation and Development (OECD) show that Indonesian students' average mathematics literacy score is below the global standard (Ding & Homer, 2020; Hu, Gong, Lai, & Leung, 2018; Indonesia PISA Center, 2013; Mullis & Von Davier, 2021; Tajudin & Chinnappan, 2016).

PISA assesses thinking skills, including proficiency in reading, mathematics and science among students around the age of 15. In the 2022 PISA study, Indonesia ranked 69 out of 81 countries with a score of 388 below the international average of 472 (OECD, 2023). Similar trends are seen in assessments like the Trends in International Mathematics and Science Study (TIMSS), where Indonesia consistently falls short of international benchmarks (Ding & Homer, 2020; Mullis & Von Davier, 2021).

Addressing these challenges and improving students' higher-order thinking skills has become crucial in mathematics education (Ichsan et al., 2019; Ismail & Imawan, 2023; Ismail, Imawan, & Nadhifah, 2023; Retnawati et al., 2018). Developing HOTS-based test items is considered a strategy to enhance students' problem-solving abilities and overall learning achievements (Hobri & Prihandoko, 2018; Meng, Jia, & Zhang, 2020; Singh et al., 2020; Wilson & Narasuman, 2020). However, many teachers face difficulties in creating HOTS items often relying on instruments that emphasize lower-order thinking skills like memorization and comprehension rather than critical thinking (Alhassora et al., 2017; Retnawati et al., 2018; Wilson & Narasuman, 2020).

Traditional test materials and approaches often do not align with future skill requirements. It is increasingly clear that students must develop HOTS to meet future challenges (Hobri & Prihandoko, 2018; Meng et al., 2020; Singh et al., 2020; Wilson & Narasuman, 2020). Assessment plays a key role in evaluating learning effectiveness and curriculum achievements. Teachers are pivotal in developing HOTS items tailored to their students' needs.

This study addresses several critical gaps in current research on mathematics education and higher-order thinking skills. Firstly, it underscores the underutilization of contextual learning environments in mathematics classrooms despite their proven efficacy in fostering mathematical modeling, problem-solving skills and promoting a growth mindset (Fosnot & Uttenbogaard, 2008). Secondly, it highlights the limited integration of cultural contexts into HOTS assessment instruments particularly among teachers in regions like Papua, Indonesia. Thirdly, it contributes to the discourse on enhancing mathematics education in Indonesia by exploring how local contexts and cultural landscapes can be leveraged to improve HOTS-based mathematics education, thus preparing students for the demands of the 21st-century society 5.0 era (Ichsan et al., 2019; Kolar & Hodnik, 2021; Waite & McDonald, 2018). Additionally, this study addresses the persistent challenge of low mathematical proficiency among Indonesian students as evidenced by international assessments such as PISA and TIMSS emphasizing the urgent

need for effective strategies like HOTS-based assessments to improve learning outcomes (Ding & Homer, 2020; Mullis & Von Davier, 2021).

3. Method

3.1. Study Design

This study employs a qualitative approach to explore the contexts used by teachers in Papua when creating Higher-Order Thinking Skills (HOTS) questions. The contexts used by teachers in Papua in creating HOTS questions need to be understood to serve as considerations in formulating future mathematics assessment questions. Qualitative research can be used to study an individual's perspectives (Creswell & Poth, 2018). Therefore, qualitative research is employed to explore the contexts used by teachers in Papua when creating HOTS questions.

The perspective in this study is the experiences presented from the teachers' perspectives. The researcher's selection of a phenomenological approach for this qualitative investigation was influenced by this research focus. Phenomenology is a qualitative approach aimed at exploring an individual's experiences of a specific phenomenon (Creswell & Poth, 2018). In this study, teachers shared their experiences based on their perspectives in developing HOTS assessments. The teachers' experiences were analyzed and synthesized into general findings describing the contexts employed by teachers in developing HOTS questions.

3.2. Participants

Teachers' experiences in using contexts when developing HOTS questions are revealed to obtain informative theme constructions. Twenty-four teachers participated in the focus group discussion (see Table 1) and five of them also participated in in-depth interviews (see Table 2). These teachers participated as respondents to this study because they were interested in developing mathematics HOTS questions based on Papuan nature and culture. They come from schools in Papua, both experienced as pioneer schools and those that have just implemented the independent curriculum. All participants are middle and high school mathematics teachers with more than five years of teaching experience.

Table 1. The origin of focus group discussion respondents.

Area	Total number of teachers
Central Indonesia	Two teachers
Western Indonesia	Two teachers
Eastern Indonesia	20 teachers

Table 2. The demographic profile of the interview participants.

Teacher (Anonymous)	Age (Years)	Length of teaching experience	School location	Educational qualifications
T1	42	20	Jayapura	Master of mathematics education
T2	32	10	Jayapura	Master of mathematics education
T3	29	7	Sarmi	Bachelor of mathematics education
T4	28	6	Keerom	Bachelor of mathematics education
T5	28	6	Jayapura	Bachelor of mathematics education

Research participants were recruited by the researcher through the first author's personal social media network. Participants who could be involved in this research had to meet certain criteria, including teaching mathematics and having worked as permanent teachers for at least five years. Participants who met these criteria were willing to contact the researcher voluntarily. The researcher then provided a signed interview consent form, which was returned to the researcher if the participant agreed. Next, the researcher scheduled online semi-structured interviews lasting approximately 40 minutes for each participant. Interviews were conducted online using a virtual meeting platform (Zoom meeting) with a recorded process. Each participant completed the interview at a different time from the others. All participants were provided with credits to purchase an internet package sufficient to conduct online interviews within the specified timeframe. Before the interview began, the researcher ensured that the participants consented to the meeting being recorded. The researcher also stated that the participants' names would be kept confidential in the case of publication.

3.3. Data Collection

The questions in the interview protocol were developed based on the theory of planned behaviour by Ajzen (Limiansi, Suranto, & Caly, 2023). Three factors influence an individual's independent intention to perform a behavior: attitude towards the behavior, subjective norm, and perceived behavioral control. Independent intention in this study represents teachers' intention to implement teaching and assessment processes in accordance with applicable regulations. The attitude towards the behavior factor refers to an individual's judgment about whether the behavior is good or bad.

In this case, it pertains to teachers' experiences and views on using context in developing HOTS questions, whether it's good or not and whether it's important or not. The subjective norm factor is seen as the social pressure experienced when performing the behavior. In this case, teachers face challenges when combining context with mathematical content. The perceived behavioral control factor is an individual's understanding of their strengths and weaknesses allowing them to choose whether or not to engage in a behavior. In this case, teachers try to overcome the challenges they face but within the limits of their abilities. Support from various parties is needed to address teachers' weaknesses.

The questions began by gathering information about teachers' data such as their place of origin, years of teaching experience and experience in developing HOTS questions. Subsequently, the researchers explored teachers' opinions when combining context with mathematical content followed by the challenges they faced and then the expectations they had to support the teaching and assessment processes in the 21st century.

3.4. Data Analysis

Data analysis consists of several steps proposed by Creswell and Poth (2018). These steps include interview data transcription, data reduction and data analysis. The recorded interview results were manually transcribed to ensure accurate results. The research data in the form of interview transcripts were then reduced and analyzed using thematic analysis with the assistance of ATLAS.ti 23 software. The thematic analysis aims to identify thematic patterns within interview transcripts. The steps in thematic analysis involve data familiarization, initial coding, theme development and reviewing and defining themes. The participants' names were anonymized to protect their privacy and adhere to research ethics. The results of the analysis are used to comprehend the contexts proposed by teachers in Papua when developing HOTS mathematics questions.

3.5. Instruments

The primary instruments used in this study are focus group discussions and in-depth interviews. Focus group discussions involved all 24 teachers while in-depth interviews were conducted with five teachers from Papua to provide further insights. Examples of questions in the interview protocol are presented in Table 3.

Table 3. Sample questions on the interview protocol.

Area	Total number of teachers
Teacher experience	Competency-based assessment aims to improve students' literacy. What is your experience regarding the use of context in the process of mathematics teaching and assessment?
Teacher challenge	Do you perceive challenges regarding the use of context in teaching and assessment, especially in mathematics?
Teacher hope	The use of context in mathematical content has been applied in minimum competency assessments. What are your expectations in supporting the implementation of these assessments?

3.6. Validity and Reliability

Validity and reliability of the data were ensured through triangulation of data sources (focus group discussions and in-depth interviews) and member checking with participants to verify the accuracy and appropriateness of data interpretations.

3.7. Ethical Considerations

The study received ethical approval from the Institutional Review Board of Yogyakarta State University, Indonesia (approval number: B/47/UN34.9/KP.06.07/2023). Throughout the research process, ethical standards were strictly adhered to, including obtaining informed consent from all participants ensuring data confidentiality, and maintaining voluntary participation.

4. Results

The implementation of new initiatives is not without its challenges like the adoption of literacy-based assessments. The application of numeracy literacy assessments that require the use of real contexts poses challenges for teachers especially in integrating mathematical content with contexts to develop HOTS questions. Nevertheless, teachers continue to strive to overcome these challenges to carry out mathematics teaching and assessment following the independent curriculum (see Figure 1).

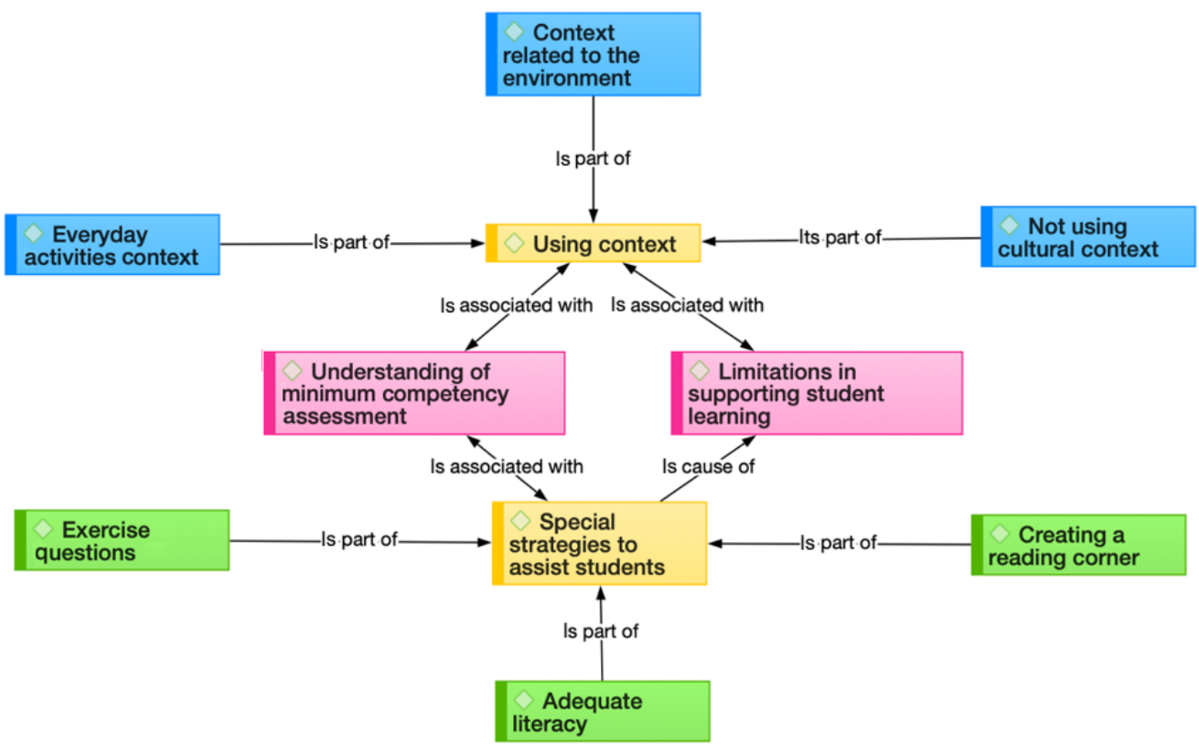

Figure 1. Challenges faced by teachers.

The findings of this research provide information related to the contexts proposed by teachers in Papua to develop mathematics HOTS assessment instruments. Data obtained were classified into no context, ("Tara Ada" context), daily life context, scientific context, social context and technological context. The acronym "Tara Ada" originates from Papua Province and means "Not Available".

Teachers often used the terms "Tara Ada" or "Tara Pake" in context during the interviews. The detail of each classification is further explained in Table 4 illustrating diverse approaches used by teachers in the development of HOTS assessments with varying challenges related to understanding and implementing contexts in mathematics education.

Table 4. Types of contexts in the development of HOTS assessments.

Context type	Verification result
No context or "Tara Ada" context	Some teachers struggled to use specific contexts for HOTS questions resulting in context-less questions due to time constraints. Many teachers still struggled to grasp its definition despite exposure to HOTS concepts in training and curriculum discussions.
Daily life context	Most teachers incorporated daily life contexts into HOTS assessment development emphasizing the importance of teaching problem-solving through real-life situations.
Scientific context	Teachers predominantly employed scientific contexts in creating Mathematics HOTS questions reflecting their comfort with scientific applications related to temperature, speed and other concepts.
Social context	Social contexts were prevalent in mathematics HOTS assessment development with teachers beginning to incorporate them into both teaching and question development.
Cultural context	Cultural contexts were largely absent due to a lack of guidance from school principals and limited discussion in teacher forums.
Technological context	Many teachers could not differentiate between contexts and media for assessment, misunderstanding the role of technology in HOTS test development. Some thought that the use of technology in developing the assessment was like the use of a computer to conduct the assessment.

5. Discussion

Some teachers faced difficulties in using specific contexts for HOTS questions resulting in context-less questions due to time constraints. Certain teachers may struggle to identify relevant real-life situations to develop HOTS questions leading to abstract questions that may be challenging for students to comprehend. Most teachers integrated daily life contexts into the development of HOTS assessments emphasizing the importance of teaching problem-solving through real-life situations. Incorporating daily life contexts into HOTS assessments can help students connect learning concepts with practical applications.

Teachers often used scientific contexts when developing HOTS mathematics questions reflecting their understanding of scientific applications in the subject. Scientific contexts help students gain a deeper understanding of mathematical concepts through real-world applications. Social contexts dominated the development of HOTS Mathematics assessments whereas cultural contexts were less used due to a lack of guidance and discussion. Social contexts in HOTS assessments help students understand the relevance of mathematics in daily life while cultural contexts enrich students' learning experiences. Many teachers struggled to differentiate between contexts and media in assessments leading to misconceptions about the role of technology in HOTS test development. Although incorporating technology can enhance interactivity and effectiveness, it is essential to distinguish between the context (problem situation) and the tools or media used in the assessment.

In a nutshell, this research highlights the contextual strategies used by teachers in Papua for developing Mathematics HOTS assessment instruments. The data was categorized into six distinct contexts: No context, daily life context, scientific context, social context, cultural context and technological context. Each context provides unique insights into the challenges and approaches in mathematics education. Table 4 illustrates the various methodologies used by teachers in crafting HOTS assessments presenting different levels of complexity in understanding and implementing contextual elements in mathematics education.

This study revealed several significant findings regarding the use of contexts in developing Higher-Order Thinking Skills (HOTS) assessment instruments in mathematics by teachers in Papua. The first finding underscores the prevalent use of daily life contexts by most teachers notably teachers 1, 2, 3 and 5. Teachers harness their creative potential using contextual inquiries as pedagogical tools by intertwining mathematics with everyday scenarios. This approach helps mathematics transcend beyond mere theorems becoming a platform for nurturing thinking skills and problem-solving abilities. This method encourages a shift from conventional linear thought processes allowing for greater flexibility in students' problem-solving approaches.

The second finding highlights the substantial utilization of scientific contexts mainly by teachers 1, 2, 3 and 4. These contexts cover a wide range of scenarios such as calculating pond depths, exploring temperature variations, body measurements and agricultural products. Teachers prefer these contexts due to their established connection with mathematics teaching and HOTS assessment development. This strategy underscores the intrinsic link between mathematical concepts and real-world scientific applications.

The third finding emphasizes the extensive incorporation of social contexts by most teachers including teachers 1, 2, 3, 4 and 5. These contexts integrate seamlessly with the teaching-learning process and the creation of HOTS assessment tools. These socially realistic environments give students a solid foundation in the knowledge that enables them to solve mathematical problems, understand social dynamics and manipulate spatial relationships.

Conversely, the absence of cultural contexts in Mathematics HOTS assessments is notable especially among teachers 2, 3, 4 and 5. These teachers attribute this absence to the lack of official recommendations from school principals regarding the inclusion of cultural contexts in learning or assessment development. However, introducing local cultural elements into the educational system can significantly enrich students' cultural knowledge which they cultivate at home and in their communities. This integration can also promote a broader acceptance of social justice principles. These findings offer valuable insights into the dynamic landscape of

mathematics education in Papua providing a nuanced understanding of the diverse approaches used by teachers in developing Mathematics HOTS assessments and the associated challenges.

Previous studies underscore the importance of developing HOTS in mathematics education to meet the complexities of modern society and economy. Learning theories such as Bloom's taxonomy and revised models by Anderson and Marzano categorize HOTS based on high-level cognitive processes. Research also indicates that integrating local contexts into HOTS assessments can enhance student engagement and their understanding of cultural heritage.

This research aims to explore and understand the specific contexts proposed by teachers in Papua when developing HOTS assessment tools in mathematics. The novelty of this research lies in its focus on Papua, a region rich in cultural diversity and natural beauty. Previous studies have explored the use of contexts in developing HOTS questions. This research provides a distinctive geographical focus, offering insights into how teachers in Papua incorporate cultural and local environmental elements into their mathematical assessments. In a nutshell, this phenomenological study contributes to mathematics education by revealing how contextualization of HOTS assessment tools in Papua enhances mathematics learning and assessment in this unique region.

The freedom to learn curriculum is the latest curriculum set to be implemented in Indonesia in 2024. One of the emphasized life skills in this curriculum is literacy and numeracy focusing on HOTS. According to the revised Bloom's taxonomy (Anderson & Karthwol, 2014), HOTS is an intersection of the top three components of the cognitive process dimension (analysis, evaluation and creation) and the top three components of the knowledge dimension (conceptual, procedural and metacognitive). However, most teachers in this study believed that HOTS questions were too difficult for students with low abilities leading to reluctance in using HOTS questions during learning processes and in developing mathematics assessment instruments due to their inadequate understanding of HOTS.

Training is needed to introduce HOTS to mathematics teachers as some of them still only have a basic knowledge of it. There is still a need for enhanced understanding of HOTS despite some socialization and training efforts by various education practitioners (Pratama & Retnawati, 2018; Retnawati et al., 2018) to improve Papuan teachers' competencies. Quality socialization and training should be provided so teachers can acquire HOTS competencies and skills. A qualitative study by Retnawati et al. (2018) found that teachers' understanding of HOTS was still lacking with issues like multiple interpretations of training themes and inadequate time for material presentation being common problems in teacher training programs.

Several previous studies by Jailani and Retnawati (2016), Kusaeri, Indayati, and Faizien (2018), Misrom et al. (2020), Retnawati et al. (2018) and Wilson and Narasuman (2020) highlighted challenges teachers face in implementing learning or assessment models that meet education policy demands. Although research has shown that students' HOTS can be improved through specific learning approaches (Handoko, Mardiati, Ismail, & Imawan, 2023; Imawan & Ismail, 2022), teachers' efforts to enhance students' HOTS are not yet optimal. Studies discuss using context in composing HOTS questions, a focus on developing HOTS mathematics questions in Papua remains underexplored.

Other studies have found that some teachers had a good understanding of HOTS assessment (Didis, Erbas, Cetinkaya, Cakiroglu, & Alacaci, 2016) categorizing essays with contextual problems as HOTS assessments and focusing on the problem-solving process rather than final answers. Research from various countries (Altun, Gümüş, Akkaya, Bozkurt, & Ülger, 2018; Stahnke, Schueler, & Roesken-Winter, 2016) revealed that student success in improving competence and thinking skills depends significantly on teachers' competencies and mastery of content and learning contexts in addition to teachers' pedagogical content knowledge (Blömeke & Delaney, 2012).

According to relevant research, many teachers believed that students' difficulties with HOTS questions resulted from a lack of familiarity with the subject matter (Altun et al., 2018). Teachers recommended that student evaluations include essays and contextual questions showing an understanding of appropriate question for measuring students' HOTS. However, another study found that mathematics teachers did not perform well in answering HOTS questions, often lacking clear procedures indicating a need for improved content knowledge (Retnawati et al., 2018). Teachers recognized HOTS' importance but had insufficient knowledge to improve students' HOTS, affecting student achievement (Altun et al., 2018; Stahnke et al., 2016).

Other research shows that using contexts like snacks and money can enhance the mathematical understanding of low-ability students in social arithmetic. These contexts can help teachers make learning mathematics more accessible and enjoyable for low-ability students (Hardini, Prahmana, Akib, & Shahrill, 2021; Silwana, Subanji, Manyunu, & Rashahan, 2021). Additionally, there was inconsistency in teacher responses when measuring and answering HOTS questions. Teachers stated that the problem-solving process should be the main focus of the HOTS assessment. However, many of them only provided final answers without explaining the process.

The phenomenological research method was effectively employed in this study enabling an in-depth understanding of teachers' experiences and perspectives in developing mathematics HOTS assessment instruments. This research is highly relevant to the challenges in Papua's education system addressing the need for culturally and contextually appropriate assessment instruments. However, the study's findings may have limitations regarding generalizability due to its focus on Papua's teachers. Therefore, the findings may not directly apply to different mathematical education contexts. Comparing the contexts used by Papua's teachers with those used by teachers in other regions of Indonesia or different countries could provide further insights into differences and similarities in mathematical teaching approaches. The research findings can be used to develop training materials for teachers in Papua and similar contexts aiming to integrate cultural contexts more effectively into mathematics instruction.

6. Conclusion

This study found that teachers primarily used daily life, scientific and social contexts to develop HOTS assessment tools, yet they did not integrate cultural contexts into their mathematics assessments. This indicates a lack of understanding among teachers regarding suitable cultural contexts for HOTS instruments and challenges

in integrating them into teaching and assessment practices. This gap underscores broader issues related to insufficient pedagogical knowledge of HOTS among teachers. The solution to this challenge involves initiatives to improve educational quality and literacy as well as comprehensive models of culturally contextualised HOTS instruments that teachers can use to construct and administer HOTS assessments. Future research should expand on these findings to enhance teachers' ability to integrate diverse contexts into HOTS assessments, thereby improving mathematics education in Indonesia.

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