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Mathematics Teachers' Design of Numeracy Task in Geometry and Measurement Content

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Abstract

Geometry and measurement affect our daily lives, both personal and sociocultural. Geometry is one of the contents in numeracy taught at every level of education. This study aimed to determine mathematics teachers' design of numeracy tasks using geometry and measurement content. Ninety-three math problems were collected from mathematics teachers in 31 Padang Pariaman districts, West Sumatra, Indonesia. Teachers were given problem-posing tasks and then asked to design numeracy tasks. To analyze, the tasks were classified as solvable or unsolvable and then further divided into context use level and cognitive process level domains. The numeracy context (personal, sociocultural, and scientific) was also analyzed. The study found that the tasks created had varying levels of context utilization, ranging from zero to second-order context. Most of the activities proposed were at the comprehension level, with just a tiny number designated as thinking functions in terms of cognitive processes. Some teachers' draft numeracy tasks in geometry content are discussed further.

Keywords Numeracy; Task Design; Geometri

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1. INTRODUCTION

Numeracy is the ability to deal with quantitative aspects of life. It is frequently thought to indicate mathematical or quantitative literacy (OECD, 2019)(Baron, 2015) (Steen, 2001). There are several components of quantitative literacy, such as having confidence in one's ability to use mathematics, understanding the nature and history of mathematics, as well as its significance for understanding public issues, applying logic to decision-making, solving real-world problems in a variety of contexts, possessing number and symbol sense, reasoning with data, and being able to use a variety of mathematical tools and prerequisite knowledge (Katrina, Crotts, 2014). Numeracy is an individual's capacity to create, apply, and understand mathematics in different situations (Yusfa Lestari, Abdur Rahman As'Ari, 2021)(OECD, 2017)(Sahidin & Sari, 2022). It demonstrates the importance of mathematics in daily life and cultivates critical thinking skills to create responsible citizens (OECD, 2017).

PISA's definition of numeracy strongly emphasizes students' capacity to design, solve, and comprehend mathematical issues in various contexts and analyze, reason, and effectively communicate ideas. Being numerate involves more than just learning the subject; it also involves using concepts, facts,

reasoning, and mathematical tools to solve issues in daily life (Genlott & Grönlund, 2016). To enhance their ability to compete and overcome obstacles in the twenty-first century, Indonesians need to become proficient in six fundamental literacy skills: (1) language literacy, (2) mathematical literacy, (3) science literacy, (4) digital literacy, (5) financial literacy; and (6) civic and cultural literacy. Completing these six literacies must be matched with critical thinking abilities in communication, cooperation, creativity, and problem-solving (Hartati et al., 2020). This should motivate all elements of education, especially teachers, to improve students' literacy skills at school, at home, and in the community.

One way to develop students' numeracy skills is for teachers to assign numeracy problems (Linuhung et al., 2023). Assignments used in numeracy focus on real-life problems outside situations or problems often discussed in class. Numeracy is needed for students to solve daily problems using mathematical reasoning to prepare themselves better for life's challenges (Stacey & Turner, 2015). This consists of the perspective of problem-solving, logical reasoning, communicating, and explaining. This thinking is developed based on mathematical concepts, procedures, and relevant facts (Westwood, 2021)(Hoogland, 2023).

Based on this, students' numeracy skills must be developed to prepare Indonesians for the challenges of the 21st century (Kemendikbud, 2020b). In addition, the role of educators becomes more critical in developing these skills through purposeful assignments and real-life problem-solving activities. Numeracy focuses on numeracy skills, emphasizing the importance of applying mathematical reasoning to everyday problems. The numeracy task design outlines a structured approach to developing mathematical thinking through tasks that reflect real life. This becomes particularly important to prepare students for practical challenges, ensuring they can transfer mathematical knowledge to various contexts. By comparing these perspectives, this research emphasizes the interconnectedness of numeracy skills in educational practice. The research highlights the need for teachers to design tasks that develop mathematical competence and integrate broader numeracy skills. This research will contribute to the field of education by providing an in-depth understanding of how numeracy skills can be effectively developed through purposeful teaching strategies, especially in designing tasks. These insights are essential for educators who aim to prepare students to meet the multifaceted demands of the 21st century.

The Three Key Aspects of Numeracy Task Design are content, context, and cognitive level (Ahyan et al., 2014). Assessing numeracy needs these three aspects (Sa'dijah et al., 2023). Considering these three aspects, teachers can design numeracy tasks that are comprehensive and challenging. The tasks improved students' mathematical understanding, critical thinking skills, and ability to connect math to the world around them.

Teachers should be involved in designing numeracy problem assignments with content, context, and cognitive level. According to (OECD, 2019), As the level increases, there is a more significant requirement to engage in cognitive processes such as generating mathematical issues, utilizing formal mathematical structures, and interpreting/evaluating mathematical outcomes within the context of the problem. Sequentially, the level of this cognitive process increases from the category of "understanding" tasks and "application" tasks to "reasoning" tasks (Kemendikbud, 2020a).

A context is used or intended to allow someone to work on a mathematical task. In most definitions of numeracy, the idea of contextualization, with phrases such as "real world" and "real context" (Ginsburg et al., 2006). Context is critical in numeracy because it fosters the development of thinking, skills, and methods that enable pupils to understand mathematical demands from life situations. Another important thing is content; geometry and measurement are some contents teachers should teach in numeracy. The idea of geometry is pervasive in everyday life. In addition to being close to everyday life and having enormous practical value, geometry provides opportunities to develop different types of reasoning skills. As with all numeracy content, a person in everyday life needs geometry concepts, and everyone cannot be separated from geometry concepts and applications (Elia

et al., 2018) (Ginsburg et al., 2006).

The cognitive component of numeracy includes problem-solving strategies that facilitate the connection between context and content. To solve numeracy challenges, pupils need a deep comprehension of the mathematical ideas or concepts related to the problem. To begin solving the problem, one must employ reasoning and logical thinking to analyze the relationships in the scenario and relevant concepts. The individual must then define the mathematical problem, devise a strategy to analyze the data, represent it effectively, and determine how to manipulate the numbers to obtain a practical solution. Mathematical processes refer to the actions humans take to link a problem's context with mathematics to solve it, together with the abilities that support these processes. The mathematical concepts intended for use in the assessment items—the setting in which the assessment items are situated (OECD, 2017).

The three most essential components of numeracy (Kemendikbud, 2020a) are content, context, and cognitive. Table 1 below shows the components of numeracy.

Table 1. Component Numeration

Content	Numbers	Representation, ordering properties, and operations of different types of numbers (integers, whole numbers, fractions, decimals)	
	Measurement and Geometry	Recognize two-dimensional figures and use volume and surface area in everyday life. Using standard units, it also assesses learners' understanding of the measurement of length, weight, time, volume and discharge, and area units.	
	Data and Uncertainty	Includes understanding, interpretation, and presentation of data and opportunities.	
	Algebra	Covers equations and inequalities, relationships and functions (including number patterns), and ratios and proportions.	
Context	Personal	Relating to personal self-interest	Aspects of life/situations for the content used
	Sociocultural	Relates to interests between individuals, cultures, and societal issues	
	Scientific	Relates to issues, activities, and scientific facts both conducted and futuristic.	
Cognitive Level	Understanding	Understand math facts, procedures, and tools.	The thinking process is required to be able to solve the problem.
	Application	Able to apply mathematical concepts in real situations that are routine	
	Reasoning	Reasoning with mathematical concepts to solve non-routine problems	

While the 21st-century numeracy model can be seen in Table 2.

Table 2. 21st Century Numeracy Model

Mathematical Knowledge	Context	Disposition	Tools	Critical orientation
Mathematical concepts and skills, problem-solving strategies, estimation capacity	The capacity to use mathematical knowledge in various contexts, both in and outside school.	Confidence and willingness to use mathematical approaches to engage with life-related tasks; readiness to use flexible and adaptive mathematical knowledge	Use of material (models, measuring instruments, representational (symbol systems, graphs, maps, diagrams, drawings, tables, ready-made recording devices) and digital tools (computers, software, calculators, internet) to mediate and shape thinking.	Use mathematical information to make decisions and judgments, add support, or criticize arguments.

The 21st-century numeracy model (Goos et al., 2011) can be seen in Figure 1 below.

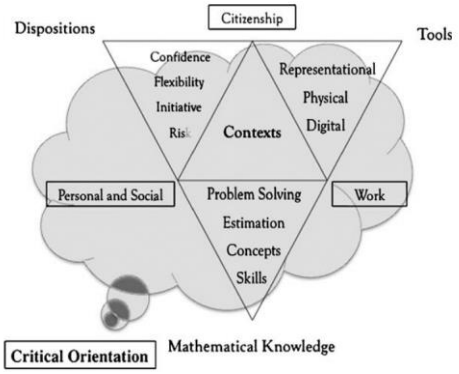


Figure 1. 21st Century Numeracy Model ((Goos et al., 2011)

A numeracy framework or model can be used to frame what we need to do to improve numeracy teaching and learning. Research using the model has been conducted in several studies, including (1) to analyze numeracy development in the South Australian school curriculum (Goos et al., 2012); (2) to support teachers' curriculum planning (Goos et al., 2011); and (3) to monitor the progress of teachers' comprehension of numeracy. (Goos et al., 2011). Many numeracy studies have focused on teaching and developing students' numeracy skills, including providing an overview of the nature of numeracy learning in grades K-7 (Beswick et al., 2008). There has not been much research on numeracy task design; some of the research has focused on training teachers in numeracy skill development and assisting teachers in designing numeracy tasks (Goos et al., 2013), helping teachers in developing numeracy tasks and testing them with students and seeing changes in their teaching practices (Liljedahl, 2015). This paper focuses on the design of teachers' numeracy tasks in geometry and measurement content, where the level of context use and cognitive level chosen by teachers in the task design will be evaluated. Mathematical knowledge should be applied in numeracy tasks. Mathematical knowledge in numeracy includes solving problems, understanding concepts and skills, and making logical predictions. (Zevenbergen, 2004). The ability to operate in and in the environment using mathematics is known as numeracy and numeracy tasks. There should be a variety of contexts for numeracy assignments (Cohen et al., 2001)(Situmorang et al., 2023). Using contexts from subjects other than mathematics in the

curriculum or from real life is possible. Teachers should be able to design numeracy tasks to improve numeracy skills, emphasize students' recognition of connections between the real world and mathematics, and improve the ability to transfer mathematics to other contexts (Lee et al., 2016)(Lei & Hu, 2020). To fulfill the criteria of appropriate numeracy tasks, teachers often struggle to design tasks rich in meaning and high in problem-solving ability; determining the cognitive level and originality of the task is essential in posing problems. The study aims to investigate teachers' task design: the level of context use (numeracy context) and the cognitive level of the task. This research needs to be conducted because teachers have an important role to contribute in helping pupils become more numerate. Developing numeracy skills is closely related to the design of tasks designed by teachers (Annisavitri et al., 2020). The purpose of this study was to investigate the design of tasks by teachers in the context of the use of numeracy and the cognitive level of the tasks. The study was conducted to understand how teachers design tasks that are rich in meaning and high in problem-solving skills, as well as to determine the cognitive level and originality of the proposed tasks. The important role of teachers in developing students' numeracy skills demands further study of their task design, which is expected to contribute to enriching the understanding of teachers' numeracy task design. This research is expected to provide concrete guidance on how teachers can improve their skills in designing tasks that are not only mathematically challenging but also relevant to students' real-life contexts. Thus, this research will make an important contribution to improving effective numeracy teaching practices in schools.

2. METHODS

In this study, the research method employed is qualitative with a descriptive approach. Descriptive analysis aims to portray a phenomenon, event, or situation that is currently occurring (Creswell, 2015).In this method, researchers strive to accurately depict the incidents or phenomena under study without manipulating or altering the existing data. The research procedure to obtain data is as follows: 1) Preparation: a preliminary study and instrument development; 2) Data Collection: teacher design numeracy task; 3) Data Analysis: research data reduction, reading through all the data, checking data validity, presenting the structure; 4) Conclusion: concluding. This study portrays the profile of teacher numeracy task design. A total of 93 numeracy tasks were created by 31 teachers (6 male and 25 female) from junior high schools in West Sumatra. These teachers needed to learn how to design numeracy tasks specifically. However, their basic knowledge of numeracy was asked, and the following descriptions of the subjects are shown in Table 3.

Table 3. Demographic Profile of Participants (n=30)

Demography	**n**
School Type	
Public School	26
Private School	5
Gender	
Male	6
Female	25
Teaching Experience	
0 – 5 years	4
5 – 10 years	5
10 – 15 years	10
15 – 20 years	9
20+ years	3
Professional Teacher Certificate	
Yes	24
No	7

The assumption is that every teacher has mastered the basic skills in designing mathematics tasks. These skills include the format of written tasks/questions, such as multiple choice, closed or open-ended tasks, and teachers already understand instrument analysis, how tasks are valid and accurate, and how to assess student answers. Teachers also know the cognitive levels and modify Bloom's taxonomy (Anderson et al., 2000), which will be used to create each math problem. The instrument was a problem-posing task where participants were asked to propose three numeracy tasks (closed or open-ended problems) using personal, sociocultural, and scientific contexts. Numeracy problems use real contexts, mathematical content, processes, and ways of working (Kieran et al., 2015). The problem-posing task is shown in Figure 1. Based on the task, the teacher develops three numeracy problems in personal, social, and scientific contexts.

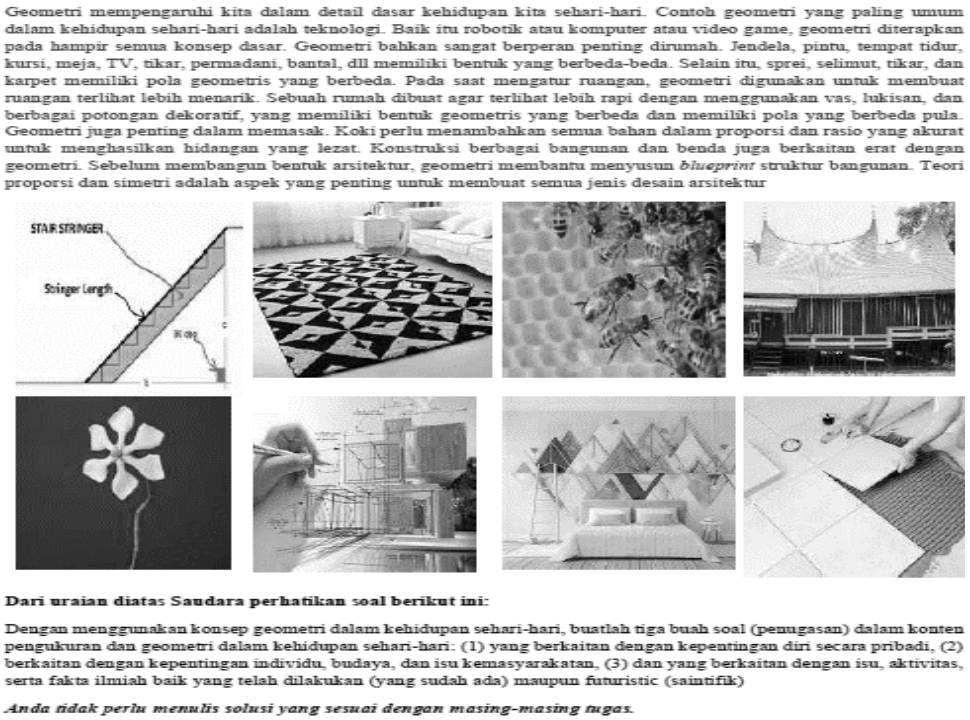


Figure 2. Geometry and Measurement Problem Posing Task

The teacher-created tasks are in two domains: context use and cognitive level. Each task was identified as solvable or unsolvable before labeling each task into these two domains. Unsolvable problems (tasks) contain unclear wording, essential things that need to be explained in the issue, or algebraic expressions that are too complex (Kwek, 2015). The analysis does not consider spelling and grammar as long as the sentence's meaning or task information is clear. Following this phase, the challenges identified as solvable were divided into two categories based on their analytical description, which is described in Table 4. Table 4 illustrates how much context is used during the mathematization process, determining the context used for each job item. The cognitive process level indicates the number of mathematical facts, concepts, and procedures used in problem-solving. Tasks at the comprehension level test students' fluency with mathematical concepts and abilities by asking them to recall facts, methods, ideas, and processes.

On the other hand, application-level activities require students to apply their knowledge and conceptual understanding of facts, relationships, processes, concepts, procedures, and methods in situations from everyday life. In addition, reasoning assignments demand that students evaluate information and data, draw conclusions, and apply their knowledge to novel contexts—some of which may be more complicated or unknown than others. As a result, this task could include multiple methods or techniques. In this study, three prominent aspects will be analyzed: first, how teachers use the context

level in designing tasks; second, the cognitive level of the designed tasks; and third, the 21st-century numeracy model used by teachers to design numeracy problems.

They are analyzing the degree of context use modified from (Salgado, 2016) as in Table 4.

Table 4. Level of Context Use

Level 0	Level 1	Level 2
Context gives the chance to act directly or draw conclusions directly from the math problem's instructions. Consequently, neither mathematical reasoning nor outcomes are interpreted depending on the problem's context.	Context is used to identify or select relevant information, variables, or relationships for the mathematical formulation of a problem. Also, context is used to determine the adequacy of mathematical results.	Context helps identify or locate relevant variables, presumptions, or connections for a problem's mathematical formulation. A mathematical answer or argument's suitability regarding the original problem is also evaluated in its context.

The level of cognitive processes in the numeracy task is analyzed in Table 5.

Table 5. Cognitive Level

Understanding	Application	Reasoning
Tasks can assess students' understanding of math facts, procedures, and tools.	Tasks can assess students' ability to apply mathematical concepts in routine real-life situations.	Tasks can assess students' reasoning on non-routine problems.

3. FINDINGS AND DISCUSSIONS

Of the 93 task items, 80 (86.02%) could be completed, while 13 (13.98%) could not. Since this study is only interested in tasks that can be solved, it only considers tasks that can be solved for further analysis. Furthermore, the solvable tasks will be categorized as numeracy tasks or not. If not, it will be classified as neglected, and the numeracy tasks will be analyzed further. Of the 80 tasks that can be completed, 60 numeracy tasks from the teacher are to be interpreted for cognitive level and use of context.

Table 6. Use of Context and Cognitive Level of Questions

	Level 0	Level 1	Level 2	Cognitive process level
Understanding	5 (8%)	19(32%)	2(3%)	26(43%)
Applying	8 (13%)	7(12%)	4(6%)	19(32%)
Reasoning	0(0%)	2(3%)	13(22%)	15(25%)
Context Level	13	28	19	60

The following describes the design of teacher numeracy tasks that can be completed related to the level of context use, and each of them will be explained at the cognitive level, and the 21st-century numeracy model.

Use of Context in Numeracy Tasks

a. Level 0

The following are numeracy problems in the context use category at level 0.

Rayya ingin melakukan *make over* pada kamar tidurnya. Rayya membeli karpet vynil motif kayu agar terlihat lebih estetetik. Pada aplikasi shoope harga karpet tersebut adalah Rp 65.000 perlembar dengan ukuran 60 cm x 10 cm. Hitunglah biaya minimum yang diperlukan Rayya jika ukuran kamarnya yang akan dipasang karpet vynil adalah 3 m x 4 m.

Translation: Rayya wanted to do a makeover on her bedroom. Rayya bought a wood motif vinyl carpet to make it look more aesthetic. On the shoppe application, the carpet price is Rp 65,000 per sheet with a size of 60 cm x 10 cm. Calculate the minimum cost Rayya requires if the length of her room that will be installed with a vinyl carpet is 3 m x 4 m.

Figure 3. Numeracy Tasks Related to Personal Interests

Based on the definition of level 0 context (Salgado, 2016), the problem can be considered to meet the criteria of level 0; the context is used to provide an opportunity to take direct action or make direct inferences from the instructions given in the math problem.

According to the numeracy component, in terms of context, the context that best fits the question is the personal context. This is because the question focuses more on an individual's decision to makeover their bedroom, which involves their preferences and interests. While there may be influences from social and cultural factors, such as interior design trends or interactions with others, the main focus remains on personal decisions and how they affect their interests and preferences. Based on the description of cognitive levels in numeracy problems, the above task can be classified at the application level.

This is because the task requires students' ability to apply mathematical ideas in everyday, real-life situations, such as calculating the room area and determining the number of pieces of carpet needed. Although the task also involves understanding basic mathematical facts and procedures, the required reasoning level may not be as complex as in this problem. So, in general, the task can be classified at the application level. In this task, students are expected to apply numeracy concepts in a real-world context. They must use their understanding of measurement (room area), mathematical operations (multiplication to calculate room area), and unit conversion (converting area from square meters to square centimeters) to solve the problem given in the problem. This includes their ability to identify and use relevant numerical information to solve practical problems. Thus, the task reflects the application level. In keeping with 21st-century numeracy, the task involves several aspects relevant to the various components of numeracy, including mathematical knowledge, context, disposition, tools, and critical orientation. Let us revisit the task from the perspective of each numeracy component:

Component	Description
Mathematical Knowledge	The task requires understanding basic math concepts and skills, such as area calculation, unit conversion, and multiplication. Students need to apply this math knowledge to solve the given problem.
Context	The problem is relevant to real life, where students are asked to install a carpet in a bedroom. The ability to use mathematical knowledge in various contexts, both in and outside of school, becomes relevant.
Disposition	Students need the confidence and willingness to use mathematical approaches to engage with tasks related to everyday life. They must also be ready to use mathematical knowledge flexibly and adaptively, especially in correctly calculating the number of carpets needed.
Tools	Students can complete this task using various materials and digital mathematical tools, such as tape measures, calculators, or area calculation apps. The use of these tools helps them mediate and shape mathematical thinking.

Component	Description
Critical Orientation	Students use mathematical information to make decisions (e.g., determining the number of carpets needed) and judgments (e.g., evaluating the total cost required). This reflects the use of a critical orientation to mathematical information.

The numeracy tasks designed by the teacher can be seen from several dimensions: context, mathematical knowledge, disposition, tools, and critical orientation. (Geiger et al., 2014)(Goos et al., 2013). The problem above corresponds to the problem-posing given and the mathematics content mentioned, namely measurement and geometry. The problem includes measuring room area and carpet requirements, which are part of measurement and geometry in everyday life. Students need to understand the concepts of length and area measurement and apply these measurements in the context of installing carpet in a bedroom.

b. Level 1

The following is a task that belongs to level 1 in Figure 4.

Keramik lantai kamar mandi dirumah Budi rusak, sehingga gambarnya seperti yang terlihat dibawah ini. Ayah ingin mengganti dengan keramik baru pada bagian keramik yang rusak saja. Jika keramik sebelumnya berukuran 30 cm x 30 cm dan keliling kamar mandi dirumah adalah 6 m. Setelah dihitung keramik yang rusak sejumlah 8 petak keramik. Pada saat ayah ke toko bangunan ternyata keramik ukuran 30 cm x 30 cm dengan motif dan warna senada tidak ada, namun hanya ada ukuran 20 cm x 20 cm. Ayah lalu membeli keramik ukuran 20 cm x 20 cm. Berapa jumlah keramik seminimal mungkin yang harus dibeli ayah jika pada lantai kamar mandi juga terdapat lubang saringan air berukuran 10 cm x 10 cm?

Translation: The bathroom floor tiles in Budi's house are damaged; the picture is below. Budi's father wants to replace it with new tiles on the damaged tiles that are damaged only. Suppose the previous tile is 30 cm x 30 cm and the home bathroom's perimeter is 6 m. After calculating, the damaged tiles are eight tiles. When Budi's father went to the building material stores, the tiles measured 30 cm x 30 cm with the same motif, and similar colours did not exist, but there were only 20 cm x 20 cm sizes. Father then bought 20 cm x 20 cm tiles. How many the minimum number of tiles must be purchased if the bathroom floor also has a water filter hole measuring 10 cm x 10 cm?

Figure 4. Numeracy Tasks Related to Personal Interests

Salgado says the context level used for this question is level 1. Level 1, because students need to identify relevant information and relate it to a personal situation (such as replacing bathroom tiles). Context is used to identify or select relevant information, variables, or relationships for the mathematical formulation of a problem. This question has a personal context because it involves a decision related to the house's owner, namely Budi's father, in replacing the broken bathroom floor tiles. This decision affects his interest in maintaining the condition of his home. This problem can be categorized at the cognitive level of understanding, where students are expected to identify relevant information (number of broken tiles, size of new tiles) and apply basic mathematical knowledge (area calculation, unit conversion) to solve the problem. This problem demonstrates the integration of various aspects of numeracy in a meaningful context, allowing students to develop their numeracy while solving real-world problems. If we relate it to the 21st-century numeracy model, associated with the question of teacher design, it can be described as follows:

Component	Description
Mathematical Knowledge	Students need to understand surface area measurement concepts, unit conversions, and the ability to perform basic math operations such as multiplication and division. They also need to use problem-solving strategies to solve the given problem.
Context	The problem provides a context for using mathematical knowledge in everyday life: replacing damaged bathroom floor tiles. Students are asked to apply math concepts in real situations at home.
Disposition	Students need to have the confidence and willingness to use mathematical approaches in solving problems related to everyday life. They should be ready to

Component	Description
	use mathematical knowledge flexibly and adaptively in different contexts.
Tools	In this problem, students may use tools such as a ruler or calculator to perform calculations and drawings or diagrams to visualize the concept of measuring surface area.
Critical Orientation	Students are expected to use mathematical information to make informed decisions, such as determining the number of ceramics needed, assessing the solutions they find, and whether they match the actual needs.

Thus, analysis of the question regarding the 21st-century numeracy model shows that it supports students' numeracy development by providing a real-world context, enabling them to use their mathematical knowledge in meaningful situations.

Some tasks classified as level 1 related to the scientific context are shown in Figure 5.

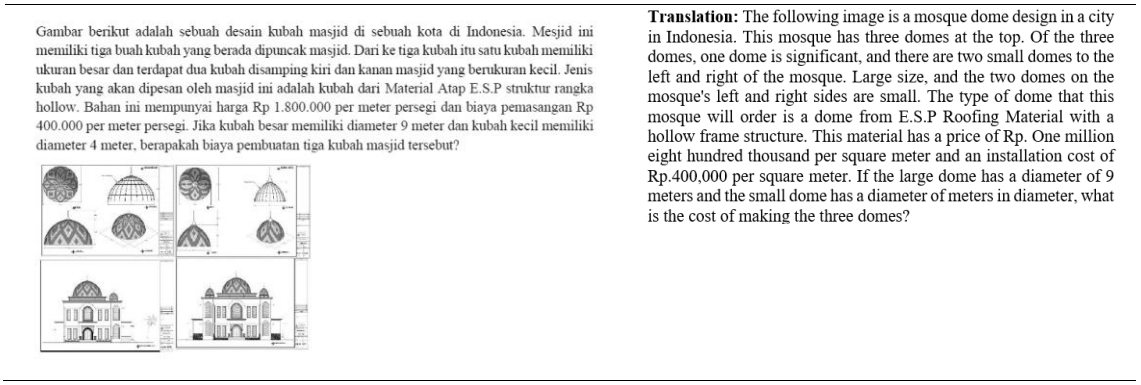


Figure 5. Numeracy Tasks Related to Scientific Contexts

According to (Salgado, 2016), this question falls into level 1 in context-level analysis. At this level, context is used to identify relevant information and determine the adequacy of mathematical results. In this problem, the context provides information about the design and specifications of the mosque dome that allows students to calculate the surface area of the dome and the manufacturing cost by considering the price of materials and installation costs.

The cognitive level of this problem is application; after understanding the context and relevant mathematical concepts, students then apply the concept to calculate the surface area of large and small domes and calculate the cost of making domes based on material prices and installation costs. Thus, the appropriate cognitive level is application because students are asked to apply mathematical concepts in a natural context to achieve the required solution. This context provides an actual situation that requires the application of mathematical concepts to solve the given practical problem. Thus, the context is about physical construction (architecture), which requires mathematical calculations to determine the cost of making a dome. However, in the problem of constructing a mosque dome, the context is more general and not directly related to the needs or experiences of a particular individual or group. Thus, the context of the problem may be more appropriately categorized as a scientific context.

In the 21st-century numeracy model, this task gives pupils the chance to practice several essential numeracy skills, like:

Component	Description
Mathematical Knowledge	Students need to use mathematical concepts, such as calculating the surface area of a circle, to solve this problem. They need to understand the concepts of diameter, radius, and the formula for the area of a circle (πr^2).

Component	Description
Context	This problem provides a natural context, namely manufacturing mosque domes with certain specifications. Students must be able to identify relevant information from the context and apply mathematical concepts to solve the problem.
Disposition	Students should be able to carefully interpret the design and specifications of the mosque dome, extract relevant information, and apply mathematical concepts accurately.
Tools	Tools might include calculators for performing calculations, diagrams or blueprints of the mosque domes for visual reference, and possibly software for modeling the dome if available.
Critical Orientation	Students need to analyze the information provided critically, determine the relevance and adequacy of the mathematical results, and ensure the cost calculation for materials and installation is accurate based on the given context.

c. Level 2

Some tasks belonging to level 2 related to the Sociocultural context (interests between individuals, culture, and societal issues) are shown in Figure 6.

Pada teras sebuah sekolah, akan dibuat keramik berpola. Diketahui ada 294 petak keramik lantai, yang terdiri dari 2 motif, keramik hitam dan putih. Keramik hitam ada 158 petak, serta keramik putih ada 136 petak. Keramik tersebut akan dipasang pada teras dengan lebar 7 keramik dan panjang 42 keramik. Sekolah ingin agar tukang memasang keramik tersebut dengan memperhatikan penyusunannya agar lebih menarik dipandang mata. Apakah mungkin bagi tukang untuk membuat pola geometri beraturan dalam memasang keramik teras tersebut?

1. Jika mungkin, bagaimana pola geometri beraturan tersebut? Coba gambarkan!
2. Jika tidak mungkin, coba kemukakan alasan mu!

Translation: On the terrace of a school, there will be tiled patterned tiles. It is known that there are 294 floor tiles, which consist of 2 motifs, black and white ceramics. There are 158 black tiles and 136 white tiles. The tiles will be installed on the terrace with a width of 7 tiles and a length of 42 tiles. The school wants the builder to install the tiles by paying attention to the arrangement to make them more attractive to the eye. Is it possible for the builder to make a regular geometric pattern when laying the tiles?

1. If possible, what is the geometry pattern? Draw it!
2. If it is not possible, tell us your reasoning!

Figure 6. Numeracy Tasks Related to Sociocultural Contexts

Salgado says this question is level 2, applying mathematical knowledge in that context to determine the possibility of creating regular geometric patterns. The content of the problem involves the concepts of geometry, measurement, and patterns. Students are asked whether a handyperson can create a typical geometric pattern in tiling a school patio. The context of the question is in a sociocultural context.

The context of this question is a school that wants to make patterned tiles on its terrace to create a more attractive appearance. This can be related to the sociocultural context where the arrangement of the physical environment, such as a school garden or terrace, has a significant aesthetic value. This question involves the application cognitive level. In this case, the arrangement and design of the school terrace is not only practically beneficial but also considers aesthetic and beauty values relevant to the social and cultural context in which the school is located. The problems place students in real-world situations where they are required to apply their understanding of mathematics to solve problems they face daily. This allows them to see the relevance of math in an accurate and helpful context (Adams, 2020)(Barwell et al., 2016)(Ojose, 2011)

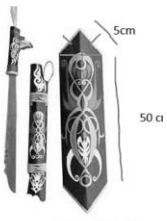
In answering this question, students will use the 21st-century numeracy model by applying their mathematical knowledge in a real-world context. They will consider possible patterns of regular geometry to meet the school's needs in creating an attractive display. Based on this analysis, this problem is an exercise that encourages students to apply their understanding of mathematics in a real-world context while developing problem-solving and geometric reasoning skills. Let us analyze the situation based on the 21st-century numeracy model:

Component	Description
Mathematical Knowledge	Students will use their knowledge of geometry, patterns, measurement, and possibly other basic math operations in solving this problem. They will need to understand the concept of regular geometry patterns and apply that knowledge in the context of installing ceramics.
Context	This problem is the school's need to create patterned tiles on its terrace to make it more attractive. This requires students to use their mathematical knowledge in a real-world context, specifically in creating the aesthetic look desired by the school.
Disposition	Students must demonstrate confidence and willingness to use mathematical approaches to solve life-related tasks, such as creating regular geometric patterns for school terrace tiles.
Tools	In answering this question, students might use tools such as pencils, paper, or other drawing tools to design regular geometry patterns. They may also use digital tools like drawing software to help visually create the pattern.
Critical Orientation	Students need to use the mathematical information they have to make decisions and judge the solutions they produce. They have to assess whether the geometry patterns they design meet the criteria desired by the school in creating an attractive display.

Based on this 21st-century numeracy model, students are expected to integrate their mathematical knowledge with real-world contexts, use relevant tools and technologies, and be cheerful about using mathematics in everyday life. This teacher-designed problem gives students the freedom to develop their solutions. Although the problem provides some clues as to what is being asked (whether it is possible to create a regular geometric pattern on the patio tiles), there is no definitive right or wrong answer. Students have the freedom to use their creativity and mathematical knowledge to design patterns that suit the preferences and needs of the school. As a result, students can demonstrate critical thinking, creativity, and the ability to apply mathematical knowledge in authentic contexts. (Geiger et al., 2015)(Ritter et al., 2020)(van Laar et al., 2017)

Other problems designed by teachers related to the sociocultural context at level 2, as shown in Figure 7.

Tari Punan Leto merupakan salah satu tari yang hadir dalam upacara Mecaq Undat atau panen yang berfungsi untuk memeriahkandan memiliki nilai penting di dalamnya yang dicontoh untuk masyarakat suku Dayak Kenyah Lepok Tukung Ritan. Tari Punan Leto adalah satu cara berkomunikasi dengan penonton melalui tarian yang memiliki simbol-simbol yang berhubungan dan memyangkut dalam kehidupan sehari-hari dari masyarakat pemiliknya. S yang terdapat pada tari Punan Leto dalam upacara Mecaq Undat memiliki peran dan mak masing-masing. Tari Punan Leto ada karena ada masyarakat yang membentuknya dari pol pikir mereka yang membuat simbol-simbol yang tergabung sehingga memiliki makna. Tari menggunakan berbagai propertis, salah satunya adalah perisai Dayak, seperti yang terliha gambar diatas. Sebuah Sanggar tari ingin membuat propertis perisai Dayak yang baru, unt orang penari. Berapakah luas minimum kayu yang dibutuhkan untuk membuat propertis ter



Translation: The Punan Leto dance is one of the dances in the Mecaq Undat cere harvest party. Ceremony that enlivens and has important values worthy of emulatio Dayak Kenyah Lepok Tukung Ritan tribe exemplary for the Dayak Kenyah Lepok Ritan tribe. Punan Leto's dance is one way of communicating with the audience throu with interconnected symbols related to daily life. Symbols that are interconnected an to the everyday life of the community that owns it. Symbols contained in the Punan Le in the Mecaq Undat ceremony have their respective roles and meanings. Punan Le exists because some people form it from the patterns of their thoughts that make symb in their daily lives. Patterns that make symbols that are combined so that they have This dance uses various properties, including the Dayak shield, as seen in the pictur A dance studio wants to make a new Dayak shield property for ten dancers. Dancers. What is the minimum area of wood required to make the property?

Figure 7. Numeracy tasks related to sociocultural contexts

In the problem above, the context is about traditional dances and the making of Dayak shield properties; context can be included in level 2. This is because the context of the problem is used as a source for defining relevant variables (for example, the number of dancers and the properties needed) and determining the adequacy of mathematical results (the minimum area of wood required). This problem is an application problem; it asks students to apply mathematical concepts in real situations.

They must use the concept of area to calculate the minimum area of wood needed to make the Dayak shield properties for ten dancers. In this case, students must use their knowledge of geometry to solve a practical problem given in the context of the culture and traditions of the Dayak Kenyah Lepok Tukung Ritan tribe.

The context of this question is sociocultural, as it discusses a tradition and cultural practice of the Dayak Kenyah Lepok Tukung Ritan community, which involves traditional dance as part of the critical Mecaq Undat ceremony or harvest party. The 21st-century numeracy model in the question:

Component	Description
Mathematical Knowledge	Students should understand the concept of area and the possibility of using geometry concepts to solve problems.
Context	This question places math in a real-life context, which helps students see math's relevance and application in culture and tradition.
Disposition	Students should be ready to use their mathematical knowledge to solve problems that arise in real situations.
Tools	In this case, students may need a ruler or other measuring device to measure the area of the property to be created.
Critical Orientation	Although not explicitly mentioned in the question, students may be asked to consider the quality or suitability of the new properties to the dance's needs and the Dayak people's culture. As such, it can help students develop their mathematical literacy by asking them to apply mathematical knowledge in relevant cultural and traditional contexts.

The design of teacher tasks at level 2 related to the scientific context (associated with scientific issues, activities, and facts, both existing and futuristic) is shown in Figure 8.

Perhatikan Gambar berikut!

Masjid Raya Sumatera Barat adalah masjid raya di provinsi Sumatera Barat yang terletak di Jalan Khatib Sulaiman, Kecamatan Padang Utara, Kota Padang yang memiliki luas sekitar 4.430 meter persegi. Konstruksi masjid terdiri dari tiga lantai. Ruang utama yang dipergunakan sebagai ruang salat terletak di lantai atas, memiliki teras yang melandai ke jalan. Denah masjid berbentuk persegi yang melancip di empat penjurunya, mengingatkan bentuk bentangan kain ketika empat kabilah suku Quraisy di Mekkah berbagi kehormatan memindahkan batu Hajar Aswad. Bentuk sudut lancip sekaligus mewakili atap bergonjong pada rumah adat Minangkabau *rumah gadang*. Di depan masjid raya terdapat taman berbentuk lingkaran dengan diameter 62 Meter. Banyaknya keluhan Jemaah bahwa penerangan yang redup dan minim cahaya dihalaman masjid menjadi bahan evaluasi bagi pengurus masjid raya sumbar, sehingga akan dipasang lampu untuk menerangi jalan didepan halaman masjid. Lampu akan dipasang mengelilingi bundaran taman, setiap tiang lampu berjarang 1,25 m. Jika upah memasang satu tiang adalah Rp 750.000, hitunglah biaya yang dikeluarkan untuk memasang lampu tersebut!

Translations: The West Sumatra Grand Mosque is prominent in the West Sumatra province, situated on Jalan Khatib Sulaiman, North Padang District, Padang City, and covers an area of approximately 4,430 square metres. The mosque is built on three levels. The main room, designated as a prayer room, is situated on the upper level with a terrace that descends to the street. The mosque's layout is square with curved corners, resembling the shape of the cloth stretched when the four Quraysh clans in Mecca jointly moved the Hajar Aswad stone. The curved corners symbolise the "gonjong" roof of the traditional Minangkabau house, known as "rumah gadang." There is a circular garden with a circumference of 62 metres in front of the mosque. The congregation's complaints about inadequate lighting and lack of light in the mosque courtyard serve as evaluation criteria for the management of Raya Sumbar Mosque. An assessment is needed to manage the Sumbar Raya Mosque and install lights illuminating the road in front of the mosque yard. The road is located in front of the mosque courtyard. Street lamps will be constructed around the garden, spaced 1.25 metres apart. The lamps are set 1.25 metres apart. To calculate the cost of installing the lights needed to install the lamp, multiply the cost of installing one pillar (Rp 750,000) by the number of lights required.

Figure 8. Numeracy Tasks Related to Scientific Contexts

This question can be categorized using level 2 context (Salgado, 2016). The context of the mosque, which provides information about the area of the building, the garden, and the problem faced by the

mosque management in terms of lighting the courtyard, is used to assess the adequacy of the mathematical results in solving the lighting problem. The context level is considered level 2 because, in the problem, the context is used to determine the adequacy of the mathematical results in solving the given problem.

The cognitive level of this problem is application because students are asked to apply mathematical concepts learned in real situations. They have to use the formula for the area of a circle to calculate the garden area, consider the distance between lampposts to determine the number of lights needed, and multiply the number of lights by the cost of installing the lampposts to calculate the total price. This process involves more than just understanding math concepts; students must apply their knowledge and skills in relevant practical situations.

The context used in this question is sociocultural because it involves a practical problem in the social environment, namely the need for adequate lighting in the mosque courtyard, which concerns the mosque management and the congregation. This question provides a clear context about the Great Mosque of West Sumatra, including its physical description, such as the building area, the number of floors, and the shape of the mosque plan. Such information helps students understand the situation given in the problem. The 21st century numeracy model includes the following:

Component	Description
Mathematical Knowledge	Students should know math concepts such as the area of a circle, area calculation, and cost calculation.
Context	This problem provides an accurate and relevant context where students have to apply math concepts in everyday situations, such as installing lights in the courtyard of a mosque.
Disposition	Students must demonstrate willingness and confidence to use mathematical approaches to solve practical problems.
Tools	Tools like calculators may be required to perform complex calculations.
Critical Orientation	Students must use mathematical information to decide the correct number and location of lights to ensure sufficient light in the mosque courtyard.

In this context, the sociocultural context of numeracy questions can be linked to contextualization theory in mathematics learning. This theory emphasizes the importance of providing relevant and meaningful contexts in mathematics learning where students can relate mathematical concepts to real-life situations. Teachers should facilitate students in solving problems in everyday life (Niswah & Qohar, 2020)(Kolar & Hodnik, 2021). By using the example of the mosque courtyard lighting problem, students learn about mathematical concepts such as the area of a circle and cost calculations and develop an understanding of the application of mathematics in practical daily contexts (She et al., 2018). The 21st-century numeracy model, in this case, includes several essential elements: necessary mathematical knowledge, relevant context, disposition to use mathematical approaches, use of tools such as calculators for complex calculations, and critical orientation in making decisions based on available mathematical information. By integrating contextualization theory and 21st-century numeracy models, this learning approach not only facilitates the understanding of mathematical concepts but also develops students' skills in solving practical problems by using mathematics as a tool for critical thinking and practical solutions (Geiger et al., 2015)

4. CONCLUSION

This study reveals that the majority of numeracy tasks designed by teachers are at the context use level with the following distribution: Level 0 (13 tasks), level 1 (28 tasks), and level 2 (19 tasks). More specifically, the analysis of the cognitive process level of these tasks shows that the majority of the tasks are at the comprehension level (26 tasks or 43%), followed by the application level (19 tasks or 32%), and the reasoning level (15 tasks or 25%). Most teacher-designed assignments were solvable and free from invalid assumptions, insufficient information, wrong wording, and inadequate information. Teacher-designed tasks are at the use of level 0, level 1, and level 2. Teachers tend to create numeracy

tasks at the application cognitive level. Teachers' contexts are already diverse, personal, sociocultural, and scientific. This research can bring another insight into the extent to which numeracy tasks designed by teachers meet the criteria of numeracy tasks regarding content, context, and 21st-century numeracy models. Limitations regarding methodology and sampling data need to be improved. Thus, more research is required, for example, by applying more sophisticated statistical procedures to investigate the correlation between the level of context use and the level of cognitive processes of the tasks created by teachers. The findings provide an overview of teachers' numeracy task design practices, focusing on the level of context use and associated cognitive processes. This research shows the importance of considering these aspects in developing relevant and effective school numeracy education.

REFERENCES

Adams, T. L. (2020). Mathematical Literacy. In *Mathematics Teacher: Learning and Teaching PK-12* (Vol. 113, Issue 4). https://doi.org/10.5951/mtlt.2019.0397

Ahyan, S., Zulkardi, & Darmawijoyo. (2014). Developing mathematics problems based on Pisa's level of change and relationship content. *Journal on Mathematics Education*, *5*(1), 47–56. https://doi.org/10.22342/jme.5.1.1448.47-56

Anderson, L. W., Krathwohl, D. R., & Bloom, B. S. (2000). *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. https://api.semanticscholar.org/CorpusID:61966728

Annisavitri, R., Sa'Dijah, C., Qohar, A., Sa'Diyah, M., & Anwar, L. (2020). Analysis of mathematical literacy test as a problem-solving ability assessment of junior high school students. *AIP Conference Proceedings*, *2215*(April). https://doi.org/10.1063/5.0000648

Baron, L. M. (2015). Financial Literacy with Families: Opportunity and Hope. *Journal of Urban Mathematics Education*, *8*(1). https://doi.org/10.21423/jume-v8i1a258

Barwell, R., Clarkson, P., Halai, A., Kazima, M., Moschkovich, J., Planas, N., Setati Phakeng, M., Valero, P., & Villavicencio Ubillús, M. (2016). Introduction: An ICMI Study on Language Diversity in Mathematics Education. In *New ICMI Study Series*. https://doi.org/10.1007/978-3-319-14511-2_1

Beswick, K., Swabey, K., & Andrew, R. (2008). Looking for attributes of powerful teaching for numeracy in Tasmanian K-7 classrooms. *Mathematics Education Research Journal*, *20*(1), 3–31. https://doi.org/10.1007/BF03217467

Cohen, P., Cuban, L., Ellis, W. J., Ewell, P., Hallett, D., & Kennedy, D. (2001). *Mathematics and Democracy*.

Creswell. (2015). *Creswell, J.W. (2015). Penelitian Kualitatif & Desain Riset Memilih Diatara Lima Pendekatan (Edisi Ke-3). Yogyakarta Pustaka Pelajar*. 2015.

Elia, I., van den Heuvel-Panhuizen, M., & Gagatsis, A. (2018). Geometry Learning in the Early Years: Developing Understanding of Shapes and Space with a Focus on Visualization. In V. Kinnear, M. Y. Lai, & T. Muir (Eds.), *Forging Connections in Early Mathematics Teaching and Learning* (pp. 73–95). Springer Singapore. https://doi.org/10.1007/978-981-10-7153-9_5

Geiger, V., Forgasz, H., & Goos, M. (2015). A critical orientation to numeracy across the curriculum. *ZDM - International Journal on Mathematics Education*, *47*(4), 611–624. https://doi.org/10.1007/s11858-014-0648-1

Geiger, V., Goos, M., & Dole, S. (2014). *Curriculum Intent, Teacher Professional Development and Student Learning in Numeracy BT - Mathematics Curriculum in School Education* (Y. Li & G. Lappan (Eds.); pp. 473–492). Springer Netherlands. https://doi.org/10.1007/978-94-007-7560-2_22

Genlott, A. A., & Grönlund, Å. (2016). Closing the gaps - Improving literacy and mathematics by ict-enhanced collaboration. *Computers and Education*, *99*, 68–80. https://doi.org/10.1016/j.compedu.2016.04.004

Ginsburg, L., Manly, M., & Schmitt, M. (2006). *The Components of Numeracy. National Center for the Study of Adult …,. December*. https://www.researchgate.net/publication/267565484

Goos, M., Dole, S., & Geiger, V. (2011). Improving numeracy education in rural schools: A professional development approach. *Mathematics Education Research Journal*, *23*(2), 129–148. https://doi.org/10.1007/s13394-011-0008-1

Goos, M., Geiger, V., & Dole, S. (2012). Auditing the numeracy demands of the middle years curriculum . *PNA. Revista de Investigación En Didáctica de La Matemática*, *6*(4), 147–158. https://doi.org/10.30827/pna.v6i4.6138

Goos, M., Geiger, V., & Dole, S. (2013). Designing Rich Numeracy Tasks. *Task Design in Mathematics Education*, *1*, 589–597.

Hartati, M., Ario, F., Nurhafni, Imayanti, R., & Andrian, Y. (2020). Panduan Gerakan literasi Sekolah di SMA Tahun 2020. *Kemendikbud*, *1*, 1–64.

Hoogland, K. (2023). The changing nature of basic skills in numeracy. *Frontiers in education*, *8*. https://doi.org/10.3389/feduc.2023.1293754

Katrina, Crotts. (2014). Assessing Quantitative Literacy in Higher Education: An Overview of Existing Research and Assessments With Recommendations for Next-Generation Assessment. In *Handbook of test development* (Vol. 34, Issue 2). https://doi.org/10.1002/ets2.12024

Kemendikbud. (2020a). AKM dan implikasinya pada pembelajaran. *Pusat Asesmen Dan Pembelajaran Badan Penelitian Dan Pengembangan Dan Perbukuan Kementerian Pendidikan Dan KebudayaanPembelajaran Badan Penelitian Dan Pengembangan Dan Perbukuan Kementerian Pendidikan Dan Kebudayaan*, 1–37.

Kemendikbud. (2020b). Desain Pengembangan Soal AKM [AKM Question Development Design]. *Jakarta: Kementrian Pendidikan Dan Kebudayaan, Pengembangan Dan Perbukuan*.

Kieran, C., Doorman, M., & Ohtani, M. (2015). *Frameworks and Principles for Task Design BT - Task Design In Mathematics Education: an ICMI study 22* (A. Watson & M. Ohtani (Eds.); pp. 19–81). Springer International Publishing. https://doi.org/10.1007/978-3-319-09629-2_2

Kolar, V. M., & Hodnik, T. (2021). Mathematical literacy from the perspective of solving contextual problems. *European Journal of Educational Research*, *10*(1), 467–483. https://doi.org/10.12973/EU-JER.10.1.467

Kwek, M. L. (2015). *Using Problem Posing as a Formative Assessment Tool BT - Mathematical Problem Posing: From Research to Effective Practice* (F. M. Singer, N. F. Ellerton, & J. Cai (Eds.); pp. 273–292). Springer, New York. https://doi.org/10.1007/978-1-4614-6258-3_13

Lee, K.-H., Lee, E.-J., & Park, M.-S. (2016). Task Modification and Knowledge Utilization by Korean Prospective Mathematics Teachers. *Pedagogical Research*, *1*(2). https://doi.org/10.20897/lectito.201654

Lei, H., & Hu, A. (2020). Designing a Rich Numeracy Task in Early Childhood Mathematics Education: Teaching Addition in a Kindergarten in Macao. *Studies in Social Science Research*, *2*(1), p1. https://doi.org/10.22158/sssr.v2n1p1

Liljedahl, P. (2015). Numeracy task design: a case of changing mathematics teaching practice. *ZDM - International Journal on Mathematics Education*, *47*(4), 625–637. https://doi.org/10.1007/s11858-015-0703-6

Linuhung, N., Purwanto, Sukoriyanto, & Sudirman. (2023). How Students Solve Pizza Problems: An Exploration Of Students' Mathematical Literacy. *Angewandte Chemie International Edition, 6(11), 951–952.*, *12*(November), 3573–3588. https://doi.org/AKSIOMA: Jurnal Program Studi Pendidikan Matematika Volume 12, No. 4, 2023, 357https://doi.org/10.24127/ajpm.v12i4.8997

Niswah, U., & Qohar, A. (2020). Mathematical Reasoning in Mathematics Learning on Pyramid Volume Concepts. *Malikussaleh Journal of Mathematics Learning (MJML)*, *3*(1), 23. https://doi.org/10.29103/mjml.v3i1.2400

OECD. (2017). PISA 2015 Mathematics Framework. *OECD Publishing*, 65–80.

Ojose, B. (2011). *Mathematics Literacy: Are We Able To Put The Mathematics We Learn Into Everyday Use?* https://api.semanticscholar.org/CorpusID:146305021

Ritter, S. M., Gu, X., Crijns, M., & Biekens, P. (2020). Fostering students' creative thinking skills by means

of a one-year creativity training program. *PLoS ONE*, *15*(3), 1–18. https://doi.org/10.1371/journal.pone.0229773

Sa'dijah, C., Purnomo, H., Abdullah, A. H., Permadi, H., Anwar, L., Cahyowati, E. T. D., & Sa'diyah, M. (2023). Students' Numeracy Skills in Solving Numeracy Tasks: Analysis of Students of Junior High Schools. *AIP Conference Proceedings*, *2569*(January). https://doi.org/10.1063/5.0113664

Sahidin, L., & Sari, T. I. (2022). Analysis of Mathematical Literacy in Solving PISA Problems Based on Students' Mathematical Ability. *AL-ISHLAH: Jurnal Pendidikan*, *14*(4), 5347–5362. https://doi.org/10.35445/alishlah.v14i4.1789

Salgado, F. A. (2016). Developing a Theoretical Framework for Classifying Levels of Context Use for Mathematical Problems. *Opening up Mathematics Education Research(Proceedings of the 39th Annual Conference of the Mathematics Education Research Group of Australasia)*, *1*, 110–117.

She, H. C., Stacey, K., & Schmidt, W. H. (2018). Science and Mathematics Literacy: PISA for Better School Education. *International Journal of Science and Mathematics Education*, *16*, 1–5. https://doi.org/10.1007/s10763-018-9911-1

Situmorang, G., Mulyono, B., & Susanti, E. (2023). Numeracy-Based Teaching Material with Data Presentation Topic to Support Students' Numeracy Skills. *Jurnal Matematika Kreatif-Inovatif*, *14*(2), 293–308.

Stacey, K. C., & Turner, R. (2015). *The Evolution and Key Concepts of the PISA Mathematics Frameworks*. https://api.semanticscholar.org/CorpusID:109886188

Steen, L. (2001). *Mathematics and Numeracy: Two Literacies, One Language*. https://api.semanticscholar.org/CorpusID:184215557

van Laar, E., van Deursen, A. J. A. M., van Dijk, J. A. G. M., & de Haan, J. (2017). The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in Human Behavior*, *72*, 577–588. https://doi.org/https://doi.org/10.1016/j.chb.2017.03.010

Westwood, P. S. (2021). Early Numeracy Development BT - Teaching for Numeracy Across the Age Range: An Introduction. In *Early Numeracy Development*. https://doi.org/10.1007/978-981-16-3761-2_2

Yusfa Lestari, Abdur Rahman As'Ari, M. M. (2021). Analysis of Mathematical Literacy in Solving PISA Problems Based on Students' Mathematical Ability. *MaPan: Jurnal Matematika Dan Pembelajaran*, *9*(1), 102–118. https://doi.org/https://doi.org/10.24252/mapan.2021v9n1a7.

Zevenbergen, R. (2004). Technologizing numeracy: Intergenerational differences in working mathematically in new times. *Educational Studies in Mathematics*, *56*(1), 97–117. https://doi.org/10.1023/B:EDUC.0000028399.76056.91