Minimum Competency Assessment: Designing Tasks to Support Students' Numeracy

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Abstract: Indonesia has introduced a new strategy on national assessment as a substitute for national examinations. Minimum Competency Assessment is used in national assessments to assess pupils' literacy. This assessment should be prepared by both students and teachers. However, few instructional methods, learning resources, and evaluation instruments based on Minimum Competency Assessment have been developed yet. Thus, the focus of this research is on designing task based on Minimum Competency Assessment in order to aid students' numeracy. The ADDIE methodologies were applied in this research and development study however the focus was on the analysis, design, and development phases. Literature study and observation were used to gather data. The findings reveal that the Minimum Competency Assessment framework aligns with the PISA framework, which includes content, context, and cognitive level. As a result, PISA characteristics could be used to construct the problems. In addition, this research produced three verified tasks: truss construction as a scientific context, utilization of empty space under the stairs as sociocultural context, and shortest path at the theme park as personal task. Each task consists of three questions in various cognitive level, namely understanding, application, and reasoning.

Keywords: Assessment, Minimum Competency, Numeracy

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1. Introduction

Mathematics is a branch of science that is closely related to other branches of science. The application of mathematics is also very important to use in everyday life. If you can connect real life with mathematics in the classroom, it can help improve students' attitudes towards mathematics (Duzenli Gokalp, 2020). Learning mathematics is an important part of development, because it allows students to master skills that are not acquired through other subjects (Larrain, Navarro, Buraschi, Torres, & Muñoz, 2018). Mathematics learning and the media used in learning are always changing to improve the quality of learning. Over the decades, passive teaching has slowly made way for more active learning (Pawa, Laosinchai, Nokkaew, & Wongkia, 2020).

PISA (Program for International Student Assessment) was created to test the academic ability of school children on average in each country. It is hoped that by using PISA benchmarks, each country can find out the quality of its education. One of the academic fields tested in PISA is mathematics, so that with PISA the quality of the abilities of students from each country in the field of mathematics can also be known, and can be compared. PISA data shows that in 2018 the mathematics score in Indonesia has decreased. In 2015 the mathematics score in Indonesia was 386, and it fell to 379 in 2018 (OECD, 2018). According to the Minister of Education and Culture, assessment PISA be input very valuable in the evaluation and improvement of the education system in Indonesia. One thing that is studied by The Ministry of Education is reform to the system of assessment.

The assessment is made to focus more on basic competencies. The results of the assessment will be reported for the improvement of classroom teaching and the formulation of education policies. The Minister of Education and Culture will replace the National Examination with the concept of Minimum Competency Assessment and Character Survey. The concept that will be used is an assessment that measure a minimum ability required by students. The determination of the Minimum Competency Assessment as a substitute for the implementation of the National Examination by the government (Pusat Asesmen dan Pembelajaran, 2020) is the background for the implementation of this research. It states that AKM is an assessment of the basic competencies of students in order to develop themselves and contribute to society (Pusat Asesmen dan Pembelajaran, 2020). Unlike the national examination which only emphasizes the mastery of cognitive ability, Minimum Competency Assessment aims to measure the competence that is more profound such as literacy and numeracy, not only a mastery of content.

Indonesia still has a long way to go in terms of time and spirit in order to continue battling at a higher level. Many things may be done by addressing flaws in the educational system, such as educator equity, access to education, and insufficient learning facilities (Fenanlampir, Batlolona, & Imelda, 2019). Many countries around the world have undergone enormous curriculum modifications, and it is suggested that the economic imperative is a major driving force behind these reforms (Coll, Dahsah, & Faikhamtac, 2010). Australia and English have implemented a curriculum concept that focuses on literacy and numeracy (H. Forgasz, Leder, & Hall, 2017; Groves, 2001; Miller, 2018). In the Australian curriculum, numeracy is included as one of seven general

capabilities that it is the responsibility of every teacher to develop in their students (Callingham, Beswick, & Ferme, 2015).

To support students in preparing for the minimum competency assessment, a task is needed to developed so that can be used to train students' abilities, especially modules that are specific to developing cognitive aspects of students. In the field of education, to understand how the whole process of integrating knowledge into new cognitive structures of students occur is fundamental to the success of Education (Catarreira, Lopes, García, & González, 2017) function found on the educational paths of individuals to contribute to the development of creative potential of students, their personal and professional skills which are required in the conditions of modern life and professional activities (Islamov et al., 2017).

Based on the problems described, the main objective of this study is to develop a cognitive process and context-based mathematics learning task in geometry material in junior high schools. To achieve these objectives, specifically and structured research objectives are formulated as follows: (1) analyzing the Minimum Competency Assessment on Geometry; (2) designing prototypes of mathematics task based on cognitive processes and contexts; and (3) developing the task to support students' numeracy.

2. Research Method

This study was carried out using a research and development design with the goal of developing a mathematics problem based on minimum competency assessment criteria to evaluate students' numeracy. Furthermore, the ADDIE methodology, which stands for analysis, design, development, implementation, and evaluation, was used to design this study. ADDIE is a framework for instructional systems design that many instructional designers and training developers use to create courses. This article focused on the steps of analysis, design, and development. The analysis step involved examining the current situation in terms of training, knowledge gaps, student characteristics, and so on. Begin with a series of questions to understand the current situation as well as the goal of the training itself. The design phase follows, in which all of the prior phase's learnings are applied to practical decisions. A plan, delivery methods, structure, duration, assessment, and feedback are all included. The next stage is to construct a storyboard and/or a prototype for the concepts. The development stage was now able to begin creating the modules. At this point, it will be substantially influenced by the prototype. Each course element should be produced in accordance with the design phase.

The analysis in the first phase focused on the framework of minimum competency assessment and material competency. The problem was then created with the feature of a minimum competency assessment. During the development phase, the tasks were created based on the context and cognitive processes, and then they were validated by four experts. This validation focused on content, layout, and language. Observations, interviews, documentation, and a questionnaire were used to collect data for this study. In this study, a focus group discussion (FGD) was also used as a supplementary data collection method. Flowcharts and descriptive comparisons were used to assess this data investigation qualitatively.

3. Findings and Discussion

The analysis phase, design phase, and development phase are the three key parts of this study. The framework of minimum competency assessment and basic competency, as well as the mathematical material for grade 8th Junior High School, were identified during the analytical phase. The assignment was then created using the component of minimum competency assessment as a guide. Experts validated the task once it was constructed based on the context and cognitive processes.

3.1.Minimum Competency Assessment on Geometry

The identification of minimum competency assessment was done by analyse the policy, rules, guidebook, and also the simulation of this assessment. The Minimum Competency Assessment and character survey in 2021 will be used as a substitute for the implementation of the national examination in Indonesia (Tohir, 2019). Minimum Competency Assessment consists of literacy skills, numeracy skills, and build up character education. This policy cannot be separated from the mathematical literacy score of Indonesian students which is still low according to PISA in 2019 (Handayu, 2020). According to The Ministry of Education, this assessment is expected to improve student learning outcomes, because it is designed to create information that can improve the quality of the learning process (Kemendikbud, 2020). The Minimum Competency Assessment is designed to assess not only content mastery, but also a variety of skills in reading and numeracy literacy, including systematic logical thinking skills, reasoning in the application of concepts and knowledge, and the ability to select and process information learned.

The Ministry of Education and Culture states that numeracy is the ability to think in using concepts, procedures, facts, and mathematical tools as an effort to find solutions to problems from various contexts and relevant to everyday life (Kemendikbud, 2020). Numeracy encompasses the knowledge, skills, behaviours and dispositions that students need to use mathematics in a various situations (H. Forgasz et al., 2017). Numeracy, also known as mathematical literacy or quantitative literacy, refers to the ability to use mathematical knowledge and skills critically in a given situation (Goos, Geiger, & Dole, 2014). The ability to "apply mathematics successfully to satisfy the general needs of life at home, in paid job, and for involvement in community and civic life" is referred to as numeracy(Muir, 2008). Numeracy was recognized to be distinct from, but supplementary to, literacy; it encompassed all parts of curriculum mathematics and was not restricted to working with numbers; and it encompassed all aspects of curriculum mathematics and was not limited to working with numbers (Callingham et al., 2015). Numeracy is the ability, confidence and willingness to engage with quantitative or spatial information to make informed decisions in all aspects of daily life (Mahmud, M. R., & Pratiwi, 2019). Therefore, it is hoped that the questions in the Minimum Competency Assessment are able to measure various content and contexts as well as at several cognitive levels.

Numbers, Geometry and Measurement, Data and Uncertainty, and Algebra are among the topics covered in the Minimum Competency Assessment. Numbers topic consist of representation, sequence features, and operations of numerous kinds of numbers (count, fraction, and decimal). Recognizing flat objects until employing volume and surface area in everyday life are examples of measurements and geometries. In addition, students' comprehension of weight, time, volume, discharge, and the usage of standard units for area will be assessed. Then, Data and Uncertainty topic covered understanding the interpretation and presentation of data and opportunity. Equations and inequalities, relations and functions (including numbers), and ratios and proportions are all covered in algebra. The PISA context questionnaire faces the challenge of providing information that is both up-to-date and stable (Jude, 2016). As an integral part of PISA from the beginning, the context questionnaires were designed to "provide a detailed basis for policy-oriented analysis of the assessment results (Jude, 2016)

Context of Minimum Competency Assessment involves personal, sociocultural, and scientific. Personal context has to do with one's own self-interest. Individual interests, culture, and society challenges are all part of the sociocultural framework. The scientific context refers to concerns, actions, and scientific truths that have already occurred as well as those that will occur in the future. Personal context relates to personal self-interest. The sociocultural context relates to the interests of individuals, culture, and societal issues. The scientific context relates to issues, activities, and scientific facts, both those that have been carried out and futuristic ones. Students must learn facts, procedures, and maths tools at the first level. Conceptual framework for identity as an embedder-of-numeracy consist of knowledge, affective, social, life history, and context (Bennison, 2015). A personal conception of numeracy was focussed on mathematical knowledge and context (Bennison, 2016). Moreover, mathematics literacy knowledge for teaching and cognisance of the contextual attribute demands in line with policy, as well as rigorous content knowledge with an emphasis on reflective practices (H. J. Forgasz & Hall, 2019). Then, on the application level, they should be able to apply mathematical concepts in everyday real-life circumstances. Finally, at the reasoning level, students are expected to answer non-routine issues utilizing mathematical principles and reasoning. Bloom emphasized the significance of providing children with lower-level information as a foundation for moving to higher levels of cognition (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956).

The framework of Minimum Competency Assessment is aligned with the PISA framework based on that identification. It is reasonable, given that the Minimum Competency Assessment policy was developed in response to Indonesian students' low PISA scores. Furthermore, the Minimum Competency Assessment aims to improve students' reading and mathematics literacy. Table 1 present the comparison of component of PISA framework and Minimum Competency Assessment framework.

Table.1. The Comparison of PISA and Minimum Competency Assessment Framework

Components	PISA Tasks Framework	Minimum Competency Assessment Tasks Framework
Content	• Change and Relationships • Space and Shape • Quantity • Uncertainty and Data	• Numbers • Geometry and Measurement • Algebra • Data and Uncertainty
Context	• Personal • Occupation • Societal • Scientific	• Personal • Sociocultural • Scientific

Components	PISA Tasks Framework	Minimum Competency Assessment Tasks Framework
Process	• Formulating situations mathematically • Employing mathematical concepts, facts, procedures and reasoning • Interpreting, applying and evaluating mathematical outcomes	• Understanding • Application • Reasoning

The Minimum Competency Assessment framework appears to be similar to the PISA, as seen in Table 1. The difference is that Minimum Competency Assessment has no occupation content. However, because the terms are similar, it might be placed in the sociocultural category. Furthermore, the PISA process was explained in detail in terms of the mathematical process that students use when solving mathematical tasks, but the Minimum Competency Assessment relates to cognitive taxonomy. As a result, the PISA problem can be used to construct tasks based on Minimum Competency Assessment. The PISA cognitive assessment framework is a consensus document that explains why it's important to comprehend country-level reading, math, science, and other creative literacy skills (Daroczy, Wolska, Meurers, & Nuerk, 2015).

It is not only determining the framework of Minimum Competency Assessment but also the basic competency based on the curricula and material during this analysis phase. Formative evaluation necessitates regular, repeated measurements by classroom teachers; measurement processes must be technically sound, rapid and easy to administer and understand, and produce relevant information about student performance in fundamental abilities (Thurber, Shinn, & Smolkowski, 2002). The focus of this study was on Geometry material in 8th grade junior high school. Each content in the Minimum Competency Assessment has its own indicator. There are two basic indicators in Geometry: (1) understanding the properties of plane figures and their relationships, as well as being able to apply the Pythagorean Theorem; and (2) calculating volume and surface area (blocks, cubes, triangular prisms, cylinders, and their composite shapes). Two-dimensional figure (2D shapes), Pythagorean Theorem, and three-dimensional figure (3D shapes) material are included in those indicators. Based on the basic competency of curriculum 2013, the most recent curricula in Indonesia, the material of two-dimensional figure in 7th grade, Pythagorean Theorem in 8th grade, and three-dimensional in 9th grade of Junior High School. As a result, the focus of this study was on developing assignments based on Pythagorean Theorem content. Table 2 present the basic competency of Pythagorean Theorem content on 8th grade of Junior High School, and also the indictor of Minimum Competency Assessment on Pythagorean Theorem material.

Table.2. The Basic Competency and Minimum Competency

Basic Competency on Cognitive	Basic Competency on Skills	Minimum Competency
Explain and prove the Pythagorean theorem and Pythagorean triples	Solve problems related to the Pythagorean theorem and Pythagorean triples	Understand the properties of plane figures and the relationship between plane figures, and also can to use the Pythagorean Theorem

The framework of Minimum Competency Assessment is aligned with the PISA framework based on that identification. It is reasonable, given that the Minimum Competency Assessment policy was developed in response to Indonesian students' low PISA scores. Furthermore, the Minimum Competency Assessment aims to improve students' reading and mathematics literacy. Table 1 present the comparison of component of PISA framework and Minimum Competency Assessment framework.

There are just two indicators on Geometry and Measurement in the Minimum Competency Assessment, despite the fact that there are eight materials on the basic competency linked Geometry topic in Junior High School. It demonstrates that the Minimum Competency Assessment really wishes to assess a student's competence that is at least owned by a student in dealing with, solving, and determining solutions. This assessment aims to see how well students comprehend the material provided in order to solve the problem or come up with an appropriate, creative, and inventive solution. The term for these abilities is known as literacy. According to Table 2, the minimum competency is only a minor part of the basic competency. Students are expected to understand and prove the Pythagorean Theorem as well as the Pythagorean triple. Meanwhile, pupils must apply the Pythagorean Theorem in the minimum competency. As a result, the task established for this study focuses on the basic competency, which is adjusted with a minimum competency.

3.2. Designing Minimum Competency Assessment-based Tasks

The analysis phase, design phase, and development phase are the three key parts of this study. The framework of minimum competency assessment and basic competency, as well as the mathematical material for grade 8th Junior High School, were identified during the analytical phase. The assignment was then created using the component of minimum competency assessment as a guide. Experts validated the task once it was constructed based on the context and cognitive processes.

As the task was design to introduce students with Minimum Competency Assessment, and also to support their mathematical literacy, then it was developed by Minimum Competency Assessment framework. The first, the task contain of one content. It was Geometry and Measurement, particularly on Pythagorean Theorem material. This material involves concept of Pythagorean theorem, Pythagorean triples, comparison of each side, and also the implementation. The task is divided into three contexts: scientific, sociocultural, and personal. Lastly, each task problem is made up of three questions, each with a unique cognitive level. They are the levels of understanding, application, and reasoning. Furthermore, because the goal of this exercise is to support students' numeracy, the given stimulus includes complex information, meaningful stories, interested knowledge, or daily problems. Students must first comprehend the text before explaining the rationale behind the linguistically challenging word problem and the development of math academic language and ways of explicitly addressing the linguistic complexity of word problems (Langer-Osuna, 2016). Thus, the task was designed in word problem that related to real-life. To gain a better understanding of the difficulty of word problems, it would be beneficial to modify such factors and their interactions using the isolated variation concept (Daroczy et al., 2015). In the teaching and learning of mathematics, mathematical tasks, including context-based tasks, play an important role (Kohar, Wardani, & Fachrudin, 2019), so that this task fulfil three kinds of the context, namely scientific, sociocultural, and personal context. The assessment grid was presented in Table 3.

Table.3. The Minimum Competency Assessment Grid on Pythagorean Theorem

Context	Theme	Cognitive Level	Questions
Scientific	Truss Construction	Understanding	Presented a picture of bridge truss construction with a certain size. Students are required to determine the minimum total size needed to make a bridge truss.
		Application	It is given a case of what would happen if a vehicle with certain height crossed the bridge. Students are asked to determine the bridge height and evaluate the problem.
		Reasoning	It is presented a picture roof truss construction. Students are instructed to build a roof truss that fit a specified size requirement.
Sociocultural	Utilization of empty space under the stairs	Understanding	It was a given a picture of bookshelf with the specified size. Students are asked to decide whether the available plywood material is sufficient to make the outer frame.
		Application	A case is presented that there is a customer who wants to make a similar shelf with some conditions. Students is instructed to design the bookshelf based on the request.
		Reasoning	Another case is given that the customer wants to put the television compartment. students are asked to decide how the right design.
Personal	Shortest Path at The Theme Park	Understanding	Given a map of theme park. Students are required to calculate the distance.
		Application	Based on the map given, students are asked to choose the shortest path.
		Reasoning	There are several destinations for the rides to be visited. Students are asked to determine the shortest path to be taken.

3.3. Developing Minimum Competency Assessment-based Tasks

Based on the previous design and the assessment grid, the development phase had beenproduced three problems with 9 questions. The problems were developed based on Minimum Competency Assessment framework on Pythagorean Theorem. The first problem related to Scientific content with truss construction theme. The second problem about sociocultural problem about utilization of empty space under the stairs. Meanwhile, the third is about shortest path at the theme park with personal content.

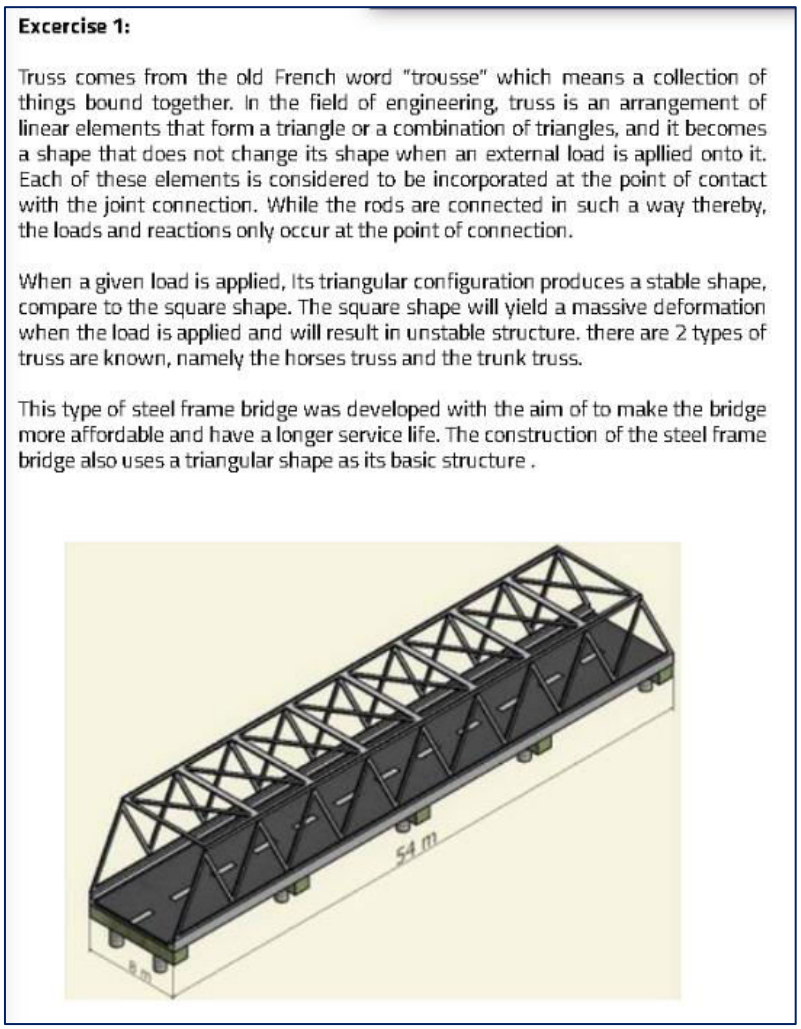

Figure.1. Problem 1 involves Scientific Context

The analysis phase, design phase, and development phase are the three key parts of this study. The framework of minimum competency assessment and basic competency, as well as the mathematical material for grade 8th Junior High School, were identified during the analytical phase. The assignment was then created using the component of minimum competency assessment as a guide. Experts validated the task once it was constructed based on the context and cognitive processes.

Figure 1 shows the stimulation of problem 1 about truss construction that used to build bridge, roof, and building structure. The stimulus shows about the truss definition, functions, types, and also the explanation why truss prefer to use triangle configuration than other shape. From this stimulation, students are expected to understand one of triangles' application in real life and processing the information to solve the problem. By providing the right stimuli, pupils may be able to improve their thinking ability. They would recognize the data information and analyze it to develop solutions by analysing the supplied stimulus. Stimulus in the form of problem could make students thinking deeply, furthermore, it helps students encourage their abilities of asking questions, and also their problem solving skills (hidayah, Pujiastuti, & Chrisna, 2016; Zamnah, Zaenuri, Wardono, & Sukestiyarno, 2021). The teacher must be able to present stimuli to the students so that they become accustomed to observing, questioning, gathering knowledge, reasoning, and communicating in order for the students' thinking abilities to grow (Kurniasih, Hidayah, & Asikin, 2019).

A picture of bridge truss construction with a certain size is presented to make it easier for students to imagine the problem. Then, students are required to determine the minimum total size needed to make a bridge truss. This question is in understanding level as students do recognize information, ideas, and principles in the form in which they were learned. This is a basic question for students before they solve the next complex problems. The use of factual questions can be defended on the grounds that students need to know certain basic information before they can engage in higher order thinking (Assaly & Smadi, 2015). At the next question, students are asked to evaluate a case and make a decision. The question is "Can a truck carrying a 4.5 meters cargo pass through the bridge?". This question involves to implementation level, where it was needed to calculate the bridge height, then they need to analyse whether a truck with certain cargo can pass through the bridge or not. Based on that activity, students need use their ability to use the given data and principles to solve the problem, namely determining the bridge heights. After that, students analyse the case and justify the solution. This activity could involves numerate, as it takes a critical orientation in order to evaluate their results and information presented to them (Bennison, 2016).

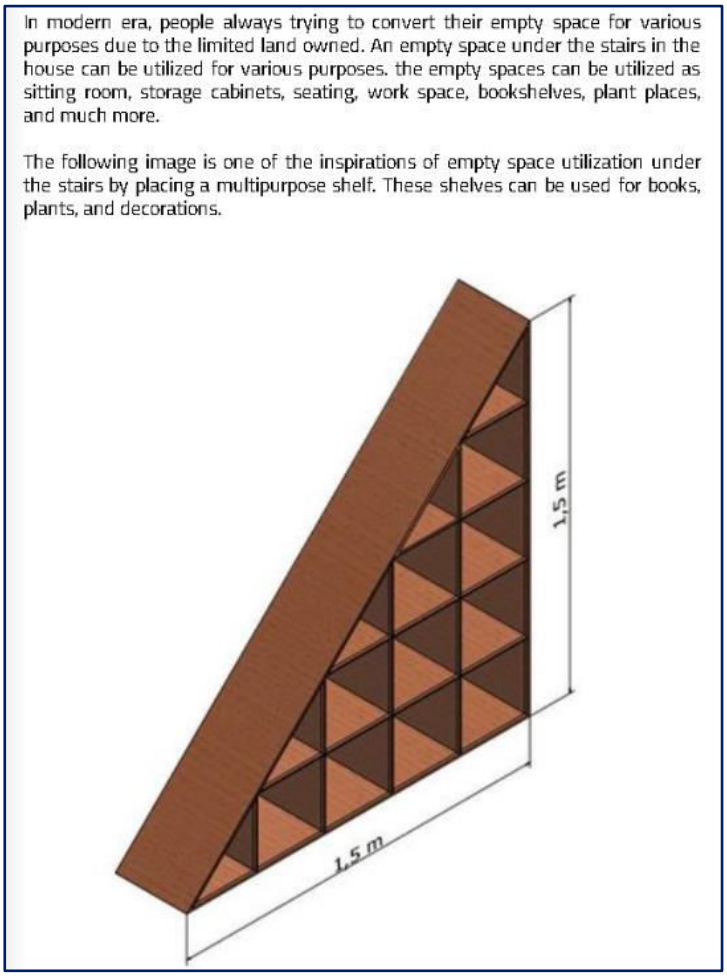

Figure.2. Problem 2involves Sociocultural Context

The figure 2 presents the sociocultural problem that is related to real-life. People in recent era tend to utilise their own space as optimal as possible. Students were asked to design an interior for optimizing the space. The first case is related to a customer who wants to make a similar shelf with limited material. Students is instructed to design the bookshelf based on the request. To solve this problem, students need to analyse whether the size of the bookshelf they want, and the size of the material. If students do not think carefully, they just apply the formula to get the appropriate bookshelf design. Even though, students need their critical thinking ability and reasoning to calculate the limited material in real situation. This condition is kind of numeracy where people can implement what they got from the information and process it to real-life situation. The inclusion of tools explicitly acknowledged the use of technology in today's society, extending the notion of numeracy (Geiger, Goos, Dole, Forgasz, & Bennison, 2013). Literacy is best defined as a collection of social activities inferred from events mediated by written texts (Perry, 2012). In addition, The literacy framework is organised around five domains of influence (knowledge, affective, social, life history and context) and includes characteristics that evidence from the literature suggests greatly impact on this particular situated identity (Bennison, 2015).

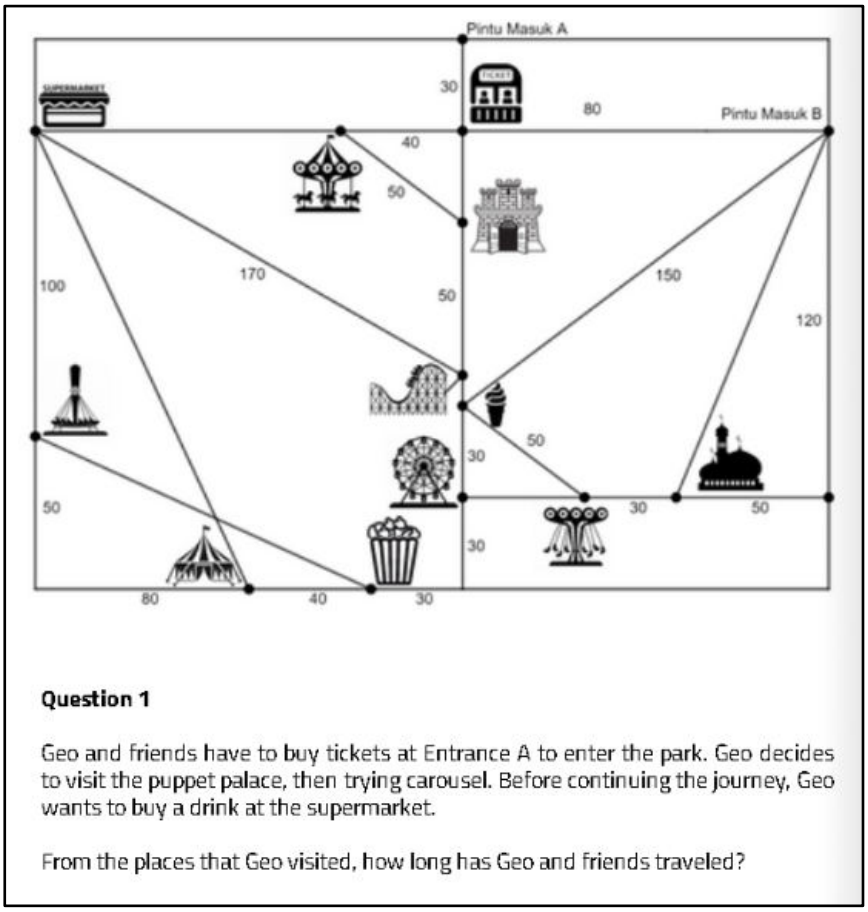

Figure.3. Problem 3involves Personal Context

It can be seen in Figure 3 that there is a map of theme park. In this part, the task was developed on personal context related to determine the shortest way. Personal context is nearest situation with students' real life, so that this context supposed to be easy for students to understand and processing the data. At the first question, student need to calculate the distance of some rides that they want to go. This problem is initial step of implementation the mathematical concept related to real-life, before facing the complex problems. By including personal context to the problem, student would understand that mathematical concept is exist in daily life. Students can learn about increasing their understanding of mathematical ideas by working through situations that have been carefully selected and apply mathematics to solve real-world difficulties (Zamnah et al., 2021).

Even this is a real-life-based problem, the questions provide students to use their thinking ability. The second question requires students to determine the shortest path to reach the destination. Meanwhile, students are asked to make a plan when visiting the theme park with some rides by considerate the shortest way. Those two questions really near with student daily life, when they have to go some places but they need to get the destination as soon as possible, they could use this mathematical concept. Based on that two question, firstly, students are required to use their critical thinking to determine the shortest path. This activity involves numeracy. Based on Geiger, a model of numeracy included mathematical knowledge at its heart, and took account of contexts, dispositions, critical orientation and tools (Geiger et al., 2013). Secondly, students also need to be creative to organize a planning so that they could enjoy their destination in effective way. Determining a plan is such an open-ended activity where student feel free to develop their creativity and become meaningful. The design of open-ended mathematics tasks and on encouraging a classroom context with shared authority such that students had the opportunity to engage meaningfully with one another's mathematical ideas (Langer-Osuna, 2016). Moreover, It suggests that teachers use problem presenting, numerical exploration, and open-ended tasks to help pupils develop their thinking abilities in mathematics (Kurniasih et al., 2019).

4. Conclusion

The findings reveal that the Minimum Competency Assessment framework aligns with the PISA framework, which includes content, context, and cognitive level. As a result, PISA characteristics could be used to construct the problems. In addition, this research produced three verified tasks: truss construction as a scientific context,

utilization of empty space under the stairs as sociocultural context, and shortest path at the theme park. Each task consists of three questions in various cognitive level, namely understanding, application, and reasoning.

5. Recommendation

Minimum Competency Assessment that was developed by Indonesian Government means to increase students' literacy. PISA framework could be reference to develop the task on Minimum Competency Assessment involves the content, context, as well as the cognitive process.As the literacy and numeracy have an essential role for students, it is necessary to develop another learning tools such as media, module, worksheets, and teaching materials based on the characteristics of Minimum Competency Assessment.

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