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COVID-19 Context in PISA-Like Mathematics Problems

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Abstract

This development research aims to produce PISA-like mathematics problems with quantity content using a valid and practical COVID-19 context and to investigate the potential effect of these problems on mathematical literacy skills. This research employed a development research design with two stages: preliminary and formative evaluations. This study also employed the Lesson Study Learning Community (LSLC) system in the process of development and implementation. This study involved eighth-grade students aged 13-15 years at SMP Negeri 19 Palembang. The data were collected using walk-through, document, observation, interview, and test techniques. This study produced 6 units and 12 items of PISA-like mathematics problems with several content characteristics of the COVID-19 context, including working, personal, and social contexts and levels that agree with the 2018 PISA framework; and competence processes, such as mathematical literacy skills and standardized linguistic skills that can be applied and interpreted by students. To conclude, the developed PISA-like mathematics problems are valid and practical and potentially affect mathematical literacy skills and learning to confront life skills during the COVID-19 pandemic.

Keywords: Development Research, PISA, LSLC, COVID-19 Context

Abstrak

Penelitian ini merupakan penelitian pengembangan bertujuan untuk menghasilkan soal matematika tipe PISA dengan konten quantity menggunakan konteks COVID-19 yang valid dan praktis serta memiliki efek potensial soal terhadap kemampuan literasi matematika. Metode yang digunakan dalam penelitian ini adalah design research dengan tipe development studies dengan dua tahap, preliminary dan formative evaluation. Penelitian ini juga menggunakan sistem Lesson Study Learning Community (LSLC) dalam proses pengembangan maupun implementasinya. Penelitian ini melibatkan siswa kelas VIII SMP Negeri 19 Palembang yang berusia 13-15 tahun. Teknik pengumpulan data yang digunakan adalah walk-through, dokumen, observasi, wawancara, dan tes. Pada penelitian ini dihasilkan 6 unit dan 12 butir soal matematika tipe PISA dengan karakteristik konten bilangan, konteks COVID-19 yang meliputi konteks pekerjaan, pribadi dan sosial, level yang sesuai dengan framework PISA 2018, kompetensi proses yaitu kemampuan literasi matematika, penggunaan bahasa yang sesuai dengan standar bahasa, dapat diterapkan serta diinterpretasikan dengan baik oleh siswa. Sehingga, dapat disimpulkan bahwa soal matematika tipe PISA yang dikembangkan valid dan praktis serta memiliki efek potensial terhadap kemampuan literasi matematika dan memiliki kecakapan hidup dalam menghadapi masa pandemi COVID-19.

Kata kunci: Penelitian Pengembangan, PISA, LSLC, Konteks COVID-19

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INTRODUCTION

Mathematical literacy is a pivotal ability in the globalization era because it can help students understand the role or benefits of mathematics in life (Syawahid & Putrawangsa, 2017; OECD, 2019a; Zulkardi, Putri, & Wijaya, 2020). In addition, in 2019, the Ministry of Education and Culture established a new policy called independent learning which discusses the 2021 minimum competency assessment

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(MCA) as a national assessment for mathematical domains; one of which is mathematical literacy skills. However, Indonesian students still have relatively low mathematical literacy skills because the results of the 2018 PISA survey show that Indonesia ranks the 72nd of 78 countries with a score of 379 (OECD, 2019b). One of the difficult contents in mathematical literacy at PISA is the quantity, the students show that they still have relatively low competence in it and have difficulties in solving PISA questions in quantity content, especially at levels 4, 5, and 6. These difficulties occur because they could not understand the problem and change real situations into mathematical situations Students could not solve problems because they do not have good reasoning abilities (Wulandari & Jailani, 2018; Noviana & Murtiyasa, 2020).

The lack of PISA-like mathematics problems in textbooks and the unavailability of specially designed questions that match students' potentials and characters have made them not accustomed to solve PISA-like mathematics problems (Nizar, Putri & Zulkardi, 2018; Murtiyasa, Rejeki & Setyaningsih, 2018). Whereas PISA-like mathematics problems are very necessary for classroom learning activities to train students to solve PISA-like mathematics problems; thus, they can improve their literacy skills in learning activities, such as the mathematization process (Nusantara, Zulkardi, & Putri, 2020a), reasoning, argumentation (Nusantara, Zulkardi & Putri, 2020b), representation (Efriani, Putri, & Hapizah, 2019), and communication (Nizar et al., 2018). In this regard, Pratiwi, Effendi, and Ummah (2020) state that designing and implementing PISA-like mathematics problems in learning activities are pivotal because the designed problems adopt familiar contexts to help students easily understand them. This shows that PISA-like mathematics problems using familiar contexts will train students to solve the problems.

The context-based Realistic Mathematics Education Approach (PMRI-in Bahasa) determines that PISA-like mathematics problems are appropriately used in learning (Jannah, Putri, & Zulkardi, 2019; Zulkardi et al., 2020). One of the characteristics of PMRI is the students' contribution which enables them to actively construct their knowledge in solving a problem (Dewi, Putri, & Hartono, 2018). Students' contribution is very relevant to a collaborative strategy which becomes the framework for 21st-century skills (Battelle for Kids, 2019). This collaborative strategy can be implemented through the Lesson Study Learning Community (LSLC) system (Sato, 2014; Octriana, Putri, & Nurjannah, 2019; Estrella, Zakaryan, Olfos, & Espinoza, 2020). Moreover, this collaborative strategy can be integrated with the effective use of ICT into an appropriate learning process that consists of synchronous and asynchronous learning and agrees with government policy, namely the distance learning, to deal with the COVID-19 pandemic.

This research was conducted to investigate the distance learning mode stipulated by the Minister of Education and Culture (MoEC) Number 4 of 2020 concerning the COVID-19 pandemic handling. The right strategy for the distance learning mode is the blended learning method because it can integrate effective use of ICT into a suitable learning process consisting of synchronous and asynchronous learning.

Several studies have investigated the development of PISA-like mathematics problems in various contexts, such as the Jambi context (Charmila, Zulkardi, & Darmawijoyo, 2016), the sailing context (Efriani et al., 2019), the Asian Games context (Putri & Zulkardi, 2020), the COVID-19 pandemic context (Nusantara, Zulkardi, & Putri, 2021), the physical distancing context (Nusantara et al., 2020b), and the Arab context (Turidho, Putri, Susanti, & Johan, 2021). Freudenthal (Bakker & Wagner, 2020) argues that a popular phenomenon and a hot issue in life can be used to attract students' interest in learning mathematics.

The researchers are interested in developing PISA-like mathematics problems using the COVID-19 context. Therefore, this research employed the COVID-19 contexts due to three reasons. First, most students have experienced the COVID-19 pandemic. Second, the COVID-19 pandemic is currently popular and a hot issue. Third, students could understand important things to deal with the pandemic, such as knowing the rules for social distancing, making hand sanitizers, and producing masks. This research aims to develop valid and practical PISA-like mathematics problems on quantity content using COVID-19 contexts that potentially affect students' mathematical literacy skills.

METHODS

This research employed the development research design to produce quantity content of PISA problem using a valid and practical COVID-19 context that affects students' mathematical literacy skills. This study involved eighth graders aged 13-15 years at SMP Negeri 19 Palembang. This study consists of two stages to develop the items: the preliminary and formative evaluation stages (Bakker, 2018).

This research employed the LSLC system in its development and implementation processes which consist of four stages. First, the planning stage included the preliminary, self-evaluation, expert reviews, and one-to-one stages. Second, the do stage included small groups and field tests. Third, the observation or reflection stage is an evaluation activity carried out after the learning process. Finally, the redesign stage refers to the process of revising the prototype at each stage.

In the preliminary stage, the researcher reviewed some literature used to design PISA-like mathematics problems, content quantity in the COVID-19 context, and all necessary instruments. Moreover, the researchers discussed PISA-like mathematics problems designed with the help of colleagues in a collaborative manner. In addition, validity and reliability tests were also carried out using SPSS to empirically explore the validity and consistency of the developed questions. This validity and reliability test involved 26 students of grades VIII.4-VIII.7 at SMP Negeri 19 Palembang.

The formative evaluation stage comprised self-evaluation, expert review, one-to-one, small group, and the field test. First, at the self-evaluation stage, the researchers evaluated and reviewed all the designed instruments by considering the results of collaboration between colleagues and further evaluation. Then the researchers revised the evaluation results to produce prototype I. Second, the revised results from prototype 1 will be simultaneously validated by expert reviews and a one-to-one stage. This stage validated three aspects of prototype I, namely content, constructs, and language. This validation involved three experts: a Mathematics Education lecturer of Universitas Ahmad Dahlan, a Mathematics Education lecturer of Universitas Singaperbangsa Karawang, and an alumnus of Doctoral Degree in Mathematics Education of Universitas Sriwijaya. Meanwhile, the one-to-one review was conducted to assess prototype I by involving three students of class VIII.3 who had high, medium, and low abilities. The results of the expert review and one-to-one stage were combined and used to revise prototype I and produce prototype II. Third, the small group stage involved eight students of class VIII.1 to review the practicality of the developed PISA-like mathematics problems and revise prototype II to produce prototype III. Finally, the field test stage involved 27 students to examine the potential effects of the developed PISA-like mathematics problems on the students' mathematical literacy skills.

The data collection techniques of this research were walkthrough, observation, interview, and test. The collected data were then analyzed qualitatively. An item was considered valid referring to the results of expert review validation on content, constructs, and language as well as the results of the one-to-one stage on the students' work. Meanwhile, the practicality of the questions was determined by unlucky items that were easily used, could be administered, and were possibly interpreted by the students. These items were the results of small group trials. Meanwhile, the potential effects of the PISA-like mathematics problems were revealed by analyzing the results of the field test trials.

Furthermore, validity and reliability tests were quantitatively carried out using SPSS to gain additional empirical data. PISA-like mathematics problems are considered empirically valid if the calculated correlation value is higher than the correlation value in the table. PISA-like mathematics problems are considered empirically reliable if the Cronbach alpha value is greater than 0.6 (Ghozali, 2011).

RESULTS AND DISCUSSION

This study resulted in six units and 12 items of PISA focused on quantity content within the COVID-19 context. However, the researcher made hand sanitizer unit as representations of the development process. This research developed the questions using a research design with a development study type. The stages of implementation are as follows

Preliminary

In the preliminary stage, the researcher conducted a literature study, reviewed the flow of problem development, and analyzed several articles developing PISA-like mathematics problems. Based on this literature, this research has a different focus from the previous research focus because this study has trained students to work on PISA-like mathematics problems in classroom learning.

In this study, the learning process was conducted to train and c students with solving PISA-like mathematics problems by applying the Lesson Study for Learning Community (LSLC) system and the PMRI approach in the learning process. The research subjects were selected based on these two criteria. At the curriculum analysis stage, the researcher analyzed learning materials based on the curriculum which included quantity content, such as topics of integer operations and comparisons. Furthermore, the researchers analyzed the PISA problems released by the OECD as the basis for developing PISA-like mathematics problems using quantity content in the COVID-19 context. The reference questions and developed questions of this study are summarized in Figure 1.

Original PISA	**MATHEMATICS UNIT 16: BOOKSHELVES** **QUESTION 16.1** To complete one set of bookshelves a carpenter needs the following components: 4 long wooden panels, 6 short wooden panels, 12 small clips, 2 large clips and 14 screws.  The carpenter has in stock 26 long wooden panels, 33 short wooden panels, 200 small clips, 20 large clips and 510 screws. How many sets of bookshelves can the carpenter make? Answer: ....
Developed PISA	Hand sanitizers are currently an important ingredient in the Covid-19 virus outbreak, making them scarce and their prices skyrocketing. This hand sanitizer functions as an antiseptic that can kill viruses or bacteria that stick to our hands. To make hand sanitizer based on WHO standards, one 1 liter bottle requires the following ingredients: Alcohol 96% as much as 840 ml H_2O_2 3% as much as 40 ml Glycerol 98% as much as 15 ml Aquadest as much as 60 ml Question : A person has a stock of 6,000 ml of Alcohol, H_2O_2 300 ml, 120 ml Glycerol and 430 ml Aquadest. How many bottles of Handsanitiser can he make?

Figure 1. Original PISA and Developed PISA on quantity content

Figure 1 shows that the reference question refers to the 2009 PISA problem. The question asks how many bookshelves can a carpenter make. Furthermore, the researchers blindly paraphrase the question by changing the picture and reformulating the problem into different aspects adopted from the Bairac method. This change results in a PISA-like mathematics problem within the COVID-19 context. This question asks how many bottles of hand sanitizer can be made from available materials based on the WHO standards. The purpose of developing this question is to inform students about the importance of hand sanitizers which are easily made by utilizing available materials.

Then, the researchers discussed the designed PISA-like mathematics problems with two peers by considering the LSLC principles on WhatsApp (Octriana et al., 2019). Furthermore, the validity and reliability tests were performed on 26 students of class VIII.4-7 at SMP Negeri 19 Palembang. The validity test aims to review the validity of the PISA-like mathematics problems developed from an empirical perspective. Meanwhile, the reliability test aims to examine the consistency or reliability of the developed PISA-like mathematics problems. The validity and reliability tests were analyzed using SPSS to quantitatively explore the validity of the developed questions. The correlation of 12 items in the validity test is presented in the following Figure 2.

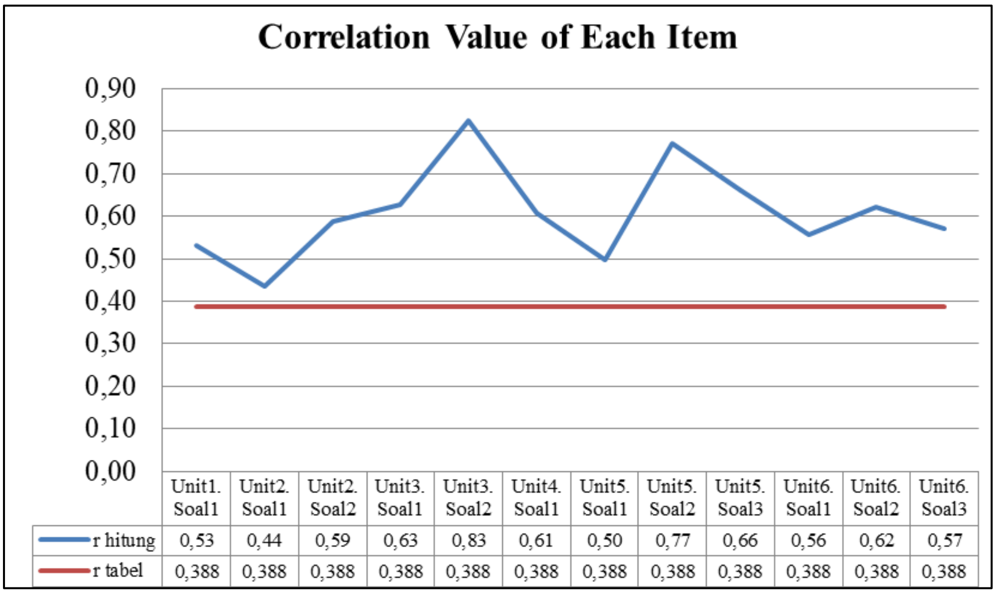


Figure 2. Validity test results of developed PISA item

Figure 2 shows that units 1-6 are declared quantitatively valid because all items have greater correlations than the table (0.388). In addition, the reliability test on PISA-like mathematics problems using SPSS with a Cronbach's alpha value obtained a value of 0.75. This score is greater than 0.6. Therefore, the developed PISA-like mathematics problems are considered reliable or consistent.

The validity and reliability tests are not parts of the formative evaluation stage. However, the tests provide additional empirical data to explore the validity, consistency, and quality of PISA-like mathematics problems developed quantitatively. Meanwhile, in the formative evaluation section, the expert review and one-to-one stage were carried out qualitatively to validate content, constructs, and language and improve the developed questions.

Self Evaluation

In this stage, the researchers revised the developed PISA-like mathematics problems through collaborative discussions with two colleagues. Then, the researchers reevaluated the PISA-like-mathematics problems and revised them again to investigate any existing shortcomings. As a result, prototype I is manufactured which consists of six units and 12 items. Prototype I of PISA-like mathematics problems for the hand sanitizer unit is presented in the following Figure 3.

> Hand sanitizers are currently an important ingredient in the Covid-19 virus outbreak, making them scarce and their prices skyrocketing. This hand sanitizer functions as an antiseptic that can kill viruses or bacteria that stick to our hands. To make hand sanitizer based on WHO standards, one 1 liter bottle requires the following ingredients:
> Alcohol 96% as much as 833 ml
> H_2O_2 3% as much as 41,7 ml
> Glycerol 98% as much as 14,5 ml
> Aquadest as much as 1000 ml
>
> Question :
> A person has a stock of 6,000 ml of Alcohol, H_2O_2 300 ml, 120 ml Glycerol and 430 ml Aquadest.
> How many bottles of Handsanitiser can he make?

Figure 3. Prototype I of PISA-like mathematics problems developed for hand sanitizer unit

Figure 3 is the result of improving the self-evaluation of the question by correcting the errors in the information about Aquadest on the question and the solution to improve the answer keys. In addition, the writing hand sanitizer was improved to be skewed due to foreign languages and changes in editorial questions. Thus, the revision of the developed problem is called prototype I.

Expert Reviews and One-to-One Stages

The expert review and one-to-one stage were carried out simultaneously to validate the qualitatively designed instrument. In the expert review, three experts validated the content, construct, and language aspects of the designed questions by providing comments and suggestions as inputs to improve the developed questions. The validation process for prototype I with expert reviews were carried out by sending files of the prototype I to the email address of each expert. Meanwhile, the one-to-one stage explored students in class VIII.3 of SMP Negeri 19 Palembang with high, medium, and low abilities to assess prototype I and ask the students to provide comments and responses freely. The comments and suggestions for Prototype I are summarized in Table 1.

Table 1. The experts' and students' comments on hand sanitizer units

Validator	Comments and Suggestions	Revision
Experts	• WHO standards to manufacture hand sanitizer are presented on a table or captured directly from the original WHO source. • Content and context in unit 1 are acceptable. • The content and context in unit 1 are good. However, the scoring rubric should carefully assess students' answers	• The rules of making hand sanitizers could be changed by referring to WHO standards and adding sources from WHO. • The grading rubrics and adding possible answers from some students could be improved
Students	• The information about the questions should be separated from the questions.	• Not using integers in the question is not accepted on the grounds because this information

Validator	Comments and Suggestions	Revision
	• The calculation is difficult because it does not use integers	has been standardized by the WHO standards.

Table 1 presents comments and suggestions from expert reviews on the aspects of content, construct, and language. In addition, Table 1 shows students' understanding, completion, and comments in a one-to-one stage. This finding is used as material to revise prototypes I and II. The expert review and the one-to-one stage signified that the questions are not changed based on the expert review and student suggestions of not using integers because this information has been standardized by WHO. The following questions have been revised and resulted in prototype II as shown in Figure 4.

Hand Sanitizer is currently an important part of the Covid-19 virus outbreak, so it has become rare and the price has skyrocketed. This Hand Sanitizer functions as an antiseptic that can kill viruses or bacteria that stick to our hands. Based on WHO standards, to make 1 bottle of Hand Sanitizer size 1 liter requires the following materials:

- Ethanol 96% as much as 833 ml
- Hydrogen Peroxide 3% as much as 41.7 ml
- Glycerol 98% as much as 14.5 ml
- Aquadest as much as 1000 ml

Source : www.who.int/gpsc/Smay/Guide_to_Local_Prodoction

If someone has a stock of 5,400 ml of Alcohol, 260 ml of Hydrogen, 90 ml of Glycerol and 6500 ml of Aquadest.
Question:
How many bottles of Hand Sanitizer can be made from the available materials?

Figure 4. Prototype II of PISA like mathematics problems developed for hand sanitizer unit

Small-Group

In the small group stage, prototype II was tested on eight students of class VIII.3. Each group consisted of four students: one student with high ability, two students with moderate ability, and one student with low ability. The learning process uses the PMRI approach, the LSLC system, and blended learning strategies. The synchronous learning was conducted using virtual meetings on zoom, and the asynchronous learning was conducted using WhatsApp groups.

When working on the questions, most of the students understood the meaning of the questions. However, some still had difficulties solving the questions because they did not understand the questions and were confused about how to solve the questions. In addition, the researchers recorded the students' questions, interviewed their responses, comments, and suggestions, and explored their difficulties. At this stage, the researchers did not revise the questions because the students had completely understood the tested questions. Thus, the developed PISA-like mathematic problems are considered practical. The results of the small group were also used to revise prototype II which would produce prototype III.

Field Test

The field test stage is the final stage in developing questions. In this stage, prototype III trials were conducted at SMP Negeri 19 Palembang. The research subjects at this stage were 27 students of class VIII.2. The students were divided into several groups, and each group consisted of four students. This stage aimed to explore the potential effects of mathematical literacy skills from the developed items by analyzing students' answer sheets and considering indicators of mathematical ability. The mechanism of this stage is similar to the implementation of the small group stage. The model teacher at the field test stage was Milhana Betty, a class VIII teacher at SMP Negeri 19 Palembang.

Learning was carried out using a blended learning method and a collaborative strategy. If the students have difficulties, they can ask for help from their colleagues who already understand the topic by applying the LSLC rule of saying "please teach me", the students who are asked must explain the questions until their friends really understand (Sato, 2014; Putri & Zulkardi, 2020). Octriana et al. (2019) state that the LSLC system requires students to discuss the questions collaboratively by forming the students' self-confidence. Thus, the students could understand and solve the problems, including mathematical literacy skills. The students' answers to question number 1 of the hand sanitizer are summarized in Figure 5.

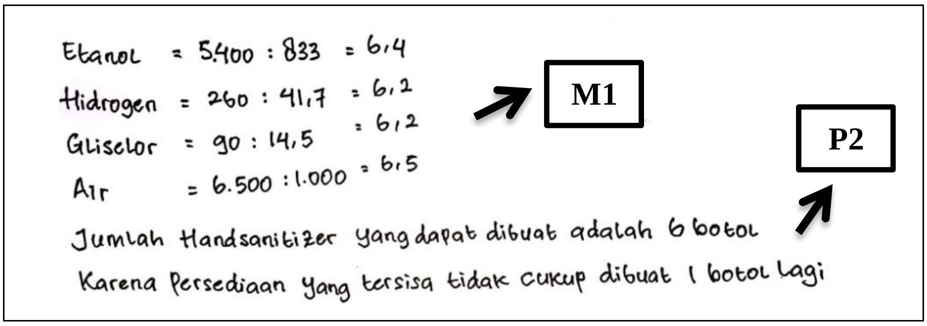


Figure 5. Answer of Student A of PISA-like mathematics problem for hand sanitizer unit

Figure 5 shows that the students could answer the questions using the mathematical ability of the M1 indicator. This indicator uses an understanding of the context to solve mathematical problems by linking the rules to produce hand sanitizer based on WHO standards and perform operations on the distribution of available materials with the materials needed. The students also involve the reasoning and argumentation skills of the P2 indicator. This indicator connects the obtained information to determine a mathematical solution by writing down the number of hand sanitizers and providing arguments for the answer. Afterward, the researchers investigated students' reasons for using the strategy and providing conclusions. The snippet of the interview is presented as follows.

(R: Researcher; S: Student)

R : Why do you use the division operation to solve the problem?

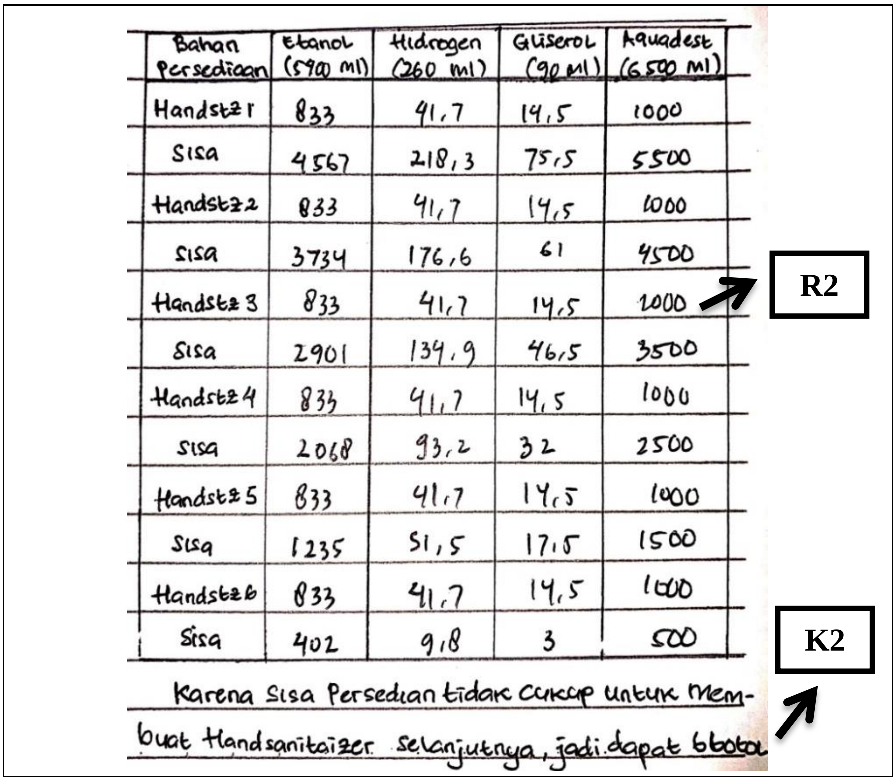
S : Producing a bottle of hand sanitizer requires provisions for each ingredient. Thus, each available material can be divided by the manufacturing rules. The results in the minimum number of bottles are made from each material.

R : Why did you only make 6 bottles?

S : Because the rest of every available material is not enough.

The conversation above shows that the students could determine the minimum number of hand sanitizer bottles that they could make from the available materials. Moreover, the students' answers denote that they could determine the answers to the questions using the mathematical ability of the M1 indicator. This indicator uses an understanding of the context to solve mathematical problems by linking the WHO rules to make hand sanitizer by performing operations on the distribution of available materials with the materials needed. Then students involved their reasoning and argumentation abilities of the P2 indicator. This indicator connects the obtained information to determine a mathematical solution by writing down the number of hand sanitizers and providing arguments for the answer.

The answers and interview results show that the students have high mathematical and reasoning abilities so that they can answer logically. This finding is supported by Hidayat, Wahyudin, and Prabawanto (2018) who state that someone with argumentation and reasoning abilities could analyze, relate the information presented, and carry out procedures to find solutions used as justification (Mumu & Tanujaya, 2019). However, the researchers have found that although some students have different strategies, their solution is the same. The results of analyzing these answers are presented in Figure 6.



Bahan Persediaan	Etanol (5900 ml)	Hidrogen (260 ml)	Gliserol (90 ml)	Aquadest (6500 ml)
Handstz 1	833	41,7	14,5	1000
Sisa	4567	218,3	75,5	5500
Handstz 2	833	41,7	14,5	1000
Sisa	3734	176,6	61	4500
Handstz 3	833	41,7	14,5	1000
Sisa	2901	134,9	46,5	3500
Handstz 4	833	41,7	14,5	1000
Sisa	2068	93,2	32	2500
Handstz 5	833	41,7	14,5	1000
Sisa	1235	51,5	17,5	1500
Handstz 6	833	41,7	14,5	1000
Sisa	402	9,8	3	500

Karena Sisa Persedian tidak cukup untuk mem-
buat Handsanitaizer selanjutnya, jadi dapat 6 botol

Figure 6. Answer of Student B of PISA like mathematics problem for hand sanitizer unit

Figure 6 denotes that to correctly solve the problem, student B applies a different strategy from student A, namely involving the ability to represent the R2 indicators by making a calculation table to manufacture hand sanitizer. These indicators consist of the number of supplies, needs, remaining materials, and the number of bottles. Afterward, the students perform a reduction operation on the amount of inventory and requirements. Although students A and B applied different strategies, their answers are equal. Thus, the researchers interviewed student B as follows.

(R: Researcher; S: Student)

R : Why does the solution use a table?

S : To simplify the solution and make the rest of the material inventory clearly visible.

R : Why does the table only contain six hand sanitizers? Why doesn't the number continue?

S : Because the rest of the ingredients are not enough. The remaining ethanol is 402, but we need 833. Moreover, the remaining hydrogen is 9.8, but we need 41.7. The remaining glycerol is 3, but we need 14.5. Finally, the remaining aquadest is 500, but we need 1000. Thus, the remaining ingredients do not meet the rules to produce the 7th bottle.

The interview above shows that the students can significantly understand the meaning of the questions and solve the given problems correctly and logically. This finding agrees with Nusantara et al. (2020a) who postulate that a student with good argument and reasoning skills can understand, formulate, and complete mathematical problems, such as PISA, as evidenced by the calculation process. In terms of mathematical literacy skills, the students could involve representation skills with the R2 indicators by making a calculation table to manufacture hand sanitizers. These indicators consist of the number of supplies, needs, remaining materials, and bottles. Moreover, the students could select the best strategy to solve problems using tables. These findings agree with Efriani et al. (2019).

Figures 5 and 6 denote that the students use different strategic formulas to solve problems. The formulation of these strategies corresponds to the information or problems identified in math problems, such as PISA, and indicates that each student can use different strategies to solve math problems, such as PISA (Nusantara et al., 2020b). This study also revealed that the students' ability to read information and analyze problems could help them determine strategies to solve problems (Franestian, Suyanta, & Wiyono, 2020)

The results of analyzing students' answers interpret that the use of the COVID-19 context on PISA-like mathematics problems potentially affects students' mathematical literacy skills, which include communication, mathematization, representation, argumentation, and reasoning skills. Moreover, the use of this context possibly affects students' problem-solving strategies as well as symbolic, formal, and technical language and operations.

Communication skills are involved in all problem-solving. This involvement can be seen when students could form models of the presented situation and present solutions for the work. The students are considered to have communication skills if they are able to express their ideas using pictures, tables, and diagrams and can state problems of daily life in symbols or mathematical models (Rusyda, Ahmad, Rusdinal, & Dwina, 2020).

Mathematical abilities in unit 1, unit 2 (2), unit 3, and unit 6 (3) require students' ability to identify variables and mathematical structures, use contextual understanding, and make assumptions to solve problems. This statement is supported by Nurzalena, Susanti, Hapizah, Meryansumayeka, & Miswanto (2019) who state that students are considered to have mathematical abilities if they are able to translate real context problems into mathematical symbols that can be interpreted in mathematical models to make assumptions.

Representation ability is used by students when completing units 1 and 4. This condition occurs when students are able to interpret mathematical results in various representations and compare or evaluate two or more related representations with situations by expressing their ideas in pictures, tables, and symbols (Franestian et al., 2020).

Argumentation and reasoning abilities can be seen when the students are able to explain, defend, and justify the process of reaching a mathematical solution in unit 1, unit 2 (1), unit 3 (1), unit 4, unit 5 (2 & 3), and unit 6 (1). Argumentation and reasoning abilities enable students to successfully analyze, relate the presented information, and carry out procedures to find solutions that serve as justification (Mumu & Tanujaya, 2019).

Meanwhile, problem solving abilities in unit 3 (2) and unit 5 (2 & 3) occur when students can solve a problem with various strategies and mindsets and compose the symbolic, formal, and technical language. The operations involved in unit 3 (1) can emerge when students could use symbols or mathematical variables and their understanding of mathematical concepts, principles, and procedures to express their ideas (Nurzalena et al., 2019). Unfortunately, not all students could use symbolic or formal language because they do not understand the meaning of symbols or variables due to a lack of understanding of definitions, rules, and algorithms.

The dominant abilities that rise from the developed problems are argumentation, reasoning, and communication. These abilities occur because the students have significantly understood the meaning of the problem and could connect the information of the problem in pictures, tables, and diagrams to solve the problems (Rusyda et al., 2020). However, the students' communication ability is still low because they only focus on finding the answers and are not accustomed to writing answers in detail. The students require training to solve problems properly because they potentially develop their mathematical literacy. However, since each student has a distinct ability to understand mathematics, the teacher must train students to optimize their ability. Consequently, their mathematical literacy ability can be extracted by giving them routine problems and asking them to solve these problems by writing down solutions in detail (Pratiwi et al., 2020).

CONCLUSION

This study produced a set of PISA-like mathematics problems on quantity content using the COVID-19 context. This set is considered valid and practical and potentially affects the students' mathematical literacy skills. The developed PISA-like mathematics problems criteria focus on quantity content, such as topics of integer operations and comparisons. The problem is about how to make a bottle of hand sanitizer. Studying the COVID-19 pandemic through PISA-like mathematics problems, allows the students to use their mathematical literacy skills, such as communication, mathematization, representation, argumentation, and reasoning, to solve problems using. On the other hand, students are also able to apply their knowledge and logical thinking to deal with the COVID-19 pandemic. For example, the students understand important information about the pandemic and know the rules to maintain distance, make hand sanitizers, and produce masks. Therefore, they can learn how to deal with the increasingly widespread COVID-19 pandemic while using their mathematical literacy skills.

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