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The development of PISA-like problems using immunity context during pandemic

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Abstract

The quality of education in Indonesia has yet to be able to balance the importance of mathematical literacy. It can be seen from the OECD's data that a mathematical literacy achievement score of 379 shows that the literacy ability of Indonesian students is still low. This research aimed to develop PISA-like problems that are valid and practical and potentially affect mathematical literacy skills using the context of immunity during a pandemic. This research used the Inquiry-Based Learning (IBL) model in small group and field test stages. The subjects in this study were eighth-grade students aged 13-15. The data were analyzed qualitatively through observations, interviews, and tests. This study produces one unit of sharing task and jumping task and three evaluation problems with characteristics of the content used, name change and relationship, and personal and social contexts. Levels by the framework PISA 2022, namely levels 3, 4, and 5, are process competence and mathematical literacy skills. Using language following language standards can be understood and interpreted well by students. Thus, this research produces the developed PISA-like problems that are valid and practical and potentially affect mathematical literacy skills and life skills in dealing with the pandemic.

Keywords: development research; immunity context; PISA-like problems

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Introduction

Mathematical literacy is an individual's capacity to reason mathematically and formulate, employ, and interpret mathematics to solve problems in various real-world contexts (OECD, 2018). Based on data from the OECD, a mathematical literacy achievement score of 379 was obtained with an average of 489 (OECD, 2019); around 28% of students in Indonesia reached level 2, this shows that the literacy ability of Indonesian students is still low (Utomo et al., 2020). The low achievement in mathematical literacy is because they are not accustomed to investigating situational problems; as a result, students have difficulty solving mathematical problems (Putri & Zulkardi, 2018). In addition, it is still difficult to apply a pattern of reading fondness (Khotimah, 2018) even though mathematical literacy skills are essential because they can help someone understand the role or use of mathematics in everyday life (OECD, 2017).

One thing that can be done to overcome this is to familiarize students with PISA model exercises. In addition, Dasaprawira et al. (2019) stated that Indonesian students must learn to solve PISA questions. By learning mathematics, students are expected to have the ability to count and to support logical reasoning, critical, and communication skills to solve problems in everyday life (Asmara & Sari, 2021). Therefore, teachers must design contexts to solve problems using contexts related to the surrounding environment so that the context is close to life (Mardiyah et al., 2021). Using the PISA model math problems using context will help students hone their mathematical literacy skills (Andari & Setianingsih, 2021). Many studies with various contexts examine the development of PISA-like questions, including soft tennis and volleyball in Asian Games activities (Jannah et al., 2019) and soccer (Yansen et al., 2019). Several studies use regional cultural contexts, such as Jambi (Charmila et al., 2016) and Bangka Belitung (Putra & Vebrian, 2019).

The development of contextual mathematics questions is certainly not limited to the cultural context of a region or society. Recent developments in community conditions, such as the COVID-19 pandemic, are possible if used as a context for developing questions (Bakker & Wagner, 2020). Some previous studies used the context of COVID-19, such as the COVID-19 transmission map (Nusantara et al., 2021a), designing PISA-like mathematics tasks using panic buying context (Nusantara et al., 2021b), designing PISA-like task on uncertainty and data using data transmission of COVID-19 (Zulkardi et al., 2021) and numeration with lesson study assisted by E-learning *Merdeka* Campus (Jayanti et al., 2021). Using context enables students to find meaningful relationships between abstract ideas and practical applications in real-world contexts. It makes mathematics much more exciting and valuable for all students (Mardiyah et al., 2021).

In addition to the use of context, an innovative learning model is needed to make mathematics more interesting, namely a student-centered learning model. One of the appropriate learning models to be applied in the learning process is the Inquiry-Based Learning (IBL) learning model because, in this model, learning not only emphasizes the acquisition or discovery of answers but also encourages students' curiosity in conducting searches and developments. Further study and analysis (Abidin, 2020; Sari et al., 2019). Applying the inquiry model in learning activities will make students more active and dare to ask questions about

material that has not been understood, encouraging students to think critically and analytically (Ramdani et al., 2021).

Students are allowed to design anything they want, and inquiry supports them in identifying every factor related to the problem they have to solve (Garrison & Vaughan, 2013). They apply their knowledge, try to find the knowledge they need, and can develop thinking skills (Putra et al., 2016; Rahmatsyah, 2022; Wahyudi et al., 2019). In addition, they poured ideas to solve the developed PISA-like problems so that they could have a potential effect on maximum mathematical literacy skills. The inquiry learning model can influence skills (Ramdani et al., 2021) and improve learning activities and students' cognitive learning outcomes (Sanjaya, 2016).

The IBL model also significantly influences scientific attitudes, namely the students' curiosity (Dobber et al., 2017; Veloo et al., 2013). However, until now, people have yet to use PISA problems using the Inquiry-Based Learning (IBL) model in the context of immunity during the pandemic. Therefore, knowledge and information about how to increase immunity in anticipating this virus attack are necessary notified to students. Thus, this research aimed to develop valid and practical PISA-like problems using immunity contexts during the pandemic that potentially affected mathematical literacy skills.

Methods

This design research type of development study was carried out in two stages, namely the preliminary stage and the prototyping stage (formative evaluation), which included one-to-one and expert reviews, small groups, and field tests (Bakker, 2018; Tessmer, 2013). At the preparation stage, four analyzes were carried out, namely, analysis of research subjects, curriculum analysis, context analysis, and making instruments. Furthermore, the researcher also reviewed the PISA 2022 framework and some literature on development research that had been made related to research that would be planned to be used as an initial prototype draft. This research employed inquiry-based learning (IBL) in small group and field test stages. The stages of the inquiry model are; orientation, formulating problems, hypotheses, data, testing hypotheses, and then getting conclusions.

In the formative evaluation stage, the first stage was the researcher evaluating and reviewing the initial prototype draft with validation by fellow master students based on the PISA 2022 framework both in terms of content, constructs, and language to be used as prototype 1 drafts. The prototype 1 developed from the self-evaluation results was later given to the expert in the expert review stage. Along with the expert review, a one-to-one validation stage was also carried out by three students with high, medium, and low abilities who were not included in the research subjects.

At the expert review stage, the product produced from the first prototype is consulted with experts for validation. Expert validation uses a study of content, construct, and language. The expert review validation process is carried out in two ways: focus group discussions (via Zoom meeting) and mail/email (mails review). Validation through focus group discussion via zoom with two lectures in the Mathematics Education Faculty of Sriwijaya University, three doctoral

students at Sriwijaya University, five master students at Sriwijaya University, and two junior high school teachers. Validation by mail review with a lecturer who researched the PISA problem's development.

Based on the walkthrough of the expert review assessment, it can be concluded that the prototype developed is classified as good (valid). However, improvements are still needed based on the suggestions and responses of the validator. The results obtained at the expert review and one-to-one stages are considered when revising prototype 1. After revising prototype 1, we produced prototype 2. Prototype 2 was then tested at the small group stage. In the small group stage, six students were selected. They were divided into two groups to discuss solving the questions in prototype 2 and asked to provide comments on the questions that had been done to see the practicality of the questions. Comments and findings at the small group stage and the criteria' validity were considered when revising Prototype 2.

Furthermore, prototype 3 was produced from the revised results of prototype 2. Prototype 3 was used in the field test phase involving 20 students of eight-grade with high, medium, and low abilities, which focuses on the potential effect of the questions that the researchers developed on mathematical literacy skills. The data collection techniques used in this study were walkthroughs, interviews, and tests. The data obtained were then analyzed descriptively. The document analysis used is the PISA 2022 framework, PISA questions, and journals about PISA. The walkthrough analysis was carried out through an expert review conducted by an expert. Experts provide input, comments, and suggestions related to content, constructs, and language. The test result data were analyzed based on the scoring rubric that had been created. Interviews at the field test stage were also analyzed descriptively to find out the potential effect on their literacy skills. as well as the results of the questionnaire when the small group focused on practicality and field tests to support the data on the potential effects of the questions.

Results

This study developed PISA-like problems consisting of sharing task (multivitamin), a jumping task (antibiotic), and three evaluation problems (distance learning, antibiotic, vaccine). However, the researchers made the antibiotic units include jumping tasks and evaluation problems as representations of the development process.

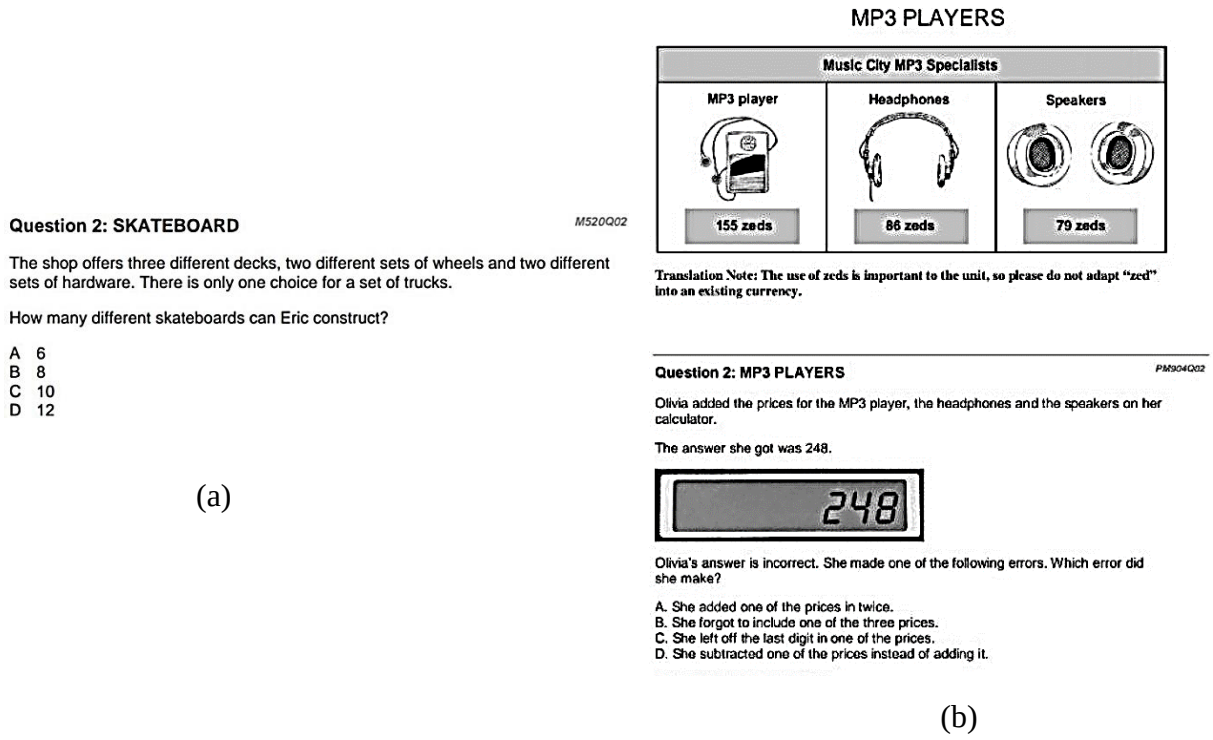
Preliminary stage

At this stage, a literature review related to the research was carried out: curriculum analysis, place, research subjects, stages of development research, mathematical literacy, framework PISA 2022, and Inquiry-Based Learning. In the framework, researchers identify the characteristics of PISA questions which consist of content, context, and level of PISA questions. In this study, researchers used to change and relationship and the context of Immunity in the Pandemic Period. The mathematical topic involved in the PISA-type questions developed is a system of linear equations with two variables with a level of 3, 4, and 5.

Researchers developed PISA-like problems based on PISA 2006 and 2012 questions in the context of skateboard and MP3 players, which were then developed using antibiotics

referring to the framework of PISA 2022. Antibiotics are needed in this pandemic era because they can be used to kill or stop the growth of bacteria in the body and help the immune system fight bacterial infections in the body. At this stage, an initial prototype is produced as a jumping task and evaluation questions using antibiotics context. The researchers designed an activity of a jumping task. It consisted of two questions about how to determine the price of each antibiotic based on the purchase receipts of two previous visitors and then determine the possibilities when other buyers bring a certain amount of money to buy the same type of antibiotic.

The jumping task is designed as closed constructed response questions totaling 1 question and one selected response. Meanwhile, the evaluation questions are designed as an open-constructed response with the problem of determining how many tablets of each antibiotic can be purchased using a certain amount of money. The researcher compiled PISA-type questions, which were developed in a set of questions consisting of grids, question cards, and scoring rubrics. The original PISA problems, which were further developed using the context of immunity in the pandemic, can be seen in Figure 1.



Question 2: SKATEBOARD M520Q02

The shop offers three different decks, two different sets of wheels and two different sets of hardware. There is only one choice for a set of trucks.

How many different skateboards can Eric construct?

A 6
B 8
C 10
D 12

(a)

MP3 PLAYERS

Music City MP3 Specialists		
MP3 player	Headphones	Speakers
155 zeds	86 zeds	79 zeds

Translation Note: The use of zeds is important to the unit, so please do not adapt "zed" into an existing currency.

Question 2: MP3 PLAYERS PM904Q02

Olivia added the prices for the MP3 player, the headphones and the speakers on her calculator.

The answer she got was 248.

Olivia's answer is incorrect. She made one of the following errors. Which error did she make?

A. She added one of the prices in twice.
B. She forgot to include one of the three prices.
C. She left off the last digit in one of the prices.
D. She subtracted one of the prices instead of adding it.

(b)

Figure 1. The original PISA problem

Figure 1(a) presents the original 2006 PISA problem using "Skateboard". Figure 1(b) the original 2012 PISA problem using "MP3 Players".

Formative evaluation stage

The first stage in this process is self-evaluation. The researchers review the initial prototype design, validated by colleagues based on the PISA 2022 framework in terms of content, construct, and language. The development results in this stage will be used in the next stage.

The next stage was validating the initial prototype's content, construct and language aspects as a result of self-evaluation by conducting a one-to-one stage and expert review at the same stage. Prototype 1 was given to experts through a mail review by sending prototype 1 to a lecturer who has experience developing research on PISA questions via email. A panel review was conducted with 2 Sriwijaya University lecturers, doctoral and master students, who also researched problem development. PISA. In line with the expert review stage, the researcher also carried out a one-to-one stage using three students who were not research subjects with various abilities (high, medium, low). The three students were given prototype 1. They were asked to read the problem and solve it to the best of their ability. After that, they were asked to convey their obstacles in solving the problem. They also were asked to provide suggestions and comments on the matter. The validation results by the expert review and one-to-one will be revised based on the comments and suggestions, which will produce prototype 2. Table 1 summarizes some of the experts' and students' comments on prototype 1.

Table 1. The experts' and students' comments and revision decisions

Validation	Comments and Suggestions	Revision Decisions
	Jumping Task	
Experts	• The sentence structure was improved to make it easier for students to understand. • Add question numbers so that students don't make mistakes • No need to use dots. Use appropriate question words • No need to add information in rupiah because receipts have been written in rupiah	• Corrected sentences and used appropriate question words • Rupiah descriptions are omitted • Each question is assigned a number.
Students	• Students do not understand how to answer the question because there are dots in the middle of the question. • Are the questions related to one another?	
	Evaluation Problem	
Experts	• Use sentences that are effective and not too long to explain the situation in the problem. • Consistency in writing numbers and letters	• Sentences are corrected so that students can easily understand them.
Students	• Students are confused whether the correct answer is more than one possibility	

Qualitative validity is assessed through three aspects. The first aspect is the content that contains the relationship between broad and circular material and the context of immunity

during a pandemic. The second aspect is the suitability of the level and framework of PISA mathematics, literacy skills, and strategies. The third aspect is the linguistic aspect related to good and correct language characteristics.

The revised results of comments and suggestions at the expert review and one-to-one stages are called prototype 2, which will be used in the next stage, namely the small group. In the small group stage, students will be divided into two groups, each consisting of 3 people with various abilities (high, medium, and low). At this stage, inquiry-based learning is applied in the learning process. Students are given problems in the form of jumping tasks and evaluation tasks. Students understand the problems, understand the problems asked in the questions, and use the information provided to solve the problems. Students conduct discussions with their group mates to solve the problems given.

In the learning process, the researcher started the study by finding out each student's knowledge about the pandemic period and things that were identical to immunity, which is used as a context in developing PISA-like problems. Next, the researcher explained the material for linear equations of two variables by relating them to the context of immunity during a pandemic. Then, the researchers distributed questions containing jumping tasks using the context of immunity during the pandemic. Moreover, the researchers began to practice the skills desired by the IBL model, namely, leading students to ask questions and discuss. Furthermore, at the second meeting, the researcher gave an evaluation question using the context of antibiotic content change and relationship. The researcher gave 60 minutes to students to work on the problems. After that, the students were divided into two groups. Students had time to work individually first. Then if they need help understanding, students can ask the researcher or their group friends to discuss their answers. If there are differences in their answers, they can explain their answers to the researcher. According to one of the objectives of IBL, students are allowed to work on problems in their way and then lead students to ask questions about the obstacles they encounter, and also teach students to discuss with their friends.

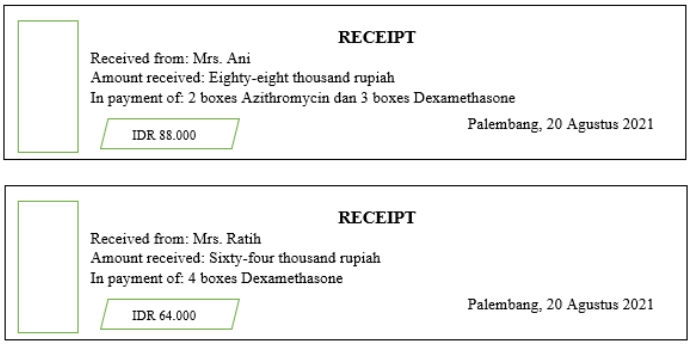
In the discussion process, there were conversations where they equalized their perspectives in understanding the problem, made hypotheses about the questions given, and then asked the researchers about the questions that confused them. Students need clarification when determining how many antibiotics can be purchased with the amount of money because so many possibilities can happen. Even so, they still answered the questions as expected by the researcher. After getting a hypothesis, students test the accuracy of their hypothesis by using the information in the problem related to the given problem. Then the hypothesis will be analyzed using the information obtained to get the right results. In the last stage, students can provide conclusions from the results of the answers to the problems that have been given.

After the small group stage, the questions were revised and called prototype 3, which would be used in the field test stage. Figure 2 is a picture of the development of prototype 3 for the jumping task and evaluation task.

Jumping Task

At one time, there were two buyers who needed antibiotics such as Azithromycin and Dexamethasone to treat COVID-19

The following is receipt of purchase of Azithromycin and Dexamethasone at the "Rezky" pharmacy.



1. How much does one box of Azithromycin and Dexamethasone each cost at the "Rezky" pharmacy?
2. Midwife Tania has a clinic at her home. Every month he buys medicines at the "Rezky" pharmacy. Today, midwife Tania bought twenty boxes of Azithromycin and ten boxes of Dexamethasone. If the midwife Tania brings IDR 600,000 then what will happen?
   a. Midwife Tania gets a change of IDR 40,000
   b. Midwife Tania did not get any change
   c. Midwife Tania's money is still less than IDR 80,000
   d. Tania's midwife's expenses are IDR 550,000

(a)

Evaluation Problem

Ani bought 1 strip of amoxicillin and 5 tablets of paracetamol at a price of IDR 20,000, while Tania bought 3 strips of amoxicillin at a price of IDR 15,000. If Fahmi pays IDR 50,000 how much amoxicillin and paracetamol can he buy?

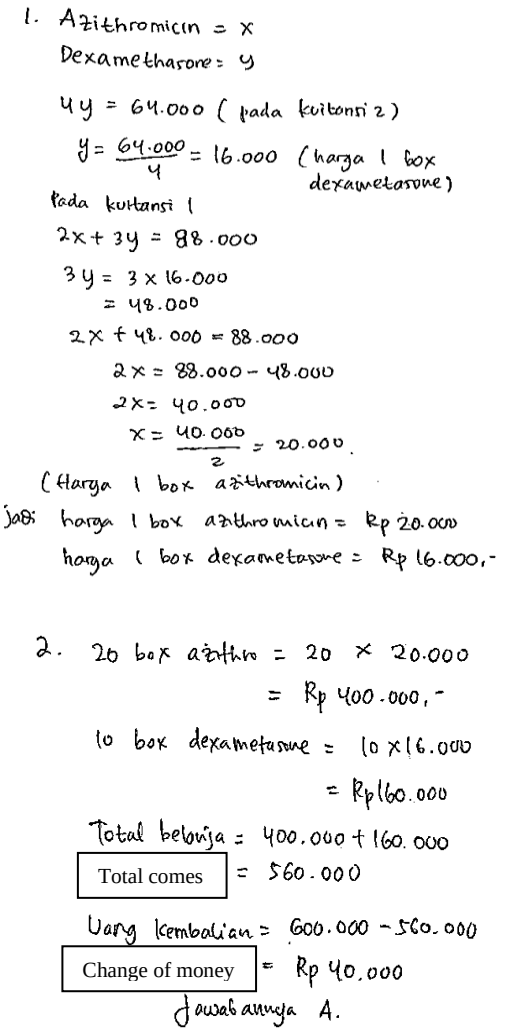
(b)

Figure 2. Prototype 3 of PISA-like problems using immunity context during pandemic

Figure 2(a) prototype 3 of jumping task which is a development of the 2006 PISA questions with "skateboard" context. Figure 2(b) prototype 3 of evaluation problem which is a development of the 2012 PISA questions with "MP3 Players" context.

Potential effect of the problem

The next stage is used to see the potential effect of the development of problems that have been made on students' mathematical literacy skills by conducting a field test involving 20 students of class VIII with high, medium, and low abilities who were the subjects in this study. Figure 3 and Figure 4 show students' answers to solving PISA-like problems for the jumping task.

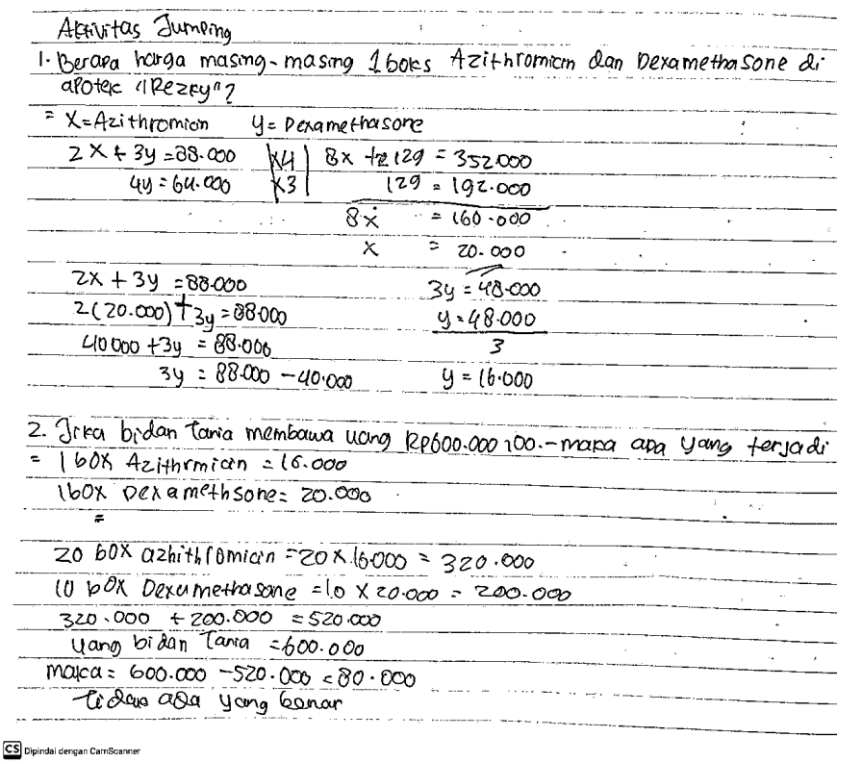


Azithromicin = x
Dexamethasone = y
4y = 64.000 (in receipt 2)
y= 64.000/4 = 16.000 (Price of 1 box Dexamethasone)

So, price of 1 box Azithromicin is IDR 20,000
Price of 1 box Dexamethasone is IDR 16,000

Figure 3. Student A's answer for jumping task (antibiotic context)

Figure 3 shows the results of student A's answers. In the figure, it can be seen that student A can connect the pieces of information listed in the question to determine the price of each antibiotic. Student A also has communication skills seen from how students write down each process of the problem to reach the desired solution. Hopefully, students will be able to explain the process of obtaining the solution by substituting the first and second equations. Students can also use the ability to make plans or strategies to reframe contextual problems mathematically by doing examples and performing mathematical manipulations well, namely doing examples using x and y variables. Students also use their mathematical abilities well, as can be seen from the process of how students can use the variables they have identified in solving the given problems.



Jumping Task
1 .How much does one box of Azithromycin and Dexamethasone each cost at the "Rezky" pharmacy?

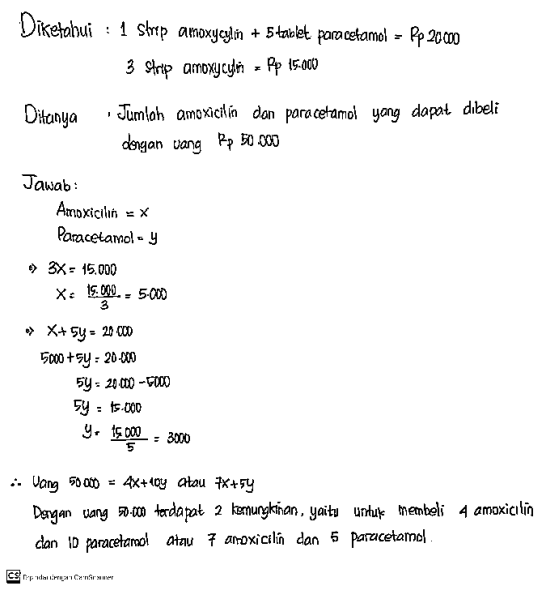
2.If the midwife Tania brings IDR 600,000 then what will happen?

There is no right answer

Figure 4. Student B's answer for jumping task (antibiotic context)

Based on Figure 4, it can be explained that student B has used communication skills by understanding statements and questions to form a model of the situation presented and then connecting pieces of information from the problem, namely by finding the price for each antibiotic from the receipt provided. Students have also been able to identify and use variables in solving these problems. However, the students needed to be more consistent when approximating the x and y variables. In the first problem, they wrote down the x variable for the price of the azithromycin antibiotic. However, in the second problem, the students need to correct the value of the x variable to represent the azithromycin price, not the dexamethasone price. Students can explain the process to obtain the results of solving problems by eliminating the first and second equations, but students need help to complete the plan to get the right results. In addition, students are not able to re-check the answers because the students are in a hurry when solving existing problems.

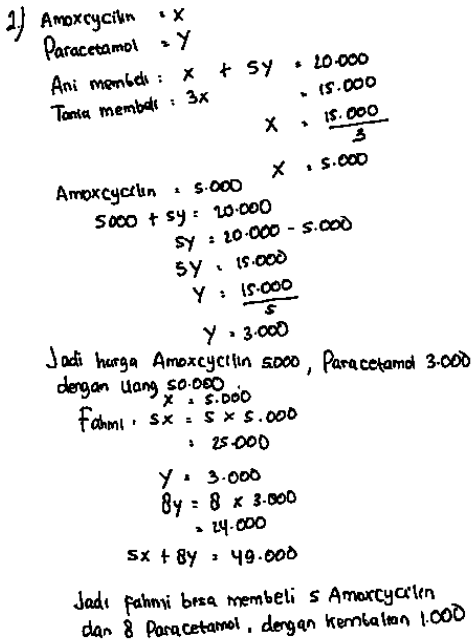
Figure 5 below shows of students' answer to solve PISA-like problems for the evaluation problem. Based on Figure 5, it can be seen that the two students can read, understand codes, understand statements and questions; identify variables and mathematical structures that underlie real-world problems, use appropriate variables to represent real-world problems using symbol language and make mathematical representations of the information presented in real-world problems, VA and FM students have different assumptions about how to use the money to buy for the antibiotic drug, VA students use the money to the maximum so that no change is obtained. In contrast, FM students use enough money to buy antibiotics, so he still gets change from their purchases.



Known : 1 stripe amoxycilin + 5 tablet paracetamol = IDR 20,000
3 stripe amoxycilin = IDR 15,000
Asked : How much amoxycilin and paracetamol that can be bought with amount of money IDR 50,000

With amount of monet IDR 50,000 there are 2 possibilities, such as 4 amoxycilin and 10 paracetamol or 7 amoxycilin and 5 paracetamol

(a)



So, the price of amoxycilin is IDR 5,000 and Paracetamol is IDR 3,000

So, Fahmi can buy 5 Amoxycilin and 8 Paracetamol with change of money IDR 1,000

(b)

Figure 5. Students' answer for evaluation problem (antibiotic context) (a) VA (b) FM

In the field test stage, the findings are collected. Some students can work according to the researcher's expectations, while others are only interested in supporting the question. Below is the interview transcript among Researcher (R), Student 1 (VA), and Student 2 (FM).

R : Please explain how could you get the amount of each antibiotic that can be used Bought by Fahmi?

VA : I saw that Tania only bought amoxicillin, so I can find the unit price of amoxicillin. After I get the price of amoxicillin, I will reduce Ani's purchase price with the price of the amoxicillin she bought. Then, after I get the price of the two antibiotics, I will look for possible drugs I can buy for a total amount of 50 thousand. I first looked for the amount of amoxicillin medicine. Then I looked for the amount of paracetamol from the remaining money.

R : Okay, good answer. How about FM?

FM : I look for the unit price of amoxicillin and paracetamol first. Then, calculate the amount of money that must be spent to buy amoxicillin and the rest for paracetamol.
R : Why did you not use all the money to buy the antibiotics?
FM : Because I saw how much money can be bought with 50 thousand, I think it is okay as long as it is not more than 50 thousand.

It can be explained that students who answered correctly can use communication skills to read, understand codes, understand statements, questions, assignments, objects, or pictures to form a mental model of the situation presented. In addition, students can use argumentation and reasoning skills to explain, defend and provide justification for those identified by using their assumptions.

Discussion

PISA-like problems with change and relationship using the context of immunity during the pandemic were declared valid in terms of content, constructs, and language based on *the expert review* and the results obtained at the *one-to-one,* namely the understanding and responses of students in solving the developed PISA-like problems (Zulkardi, 2002). The content aspect is reviewed based on the suitability of the problems developed with the characteristics of the PISA questions in the framework and the 2013 curriculum, namely using change and relationship using the topic of two-variable linear equations and the context of immunity during the pandemic, *i*ncluding personal and social contexts. The construct aspect is reviewed based on the suitability of the problem with the characteristics of the PISA problem level, namely, process competence, namely Basic Mathematics Ability in mathematical literacy, namely communication skills, mathematization, representation, argumentation and reasoning, strategy selection in problem-solving and the use of symbolic, formal and technical language as well as operations and PISA level questions consisting of levels 3, 4 and 5, display of images, graphs and tables of the questions presented and language aspects are reviewed based on PISA-like problems which were developed using correct spelling according to language standards and did not contain double meanings (Zulkardi, 2006).

The practicality of PISA content of change and relationship using the context of immunity during a pandemic can be viewed from how students understand the problem. The questions developed are easy to understand by students, supported by learning by applying discussion strategies using IBL learning, making it easier for students to integrate problems well so that they can be said to be practical. In addition, practical aspects can also be reviewed based on PISA-type questions that can be applied both in the learning process and during written tests (van den Akker, 1999). In this case, students can understand the problem well and do not cause double interpretation even though some students experience some mistakes, and these mistakes can be used as revision material for researchers to perfect the questions developed so that the questions developed can be said to be practical (Zulkardi, 2006).

The potential effect that the researcher reviewed is based on the student's mathematical literacy ability in solving PISA-type questions with the content of change and relationship using

the context of immunity during a pandemic. Which was developed was applied in learning activities using the Inquiry-Based Learning (IBL) learning model. Learning activities build students' confidence to use their abilities in solving mathematical problems, including mathematical literacy skills (Pratama, 2020). The IBL learning model directs students to seek and find their answers to something in question. The teacher is placed not as a learning resource but as a facilitator and motivator of student learning (Abidin, 2020); finding their own will make them apply their knowledge and try to find out knowledge. Needed and can develop thinking skills (Rahmatsyah, 2022) and then pour ideas to solve the developed PISA-type questions to affect maximum mathematical literacy skills. The IBL model also helps students explore their answers by directing students to ask questions if they have difficulty. It makes students challenged and enthusiastic about solving the problems in question. It is reinforced by (Artigue & Blomhøj, 2013), which state that students are guided to discuss with friends or ask the teacher if something is not understood. IBL learning also provides opportunities for students to use their respective strategies in solving problems.

The mathematical literacy ability reviewed by researchers is based on the Basic Mathematics Ability framework. The following is an explanation of the Basic Mathematics Ability students use to solve PISA-like problems that the researcher developed:

Students use their communication skills to complete the jumping activity and evaluation problem. Students' abilities can be seen by presenting solutions, showing the work involved in solving answers, or summarizing mathematical results. In line with the research of Jannah et al. (2019), students are said to have communication skills when they can write down the process of finding a solution. However, many students still need help with communication skills due to errors in understanding statements or questions and their inability to present these problems mathematically. In line with the research of Fazzilah et al. (2020), which states that the cause of students not being able to evaluate problems is that students do not know the process of solving problems even though students are correct in determining the formula and appropriate in carrying out procedures. Rusyda et al. (2020) state that weaknesses cause the weak communication skills of students in expressing mathematical ideas and relationships due to the difficulty of interpreting numerical symbols, variables, and so on, which are influenced by experience.

In addition, students also use representational abilities in solving evaluation problem one, where the question uses a literacy process to formulate mathematical situations. Representational skills are seen when students can make mathematical representations of the information presented in real-world problems. It is supported by the results of Utomo et al. (2020), which state that based on indicators of mathematical literacy, students have met the category in formulating problems in real situations mathematically when students can write down information and develop problems in the actual context in the issue. However, some students cannot make representations, and some have tried to make representations. Still, the models they produce are wrong or do not follow the information presented in mathematical problems. The term is separate from understanding the problems presented (Samsuddin & Retnawati, 2018). In this case, procedural errors made by students were defining variables and

forming mathematical structures, and this was because students needed to understand the problems presented fully.

Students also use argumentation and reasoning skills. Students' argumentation and reasoning abilities can be seen in students ability to connect pieces of information to achieve mathematical solutions and make various levels of arguments correctly. It is in line with Nurhalin and Effendi (2022), which states that reasoning ability is a thought process to produce a statement, and conclusions can be drawn without being based on formal logic, but the truth is already known. Mumu and Tanujaya (2019) state that various processes can achieve the reasoning used by these students, one of which is making assumptions or conjectures, namely by forming opinions or assumptions based on incomplete information.

In addition, students have also demonstrated their ability to formulate strategies in problem-solving, which can be seen from the way students complete jumping tasks and evaluation questions two that use the literacy process to formulate mathematical situations. This ability can be seen in the ability of students to choose or make a plan or strategy to frame mathematical contextual problems. It is in line with the research results of Suratmi and Purnami (2017), which state that the problem-solving ability that every student must have is how to solve problems related to learning activities, including solving mathematical problems by making a strategy or plan.

Then, the student's ability to use symbolic/formal and technical language, as well as the operations used by students to complete the jumping task and evaluation problem using the literacy process to formulate mathematical situations where the use of symbolic/formal language and operations in this process can be seen from the student's ability to use variables, symbols, diagrams, and standard models that are suitable for representing real-world problems. It is in line with Zulyanty (2022), which states that sometimes students use symbols, mathematical language, and operations in solving problems. In contrast, the benchmark is that students can use symbols, formulas, and mathematical models in solving problems and can use mathematical symbols correctly, even knowing the meaning of variables used in solving problems. In this case, the definitions, rules, and formal systems and algorithms used include substituting a value in a variable, multiplication, and division.

Conclusion

This research produced valid and practical questions in the form of jumping tasks and evaluation problems that impact mathematical literacy skills. The criteria of the developed PISA-like problems focused on change and relationship contents of immunity context problems. Learning how to maintain immunity through PISA-like problems enabled the students to use their mathematical literacy skills, such as communication, mathematization, representation, argumentation, and reasoning, to solve the problems using the strategy on the problems. Besides, the students applied their knowledge and logical thinking to increase the immune system and understand various multivitamins and antibiotics used to help boost the immune system. Therefore, the students could learn how to protect their health and deal with the pandemic while using mathematical literacy skills. For further research, the researcher

suggests that other researchers prepare a long time to create a more conducive atmosphere when applying the inquiry-based learning model.

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Conflicts of Interest

No conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies, have been completed.

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Author Contributions

Ayu Luviyanti Tanjung: Conceptualization, writing - original draft, formal analysis, editing, and visualization; **Zulkardi:** Writing - review & editing and methodology; **Ratu Ilma Indra Putri:** Validation and supervision.

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