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DEVELOPMENT OF PISA TYPES OF QUESTIONS AND ACTIVITIES CONTENT SHAPE AND SPACE CONTEXT PANDEMIC PERIOD

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ABSTRACT

This research belongs to the type of development research, which consists of three main stages, including preliminary design and formative evaluation. This study aims to obtain valid and practical PISA-type development questions consisting of initial design, self-evaluation, expert review, one-to-one, and small group. The emergence of this research is due to the low mathematical literacy of students in Indonesia. This study took a particular research subject for grade IX junior high school students in Palembang City. From this study, the results obtained include the development of PISA-type questions and activities using the context of social distancing during the pandemic.

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1. INTRODUCTION

Mathematical literacy is one of the most important skills to have in the 21st century. Mathematical literacy is closely related in everyday life, especially in the problems that arise. (Stacey, 2015). Stacey (2015) argues that mathematical literacy is needed in various fields of expertise and in various age ranges. The main idea that is often carried out in media literacy is related to real-world problems and mathematical problems. Media literacy is very necessary as a provision in knowing the role of mathematics in everyday life, as needed in the 21st century (Stacey & Turner, 2015).

Based on the results of PISA, especially for Indonesian students, it is stated that the mathematical literacy ability of school students in Indonesia is relatively low (Putri & Zulkardi, 2020; Rawani et al., 2019; Zulkardi et al., 2021). The scores obtained in 2015 and 2018 showed a significant decrease (Schleicher, 2019). The score obtained in 2015 was 389 while in 2018 it was 379 (Schleicher, 2019).

There are various causes of the decline and low PISA scores, including the lack of facilities in the form of textbooks provided in solving mathematical problems with the real world (Jannah et al., 2019; Novita et al., 2012; Zulkardi et al., 2021). Therefore, there is a lack of fulfillment in terms of providing textbooks, so it is better to develop various kinds of PISA questions and activities that can be used during the learning process which is believed to improve mathematical literacy for students (Munayati et al., 2015)

Another demand that must be met by educators is to make learning integrated with the surrounding environment and daily life. This is related to learning that uses contexts that are close to students (Magen-Nagar, 2016). Problems that can be used as the closest context at this time include the case of COVID-19. The COVID-19 case was caused by the Corona virus that originated in the Wuhan area and spread to various parts of the world (Irfan et al., 2020; Pertiwi et al., 2021; Zulkardi et al., 2021).

Understanding students' concepts is very important to be considered as one of the requirements in solving various kinds of math problems related to everyday life (Edo et al., 2015). Therefore, understanding important concepts is made meaningfully in the learning process (Magen-Nagar, 2016). This study aims to develop questions and activities with the PISA framework for shape and space content using the context of social distancing during a pandemic.

From the background of the problems that have been stated, it is known that the formulation of the problem in this study are: What are the characteristics of PISA type questions and activities with shape and space content? Is social distancing valid, practical and has potential effects. The purpose of this research is to find outthe characteristics of PISA type questions and activities in the shape and space context of social distancing during the pandemic are valid, practical and have potential effects.

In previous studies, there have been studies on the development of PISA questions including the use of shape and space content in the context of soft Tennis and Volleyball, and so on (Efriani et al., 2019; Jannah et al., 2019; Kohar et al., 2019; Meryansumayeka et al., 2020). However, until now no one has made the development of questions from the context of COVID-19 to be studied.

2. METHOD

This research is a type of development study which has two main stages including the preliminary and formative evaluation stages (Nieveen & Folmer, 2013; Tessmer, 1993). This study aims to obtain PISA type questions and activities that are valid, practical and have potential effects.

Validation in this study was held on activitiesexpert review with master's colleagues (Gravemeijer et al., 2017), as well as junior high school mathematics teachers and led by experts in the development of PISA questions. In addition, there is a one to one validation stage for heterogeneous students with each of them having low, medium and high abilities who are not included in the research subject. Then it was tested on 12 junior high school students who have high, medium and low abilities online (via zoom meeting) so that the practicality of the questions obtained can be obtained. After that, a trial was conducted on students in one particular class as many as 20 students in the field test to see the potential

effect on PISA type questions and activities with shape and space content using the context of social distancing during a pandemic (Bakker & Wagner, 2020).

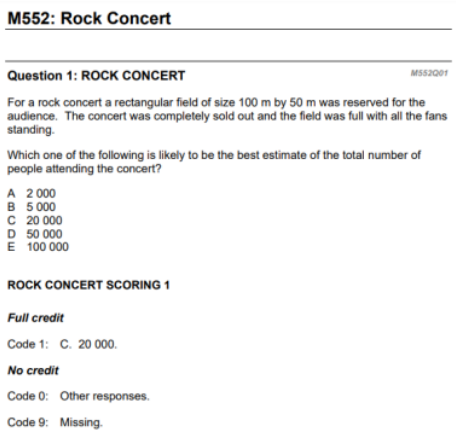
In this study, using walkthrough, observation and test data collection techniques. Data collection techniques used are walkthrough, observation and test techniques. The walkthrough technique is used to see whether or not the questions and activities made by researchers against experts are based on the content, constructs and language used from suggestions and comments obtained during expert reviews and FGDs. However, at the same time as validating from the experts, the researchers also conducted one to one on students who had been selected to be tested in later development. Observation in the study aims to observe and know the characteristics and needs of these students as well as when the trial took place. Other than that, Tests are also carried out which are useful to see the practicality of the questions that have been made by the researchers that will be done by the students. At this stage of the test or trial, 12 junior high school students with heterogeneous abilities (high, medium and low). Furthermore, the results of the student's answers were analyzed qualitatively in order to see the practicality of the questions being worked on.

3. RESULT AND DISCUSSION

3.1. Result

During the preliminary design stage, researchers made observations first to junior high schools in Palembang City to look for various kinds of information needed in sorting research subjects, time and knowing the flow of learning and teaching and learning activities in the classroom as well as taking care of permits as administrative requirements in carrying out research. at the school concerned and analyze various kinds of PISA questions and activities and then develop questions and activities using the context of social distancing during the pandemic.

During formative evaluation, the first thing to do is self-evaluation. At this stage, the researcher evaluates the questions that have been developed. The questions are made in the form of questions and activities with a total of two types of activities (sharing tasks and jumping tasks) with the PISA type of shape and space content with the context of keeping a distance during the pandemic. The PISA questions developed were taken from the PISA questions in 2006. Figure 1 is a picture of the 2012 PISA questions taken as an example for the development of the questions in this study.



M552: Rock Concert

Question 1: ROCK CONCERT M552Q01

For a rock concert a rectangular field of size 100 m by 50 m was reserved for the audience. The concert was completely sold out and the field was full with all the fans standing.

Which one of the following is likely to be the best estimate of the total number of people attending the concert?

A 2 000
B 5 000
C 20 000
D 50 000
E 100 000

ROCK CONCERT SCORING 1

Full credit

Code 1: C. 20 000.

No credit

Code 0: Other responses.

Code 9: Missing.

Figure 1. Original PISA questions in 2006 with the context of "rock concert"

Table 1 shows the development of questions that have been developed by researchers. This problem is then used as prototype 1 (see Figure 2).

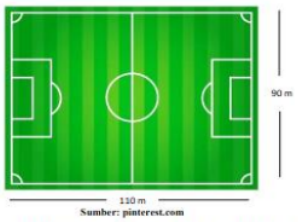
Pada sebuah kegiatan pagelaran seni massal di masa Pandemi COVID-19 yang diadakan pada stadion Bumi Sriwijaya Palembang seperti gambar berikut ini.
Tiket pagelaran seni tersebut ternyata terjual habis, namun akibat adanya pandemi, maka diberlakukan peraturan untuk jaga jarak yang mana, masing-masing pengunjung harus berjarak minimal 1,5 meter antara satu dan yang lainnya.

Sumber : Wikipedia.com

Untuk menjawab soal-soal tersebut, maka ikuti langkah-langkah dalam aktivitas berikut!
1) Coba lihat gambar stadion tersebut! Menurutmu bentuk bangun ruang apakah stadion itu?

2) Setelah mengetahui bentuk bangun ruang tersebut, masih ingatkah kalian bagaimana cara menemukan luas dari suatu bangun ruang tersebut? Jika masih, silahkan tuliskan rumusnya!

3) Apabila kalian telah mengetahui rumus bangun ruang tersebut, maka selanjutnya tentukan berapa luas stadion dari keterangan deksripsi gambar tersebut!



Sumber: pinterest.com

4) Mari perhatikan kembali soal diatas dan lihat ilustrasi gambar berikut! Setelah kalian mencari luas dari stadion tersebut, maka coba perhatikan berapa jarak antar satu orang dan orang lainnya yang harus dipatuhi bagi para pengunjung pameran seni?

5) Jika kalian sudah mengetahui luas dan jarak antar satu dan yang lainnya pada masing-masing orang, maka untuk mengetahui jumlah pengunjung berdasarkan keterangan tersebut operasi hitung apakah yang dapat kalian lakukan? Berikan alasannya!

6) Kalian sudah menetapkan jenis operasi hitung yang akan digunakan, maka selanjutnya yaitu kalian harus melakukan operasi tersebut pada luas dan keterangan jarak antar perseorangan. Maka, berapa jumlah pengunjung yang ada?

Translated into English:

During the Covid-19 pandemic, tickets for the Bumi Sriwijaya Stadium art show were sold out. In this case, to prevent transmission of the virus, a 1.5 meters distance rule is applied for each visitor.

To answer these questions, follow the steps in the following activity!

Question 1:
Look at the pictures of the stadium! What shape do you think it is?

Question 2:
After knowing the shape, do you still remember how to find the area? Please write down the formula!

Question 3:
If you already know the formula, determine the area of the stadium based on the description of the image!

Question 4:
Please take a look above and see the illustration of the following picture! after you know the area, what is the distance between the audience that must be obeyed?

Question 5:
If you already know the extent and distance between one and the other in each person, then to find out the number of visitors based on what operations can you do? Give the reason!

Question 6:
You have set the type of calculated operation to be used, then next is that you have to perform the operation on the area and information distance between individuals. So, how many visitors are there?

Figure 2. Development of PISA prototype 1 questions

You have set the type of calculated operation to be used, then next is that you have to perform the operation on the area and information distance between individuals. So, how many visitors are there?

After obtaining questions with prototype 1, then validation tests were carried out by experts and FGDs as well as one to one which aims to get valid questions in terms of constructs, content and language. In the characteristics seen by researchers for the shape and space content in PISA with the current independent emergency curriculum. Furthermore, in terms of constructs to see the suitability of the level of students' abilities, especially in the ability to examine problems that are in accordance with reality for students. Furthermore, in terms of language, several aspects that are seen include the suitability of writing questions with EYD rules, using sentences that are easy to understand and not experiencing problems. ambiguity in the meaning of the developed questions. In line with FGD and expert review, The researcher also did one to one to see the opinions of students in working on the problem and to see comments and suggestions in the development of this prototype 1 question. After doing this stage, valid PISA prototype 2 type questions and development activities are obtained based on comments and suggestions obtained on prototype 1 questions.

Table 1. Comments / suggestions and revision decisions

No.	Comments and Suggestions	Revision Decision
1	In the picture, it is better to use an image that is more relevant to the flat shape that students want to ask	The image has been corrected and selected based on the reference on the problem to be relevant
2	In questions, it is better to use more than one picture for every three questions in the form of one illustration. So the total image becomes two	Images have been added to the problem so that not just one picture
3	The context of the questions that were made, some of them used ineffective sentences, so it was suspected that it would make students confused when working on them	Sentences have been revised so that the sentences used are more effective

The next stage is to conduct direct trials of students with small groups to see the practicality of prototype 2 questions for students of SMP N 13 Palembang. Trial questions in small groups are carried out face-to-face. In the implementation, students are given 20 minutes to solve the problem.

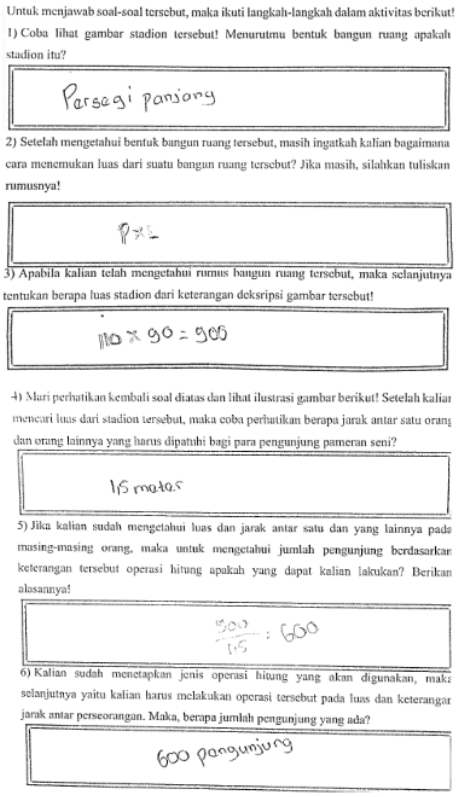
After doing the small group, the researcher then revises the questions and activities that have been made so that they become prototype 3 for the students of SMP N 13 Palembang. Then, there are several kinds of inputs and suggestions for use as prototype 3. Here are some kinds of input given to students for the implementation of small group prototype 2 trials (see Table 2).

Table 2. Comments / suggestions for the small group

No.	Comments and Suggestions	Revision Decision
1	It's good to change the word wake up space to wake up flat	Already repaired

Student Answer Analysis

The questions developed are PISA type questions and activities with the context of online shopping during a pandemic which consists of one item. The problem is solved by students within a period of 20 minutes through one-to-one. In these questions, students are given several kinds of information about the field, the size of the field, the distance between the people in it and the steps in solving these problems and activities. These questions are included in level 4 by solving problems based on sequential procedures. The material used is the area and circumference of a flat figure.



Translated into English:

Answer 1:
Rectangle

Answer 2:
Length times width

Answer 3:
110 x 90 = 900

Answer 4:
1,5 meters

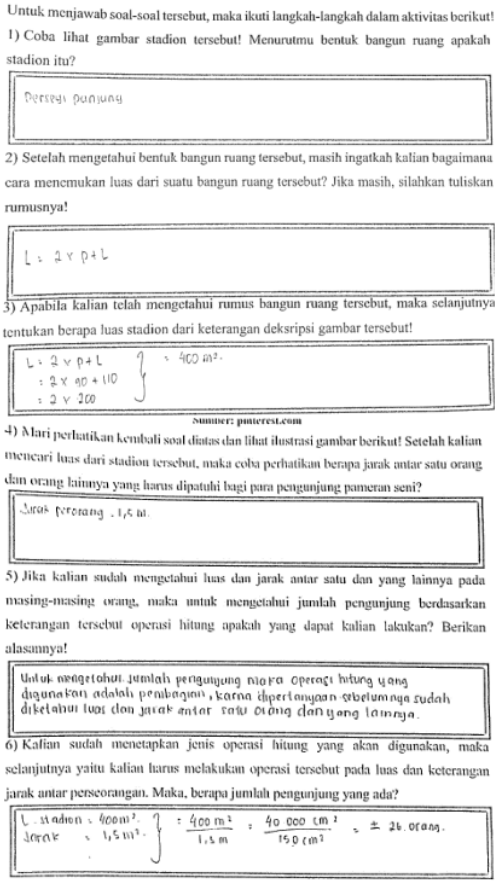
Answer 5:
900/1,5=600

Answer 6:
600 visitors

Figure 3. One-to-one answers of student 1

Figure 3 shows that the student's answer can be answered based on the activity in the problem. These activities are based on the context of keeping a distance in the pandemic period. Based on these answers, students answer questions correctly but there is a mistake in calculating the results of the operation. The result of 110 x 90 is 9900. But the student was

wrong in answering 900. The student can answer the question correctly but cannot describe it.


Untuk menjawab soal-soal tersebut, maka ikuti langkah-langkah dalam aktivitas berikut!

1) Coba lihat gambar stadion tersebut! Menurutmu bentuk bangun ruang apakah stadion itu?

Persegi panjang

2) Setelah mengetahui bentuk bangun ruang tersebut, masih ingatkah kalian bagaimana cara menemukan luas dari suatu bangun ruang tersebut? Jika masih, silahkan tuliskan rumusnya!

L : 2 x p+L

3) Apabila kalian telah mengetahui rumus bangun ruang tersebut, maka selanjutnya tentukan berapa luas stadion dari keterangan deksripsi gambar tersebut!

L : 2 x p+L
: 2 x 90 + 110
: 2 x 200
: 400 m².

Sumber: pinterest.com

4) Mari perhatikan kembali soal diatas dan lihat ilustrasi gambar berikut! Setelah kalian mencari luas dari stadion tersebut, maka coba perhatikan berapa jarak antar satu orang dan orang lainnya yang harus dipatuhi bagi para pengunjung pameran seni?

Jarak perorang : 1,5 m.

5) Jika kalian sudah mengetahui luas dan jarak antar satu dan yang lainnya pada masing-masing orang, maka untuk mengetahui jumlah pengunjung berdasarkan keterangan tersebut operasi hitung apakah yang dapat kalian lakukan? Berikan alasannya!

Untuk mengetahui jumlah pengunjung maka operasi hitung yang digunakan adalah pembagian, karna dipertanyaan sebelumnya sudah diketahui luas dan jarak antar satu orang dan yang lainnya.

6) Kalian sudah menetapkan jenis operasi hitung yang akan digunakan, maka selanjutnya yaitu kalian harus melakukan operasi tersebut pada luas dan keterangan jarak antar perseorangan. Maka, berapa jumlah pengunjung yang ada?

L. stadion : 400m².
Jarak : 1,5 m².
: 400 m² / 1,5 m : 40 000 cm² / 150 cm² = ± 26 orang.

Translated into English:

Answer 1:
Rectangle

Answer 2:
Area = 2 × length+width

Answer 3:
L = 2 × length + width =
2×90+110=2×200=400m^2

Answer 4:
Distance per person 1.5 meters

Answer 5:
To find out the number of visitors, the calculated operation used is division, because the previous question was already known widely and the distance between one person and another.

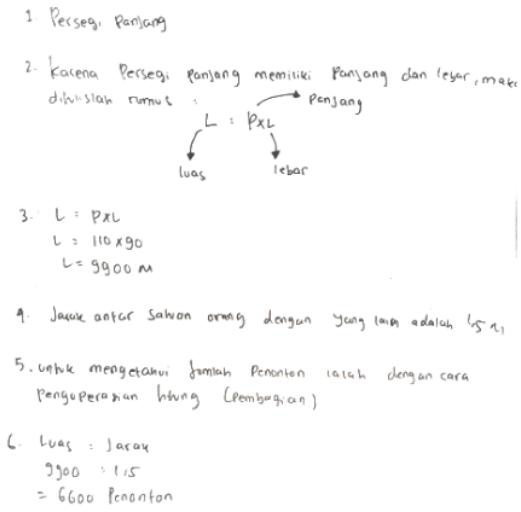
Answer 6:
$L.stadion = 400m^2$ *and* $distance = 1{,}5m^2$

$$\frac{400m^2}{1{,}5m} = \frac{40.000cm^2}{150cm} = 26.000\ person$$

Figure 4. One-to-one answers of student 2

Figure 4 show that the student's answer is still incorrect. The actual formula of the rectangle area is p x l and the roving formula is 2length + 2width. But the student wrote it the formula of the two in reverse.

For the one-to-one stages, it can be seen in the image above. In the answers of students 1 and 2 above, it can be seen that students understand the information about the questions well. However, student 1 can answer the question correctly but does not describe the desired answer. In addition, for student 1 there was an error in calculating the questions and activities. Then for student 2, it is known that they can answer the questions well and can describe the answers as desired. However, student 2 has misperceptions about the area and perimeter formulas. So the use of area and perimeter formulas is used in reverse.



Translated into English:
Answer 1:
Rectangle

Answer 2:
Because the rectangle has a length and width, then write the formula area = width x length

Answer 3:
Area = width x length = 110 x 90 = 9900m

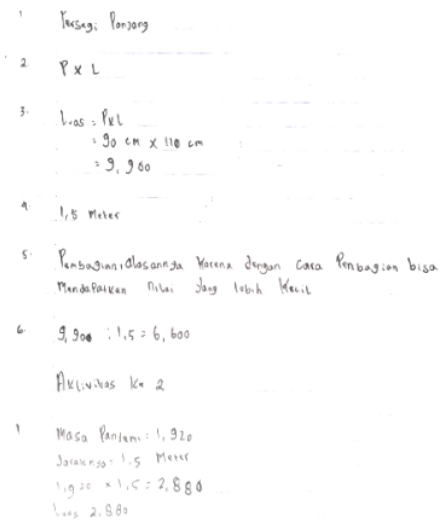
Answer 4:
The distance between units of people with others is 1.5 meters.

Answer 5:
to find out the number of spectators is by operating the count (division)

Figure 5. Small group student answers

Figure 5 shows that in this case students can highlight the activity problem as in figure 2 properly and correctly. In addition, in this case students can also describe the answers they choose. But in this case, for problem number 3, students' understanding of the unit concept of broad operations is still so lacking.

After the questions and activities have been revised, the next step is to conduct a small group trial on prototype 2. The picture shows students who can know that students have understood well the questions asked. However, for the elaboration of question number 5, it can be seen that the student still has not answered what he wants from the question. The student only answered using the division operation without explaining the reason why he chose the division operation in solving the problems and activities. In addition, for question number two, students should clearly write down the units in the problem to be solved in the completion step. However, the student only wrote down the units in the result of the solution.



Translated into english:

Answer 1:
Rectangle

Answer 2:
Length x width

Answer 3:
Area = length x width = 90 cm x 110 cm = 9900

Answer 4:
1,5 meters

Answer 5:
Division, the reason is because by way of division can get a smaller value

Answer 6:
During Pandemic = 1920
Distance: 1,5 meters
1920 x 1,5 = 2880
Area = 2880

Figure 6. Student field test answers

Figure 6 shows the results of students' answers at the time of the field test. At this trial stage, there is one student who becomes the reference for the analysis at this stage. Almost all students have the same answer. From these answers, it can be analyzed that the student can work on the questions in accordance with the directions from the questions and activities given. For question number 3, the student can explain the reasons why he chose the arithmetic division operation in the process of analyzing questions and activities.

3.2. Discussion

After conducting trials from one-to-one, small group to field tests, the results obtained from this research are whether the questions and activities developed can be classified as valid and practical questions and developments or not. Based on the results of the data analysis above, it can be seen that the literacy skills of students in this case are classified as good. This can be seen from the one-to-one process, small group to field tests where it can be seen that the student can answer questions according to the desired direction.

In the process of assessing their mathematical literacy skills, there are several aspects that are used as a reference in assessing student's mathematical literacy include (1) communication, (2) mathematization, (3) restating, (4) reasoning and giving reasons, (5) using problem solving strategies, (6) use symbols, Formal language and techniques and (7) using mathematical tools (Hesse et al., 2015; Lin & Tai, 2015; Nusantara & Putri, 2018; Putri & Zulkardi, 2018). From these seven aspects, it can be seen that most of the students who are the subjects of this research have good mathematical literacy skills. This can be seen from the way students answer various questions on the questions and activities that have been given. There are some students who are not able to explain the reasons when choosing a particular operation path as stated by question number 5. However, there are also some of them who can describe it well.

4. CONCLUSION

This research produces questions and develops PISA types with shape and space types using social distancing during a pandemic that is valid, practical and has potential effects. In this case, the question can be said to be valid based on FGD activities, expert validation and one-to-one trials. Meanwhile, to see whether the question is practical or not, it can be seen from the results of the small group that has been held for several students. Then to see the potential effects based on the field test trials. Based on the results of the answers obtained from these students, it can be classified that the questions are included in the type of questions and practical activities because they can be solved easily by students and can be interpreted well with various kinds of student responses in answering and adjusted to the level of difficulty of class students IX.

After this research has been carried out with valid, practical and potential effects and questions, it is hoped that future researchers can develop other research on PISA questions with much more diverse content and other contexts.

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