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ISLAMIC TOURISM IN INDONESIA CONTEXT IN PISA LIKE MATHEMATICS PROBLEM

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Abstrak

Penelitian ini dilaksanakan dengan tujuan untuk menghasilkan soal matematika tipe PISA dengan konteks wisata islami di Indonesia yang sesuai dengan kerangka kerja soal PISA, memiliki daya tarik, serta memperlihatkan efek potensial dari pemberian soal tes setipe PISA terhadap kemampuan literasi matematis siswa. Subjek penelitian merupakan 21 orang siswa kelas IX A MTs Muhammadiyah 1 Palembang. Metode penelitian yang digunakan merupakan penelitian pengembangan yang terbagi menjadi dua tahapan besar yaitu tahap persiapan dan tahap prototyping dengan alur formative evaluation Tessmer. Teknik analisis data yaitu deskriptif kualitatif. Hasil akhir penelitian merupakan 7 buah soal matematika tipe PISA dengan konteks wisata islami di Indonesia pada tingkat SMP yang valid berdasarkan penilaian validator pada tahap expert review. Soal memiliki daya tarik berdasarkan hasil pada tahap one-to-one dan small group karena diketahui bahwa siswa menjadi tertantang menyelesaikan soal dengan benar dan dapat menstimulus cara berpikir siswa untuk menggunakan kemampuan matematis yang dimilikinya dalam permasalahan sehari-hari. Hasil jawaban siswa pada tahap field test memperlihatkan efek potensial bahwa soal yang dikembangkan memunculkan berbagai perlibatan kemampuan dasar dan literasi matematis pada proses penyelesaian soal.

Kata kunci: Penelitian Pengembangan, Soal Matematika Tipe PISA, Wisata Islami di Indonesia

Abstract

The aim of research was to producing PISA-like mathematics problem in using Islamic tourism context in Indonesia that are accordance with the PISA problem framework, had attractiveness, and had potential-effect to mathematics literacy skill on junior high school students. The subject of the research were 21 students of ninth grade A class at MTs Muhammadiyah 1 Palembang. The research method used was development research which is divided into two major stages, namely the preparation stage and the prototyping stage with Tessmer's formative evaluation flow. The techniques of collecting data were used open questionnaire, interview, and test. The technique of analysis data was used descriptive qualitative. The final results of the study are 7 PISA-like mathematics problem in using Indonesia's Islamic tourism context at the junior high school level that were valid based on the validator's assessment at the expert review stage. The questions had an attractiveness based on the results at the one-to-one and small group stages because it is known that students are challenged to solve problems correctly and can stimulate students thinking to use their mathematical abilities in any problems. The results of student answers at the field test stage show the potential effect that the questions developed lead to the involvement of various basic abilities and mathematical literacy in the problem solving process.

Keywords: Development Research, PISA-Like Mathematics Problems, Islamic Tourism in Indonesia

Introduction

The low quality of human resources in Indonesia is one of the major obstacles to the progress of Indonesia. Improving the quality of human resources starts from the field of education, that's why the quality of education in Indonesia is important to improve for the sake of better quality human resources. One of the international studies carried out by the Organization for Economic Cooperation and Development (OECD) in the field of education is the Program for International Student Assessment or known by PISA.

PISA is a survey that is carried out regularly every 3 years to 15 year old students around the world (OECD, 2020). PISA aims to assess student's proficiency in reading, mathematics, and science as well as what students can do with what they know in order to contribute significantly to society (Wilkens, 2011). PISA also invites countries to learn from each other about the education system in each country in order to create a better education system. As stated in the 2nd Core Competence in the 2013 curriculum which focuses on student's social attitudes, students are required to contribute to finding solutions to various social and economic problems in the world. This is in line with the purpose of making PISA questions, namely so that students can contribute to the social and economic fields of life.

In the OECD official website, from the results of the PISA test which is conducted every 3 years, it is known that the position level of Indonesian students is very low, which is only up to level 3 of the 6 levels determined by PISA. Indonesia is ranked 72 out of 78 countries participating in PISA. The level of reading literacy possessed by 7 out of 10 students aged 15 years is still below the specified minimum competence. This shows that the reasoning ability of Indonesian students is still very low, one of which is in the field of mathematics.

In the field of mathematics, Indonesia was only able to achieve a score of 379 which is below the PISA average score of 489 in 2018. Broadly speaking, this is due to a lack of training on student's mathematical literacy skills (Pulungan, 2014; Putra et al., 2016). Even though this ability is very important for students to have so that it is easier for them to reason about how to solve the problems they face and they can also know what they will do about the problem.

One way to train student's mathematical literacy skills is by giving PISA-like questions to students. The lack of provision as well as the availability of PISA-like questions causes students to be less trained in working on non-routine questions such as PISA questions (Junika et al., 2020). The result of research conducted by (Yazgan et al., 2021), show that the flexibility of students strategies in answering mathematical questions could be improved by giving non-routine question through learning. The statement is accordance to PISA-Like Mathematics question that students can solve the question with their strategies and methods that are in accordance to logic. For Indonesia, based on the results of PISA in 2012 and 2015 where Indonesia experienced an increase in points, it gives an illustration that the mathematical literacy skills of Indonesian students can also be developed if they are trained regularly by habituating the use of PISA questions in education in Indonesia (Wulandari & Azka, 2018). PISA questions that use context can also make it easier for students to understand a question. The context relates to personal, educational or work contexts, contexts in society, or general or

scientific contexts. Examples of common or scientific contexts that are easy to find include historical buildings and tourist attractions.

One of the tourist attractions that are growing rapidly and can increase economy growth is Islamic tourism. The Islamic tourism sector has grown rapidly globally especially in countries with dominant Muslim populations (Adinugraha et al., 2021; Satriana & Faridah, 2018). Islamic tourism is a tourist spot that comes from nature, culture, or creativity with Islamic values in it which is supported by the community, entrepreneurs, or governments that must meet the requirements and Islamic terms (Amir Abdullah et al., 2020). Indonesia as one of the countries with the largest Muslim population also has many Islamic tourist destinations that can be visited. According to GMTI (Global Muslim Travel Index), Indonesia is ranked 4th out of the 20 best halal tourist destinations in the world in 2021 with a score of 73. This shows that Indonesia has decreased in ranking from first place in 2019 with a score of 78 alongside Malaysia. One of the impacts that made this score decrease was due to the COVID-19 pandemic so that many Islamic tours were closed or limited in the number of visitors. This reason is one of the backgrounds of researchers wanting to develop PISA-like mathematics problem to improve Islamic tourism in Indonesia through mathematics problem as well as representing Islamic tourism that has never been used as a context for PISA-like mathematics problem before. For the reasons above, researchers are interested in developing PISA-like mathematics problem with the context of Islamic tourism in Indonesia in order to train and improve student's mathematical literacy skills.

Methods

The research subjects were 21 students of class IX A of MTs Muhammadiyah 1 Palembang aged 15 years. In the one-to-one stage, the subjects were 3 non-subject students with high, medium, and low abilities. Meanwhile, in the small group stage, 6 non-subject students were involved, each with 2 high, medium, and low abilities. The type of research used is a development research method. This type of research is used because it is in accordance with the purpose of this study, namely developing PISA-like mathematics problem with the context of Islamic tourism in Indonesia at the junior high school level that is valid, practical, and has a potential effect on student's mathematical literacy skills. The research is divided into two major stages, namely the preliminary or preparation stage, and the prototyping stage with a formative evaluation tessmer stage. The preparation stage is further divided into two, namely the preparation stage which includes the analysis of curriculum, material, and student characteristics and the product design stage. The flow of formative evaluation starts from *self-evaluation, expert review, one-to-one, small group,* and *field test* (Tessmer, 1993). Data was collected by means of a validation questionnaire, interview guidelines, and tests. Data were analysed descriptively qualitatively based on the steps contained in Tessmer's book.

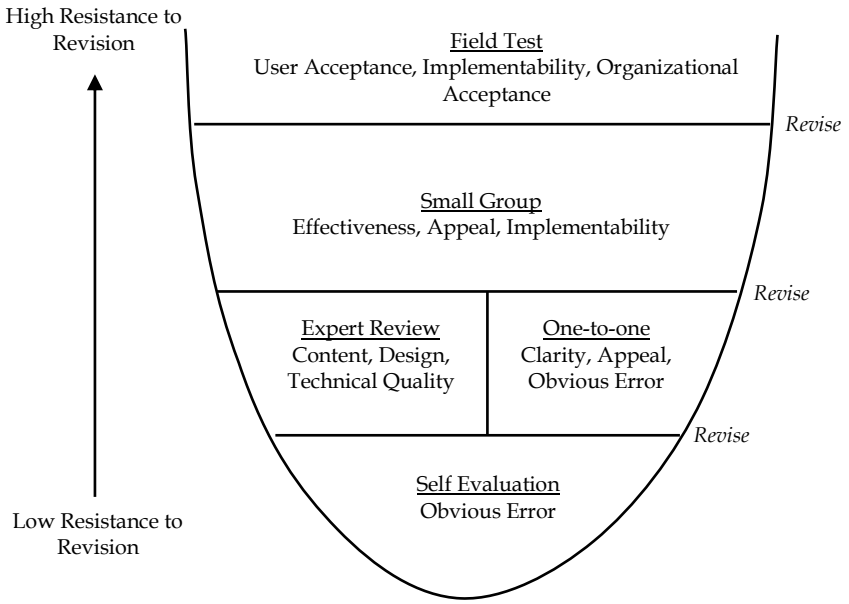
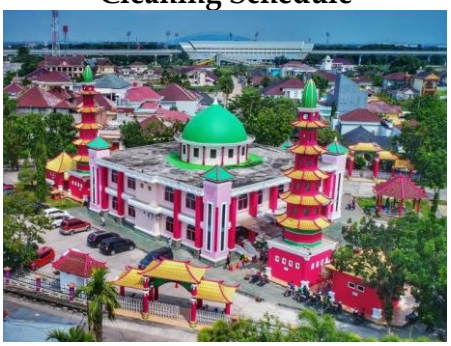


Figure 1 Formative Evaluation Tessmer Flow

Result and Discussion

At the analysis stage, it is known that the school uses the latest revised 2013 curriculum. The material taught is guided by the Kemendikbud book. The researcher also knows that the research subject class is a regular class where students with low, medium, and high abilities are combined into one. At the product design stage, 6 PISA-like math problems were produced along with grids, question cards, and scoring rubrics. In this article, 2 questions will be discussed among the 7 questions generated. The following is the result of the question design made by the researcher.

Table 1 Design Questions

Number	Question	Framework of Question
1.	**Cleaning Schedule**  Source: instagram.com/Palembang Info Chengho Palembang Mosque is a famous Chinese Muslim Mosque in Palembang. This mosque has a main building and two towers on the right and left sides. The mosque management plans to divide the shifts of the 4 janitors into several groups to clean the main building and the two minarets. For the main building, 2 people will be assigned to do the cleaning, while for each tower, 1 janitor will be	**Content:** uncertainty and data **Context:** occupational **Process:** employing mathematical concept, fact, procedures, and reasoning **Level:** 3

	assigned. This cleaning schedule will be changed every day. Make a list of cleaning schedules in every possible building!	
2.	**Mosque's Roof**  Source: sumsel.idntimes.com The Great Mosque of Sultan Mahmud Badaruddin I Jayo Wikramo or better known as the Great Mosque of Palembang is a large mosque in the city of Palembang which was founded in the 18th century by Sultan Mahmud Badaruddin I Jayo Wikramo. The roof of the main building of this mosque is shaped like 3 pieces of the same pyramid space and congruent, where the roof in the middle is 1/8 larger than the size of the roof on the other side. The sides of the base and the hypotenuse of the smaller pyramid are the same length, i.e., 6m. How long is the wood needed to make the pyramid frame plus a pole in the middle of the pyramid or the height of the pyramid?	**Content:** Space and shape **Context:** Occupational **Process:** Employing mathematical concept, fact, procedures, and reasoning **Level:** 4

In the self-evaluation stage, the researcher got advice from the supervisor and also colleagues. The comments include adding subtitles for each question. So, the researcher added subtitles for each question. At the expert review stage, the researcher got a lot of comments and suggestions that were used by the researcher as a guide for improvement. In general, validators argue that the sentences used by researchers are too long and ineffective.

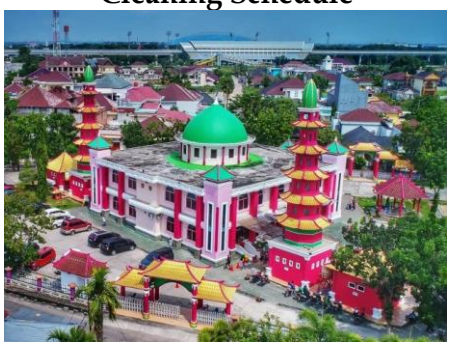
Table 2 Comment from Expert Review and One-to-one Stage

Name	Comment
Expert 1	Questions number 3 and 5 are suitable to use
Expert 2	Questions number 3 and 5 are suitable to use
Expert 3	• In general, it is all a matter of bringing an Islamic context with history that provides new knowledge for the reader. However, I think the description is too long, especially if it is not related to the content of the question to be measured. Maybe it can be taken from the example of the PISA problem which only writes a few sources or descriptions under the picture. • The problem of question number 3 provides an illustration of a mosque with a fairly large and spacious condition. The realistic value of questions with 4 officers is less rational unless there is an explanation that they are only in charge of sweeping the floor. If 1 person is in charge of cleaning a tower with a certain schedule, the impression cannot be completed in one day. Perhaps the assignment problem could be simplified. • Question number 5th seems to need an illustration above, such as the example in the context of the PISA questions listed on the left. This is to

	complete the information that only the length of the wood for the roof is measured, not the floor.
Student 1	The sentence in the question are too long and there is a lot of information on the question that is no needed in answering the question
Student 2	The sentence in the question are too long.
Student 3	The sentence in the question are too long

In the one-to-one and small group stages, the researchers looked at the attractiveness of the questions and also the practicality of the questions based on predetermined indicators. The results show that the questions have an appeal based on student comments. The researcher also revised the questions based on the comments from the students. At the field test stage, the researcher saw whether there was a potential effect from the answers given by the students. From the results obtained, it can be seen that none of the students managed to answer all the questions perfectly. The imperfect score in numbers 1 and 2 is caused by the student's inaccuracy in reading the questions. On the questions with a higher level, the fewer students who can answer and understand the questions according to their respective ability levels. However, it appears that 18 students have been able to correctly answer the questions for level 1-4 and understand the intent and purpose of the level 5 and 6 questions. This is in accordance with the results of the PISA test for Indonesian students, where Indonesian students are only able to solve PISA questions properly and correctly up to level 4. As for level 5 and 6 questions where students are able to understand the meaning of the questions but have not been able to solve the questions correctly, it shows that the questions made by researchers are good and can be used to train student's mathematical literacy skills so it is hoped that if students are used to working on PISA like questions, students can solve them and give strong reasons for the answers they have given.

Table 3 Finish Question

Number	Question
1.	**Cleaning Schedule**  Source: instagram.com/Palembang Info Palembang Chengho Mosque has a main building and two towers on its right and left sides. The mosque administrator plans to divide the shifts of the 4 cleaners into several groups to sweep the floors of the main building and the two towers. For the main building, 2 people will be assigned to do the cleaning, while for each tower, 1 janitor will be assigned. This cleaning schedule will be different every day. Make a list of cleaning schedules in each building that may form in one week in the form of the table below!

<table>
<tr><td></td><td>
<table>
<tr><td>Day -</td><td>Main Building</td><td>1st Tower</td><td>2nd Tower</td></tr>
<tr><td>1</td><td>...</td><td>...</td><td>...</td></tr>
<tr><td>…</td><td>...</td><td>...</td><td>...</td></tr>
</table>
</td></tr>
<tr><td>2.</td><td>Mosque's Roof
 

Source: sumsel.idntimes.com
The roof of the main building of the Great Mosque of Palembang is shaped like 3 pyramids that are the same and congruent, where the roof in the middle is 1/3 larger than the size of the roof on the other side. The sides of the base and the hypotenuse of the smaller pyramid are the same length, i.e., 6m. Calculate the length of the wood used as the roof frame in the middle, then add the length of the wood from the base to the top of the roof!</td></tr>
</table>

According to the Big Indonesian Dictionary or KBBI, valid is the nature of being true according to existing evidence, logical thinking, or validity. The validity of the questions can be seen from the results of the expert review stage where experts have received instruments that were developed both in content (based on content, constructs, and language) as well as in format without any revision (Putra et al., 2016). The validity of the PISA like math questions with the context of Islamic tourism in Indonesia developed by the researchers can be said to be valid if they are in accordance with the original PISA problem framework, and have gone through the improvement stage based on comments and suggestions from experts at the expert review stage.

The validity of the questions begins at the prototyping stage, namely the self-evaluation stage, where the design of the questions that have been made is then discussed with the supervisor and colleagues. In the design of the questions made, the researcher did not add a title for each question. The researcher then revised it by adding a title for each question that had been made to make it more in line with the original PISA questions. This fix relates to the PISA like question construct. There were no comments related to the context, content, process, construct and language aspects so that the results of the improvement of the question design with comments in terms of context were considered good enough to be shown to experts.

The revised questions then proceed to the expert review stage to be assessed by experts. In terms of the general context, namely the context of Islamic tourism, there are no experts who question the context of Islamic tourism used by researchers. In particular, the third validator argues that the realistic value of the question number 3 is less rational in the context of work where the officer cleans a large mosque without any explanation of the task. The questions were revised with the addition of the editor that the officers were only in charge of sweeping so that the questions became more realistic and rational. This is in line with the PISA framework where students are expected to have an understanding of mathematical content that is important to citizens and the ability to apply knowledge to solve meaningful contextual

problems. That is, by working on questions students are required to reason mathematically in solving problems and interpreting situations in personal, work, social and scientific contexts as well as the need to utilize certain mathematical knowledge and understanding (OECD, 2021). Based on the research stages that have been passed to expert review, focusing on the context of the questions, it can be seen that the development of PISA like math problems with the context of Islamic tourism in Indonesia is in accordance with the context of PISA questions.

In addition to validation regarding the context of the question, the validator also looks at the suitability of the question in terms of the content on the question. The third validator provides comments for question number 6 about the number of worshipers for Eid prayers. According to the third validator, question number 6 has provided enough problems for students even though the lengthy editorial should be shortened so that the purpose of the question becomes clearer. This is in accordance with the PISA framework where the questions given to students can show how well a student is able to perform calculations, manipulate, apply known concepts and facts to arrive at a mathematical solution to a problem formulated mathematically, and how effectively students are able to reflect on the solution. or the mathematical conclusions it draws to be interpreted in the context of real-world problems (OECD, 2021).

The first validator provides suggestions in terms of content for question number 1. In prototype 1, the researcher only provides information about the price of admission without categories, which is Rp. 15.000,00. The first validator suggests that the researcher displays an image of the actual ticket price list with different categories, then develops questions on the questions. The researcher developed the problem to calculate the money that the Indah family needed to prepare to be able to enter the Islamic tourist spot. This is in line with the PISA framework, students are expected to be able to use their understanding, knowledge, and mathematical concepts in order to evaluate various events or diverse situations that are relevant in people's lives (OECD, 2021).

In terms of language, the first and third validator provides comments for the whole question in general. According to the third and first validators, indeed all questions carry an Islamic context with history that provides new knowledge for readers, but the descriptions given are too long and unrelated to the content of the questions to be measured. Sentences presented should be shortened and stories on questions that are not needed in problem solving are removed. The existing context does not need to be explained in detail because it should already be known by students. The original PISA problem only wrote a little source or description under the picture.

From the discussion above, PISA-like mathematics problems with the context of Islamic tourism in Indonesia have been valid in terms of content, namely the questions developed have been in accordance with the PISA framework. The content, context, and process in the questions are in accordance with the PISA question framework. Valid in terms of constructs, namely the questions developed have been rich in mathematical concepts and have developed student's mathematical literacy skills as well as higher concept development. Valid in terms of language, namely the questions developed by researchers are in accordance with the

Indonesian EYD, are not complicated, use good and standard language, and are easily understood by students.

The attractiveness of PISA-like mathematics problems can be seen from the student's comments at the one-to-one and small group stages. In the one-to-one stage, the researcher conducted interviews with students using interview guidelines that had been prepared by the researcher. Interviews were conducted related to the content of the questions; clarity; interest and acceptance; benefits of using questions; environment; as well as general and specific revisions that may be obtained from student's comments and suggestions. In addition to using the main questions that have been prepared by the researcher, the researcher also adds spontaneous questions that may arise during the research so that the information obtained by the researcher is more accurate and diverse.

Regarding interest and acceptance, all subjects thought that they were interested in working on the problems because of problems related to real life and were interested in using the questions as practice questions at home. From the results of interviews at the one-to-one stage with AEW students, it appears that students are interested in working on questions because the problems in the questions can be imagined in real life, although there are questions that take time to understand, such as question number 7. It is also known that students want more free time to be able to solve the problem. Students are interested in solving the problems given. Students can understand the meaning of the questions asked even though it takes a longer time. This is because students are not familiar with questions that require student reasoning so that students cannot understand the meaning of the questions in a short time.

At the small group stage, researchers want to know how to make questions more effective, efficient, usable, and interesting. In the small group stage, the researcher tried out the questions to 2 students with high abilities, 2 people with moderate abilities, and 2 more people with low abilities.

The results of the small group stage which show the attractiveness of the questions that have been developed by the researchers can be seen from the results of interviews related to the attractiveness of the questions. All subjects thought that students were interested in using the questions given as practice questions both in the learning process at school and at home. Mathematics teachers who teach in schools also think that they are interested in using questions with reasoning like this in learning to attract student's interest and also provoke students to think more logically in answering questions. Based on the explanation above, it can be seen that the questions developed by the researcher have an appeal based on student comments.

Based on the results of the field test stage described in the previous chapter, it is known that students have been able to work on level 1 to 4 questions well, and have decreased in working on level 5 and 6 questions. This is in line with the results of PISA where Indonesian students have not been able to complete and provide strong reasons for the answers on PISA level 5 and 6 questions. In the PISA question framework, there are 7 components of ability in mathematical literacy, namely communication; mathematization; restate; reason and reason; using problem solving strategies; use symbols, language, and techniques; and use

mathematical tools. researchers have made indicators of student's mathematical literacy abilities based on these seven components. Based on the 7 mathematical literacy skills, the following are some of the results that can be seen from the answers given by students which can show the potential effect of using PISA type math problems in the context of Islamic tourism in Indonesia.

Student's answer to question number 3

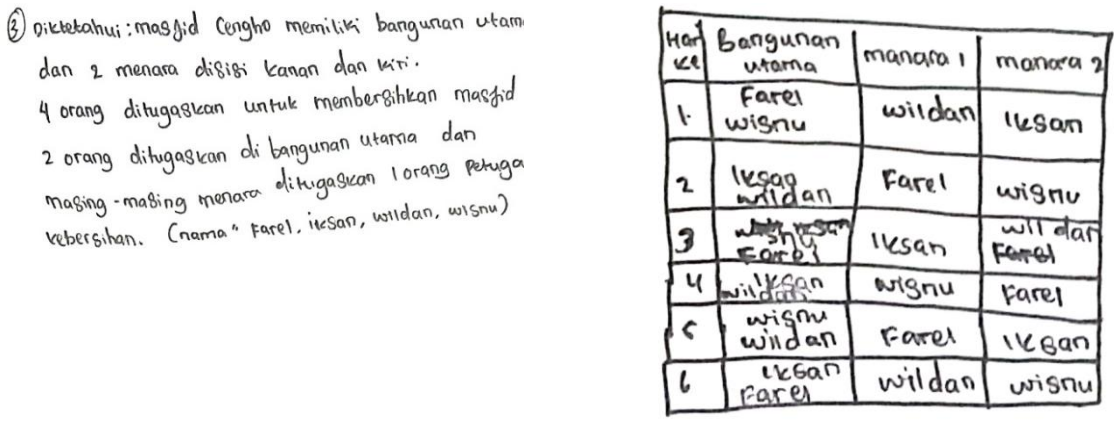


Figure 2 Students Answer for Question number 3

In the student's answers, it can be seen that students can communicate an explanation of the problems contained in the question (K1). The communicate an explanation of the problem accordance with the result of research conducted by (Dayona & Zulkardi, 2019). Students make an example to answer questions even though the names of the cleaners are not known in the questions. Students assume the name of the officer with the names of his friends. Student's answers show their ability to use symbols in mathematics (K6). This is accordance with the result of research conducted by (Amalia et al., 2021; Nizar, 2021), PISA-Like mathematics problem had a potential effect that can bring up the ability to represent an use language, symbolic, formal, and technical operations. In question number 3, students are expected to be able to make connections between simple combination materials and real-life problems that exist in society. In the student's answers above, it can be seen that students can do simple combinations based on the real situation presented. Students can use appropriate problem-solving strategies to interpret, assess, and validate solutions (K5). The combinations made by students have met the requirements listed in the questions. This shows a relationship between students' mathematical literacy and knowledge of mathematical content (Godek et al., 2017; OECD, 2020). Good mathematical literacy skills produce these students can understand the problems in the problem and formulate it mathematically. Students then solve these problems with appropriate strategies according to their knowledge.

Conclusion and Implication

Based on the results of the research and discussion described in the previous chapter, can be concluded that PISA type math problems with the context of Islamic tourism in Indonesia were developed with a formative evaluation flow. The questions developed are in accordance with the context of the PISA questions contained in the PISA framework. This can

be seen from the results of the revision based on comments and suggestions from experts and the research team that accompanied the research activities. The questions developed are in accordance with the latest PISA question framework so that the goals to be achieved can be realized properly.

The results obtained in the one-to-one and small group stages show that the PISA type math problems with the context of Islamic tourism in Indonesia developed by the researchers have been interesting according to comments from students and also mathematics teachers. Throughout the ongoing development process, there are several potential effects that indicate the existence of mathematical literacy skills based on the answers given by students. With diverse abilities, students also show different types of answers according to their respective abilities.

Based on the experience gained by the researcher throughout the research process, there are several suggestions that the researcher would like to convey to students, teachers, and further researchers. Students are advised to practice more questions that require higher-order thinking skills and also keep trying to understand the questions without having to think first that the questions they will be working on are difficult. Teachers are expected to be able to give students questions that are diverse and not limited to student manuals, as well as questions that provide real problems to students so that students can get used to questions that require mathematical literacy skills and higher-order thinking skills.

Further researchers are advised to develop PISA questions with a more diverse context and make questions as interesting as possible in order to increase student's motivation in working on PISA-type questions. The researcher also suggests that future researchers can better search for experienced experts in accordance with the objectives of development research itself. In developing PISA questions with a context, further researchers are advised to develop PISA-type questions with contexts that are really attached to the questions so that the questions developed are even better.

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