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Improving PISA-Like Questions Through Trialmusi Video Context: LRT, Damri and Transmusi

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Abstract

The aims of this study were (1) to generate PISA mathematics quetions of uncertaint context with the integrated data from LRT, Damri and Transmusi (Trialmusi). (2) is there any potential effect from PISA mathematics questions of uncertain context with the integrated data from LRT, Damri and Transmusi (Trialmusi) towards students' mathematical literacy abilities of junior high school students. The subjects of this research are the students of junior high school number 1 Palembang. This research applied design research with development study type, with 2 steps, preliminary and formative evaluaions steps. In preliminary step, there were analazying the subject research, curriculum, PISA framework, and designing instrumental questions. In formative evaluation step, there were self evaluation, expert reviews and one to one, small group and field test. The data collection in this research apllied walk trough, documentation, observation, interview and test. This research generated PISA math questions of uncertain context. With the valid and practical integrated data from trialmusi. The validation came from the result of validation assessment, which were from context, construct, language and one to one students' assessment. Practical came from the result of student understanding towards small group question. Then from the students' answers in the field test steps.

Keywords: PISA, Design Research, Mathematics Literacy

Abstrak

Tujuan dari penelitian ini yaitu (1) menghasilkan soal matematika tipe PISA konten uncertainty and data dengan konteks Terintegrasi LRT, Damri dan Transmusi (Trialmusi) (2) mengetahui efek potensial soal matematika tipe PISA konten uncertainty and data dengan konteks Terintegrasi LRT, Damri dan Transmusi (Trialmusi) terhadap kemampuan literasi matematis siswa kelas SMP. Subjek penelitian adalah siswa SMP Negeri 1 Palembang. Metodologi yang digunakan adalah design research dengan tipe development studies, dengan 2 tahap yaitu preliminary dan tahap formative evaluation. Pada tahap preliminary dilakukan analisis subjek penelitian, kurikulum, framework PISA, dan membuat instrumen soal. Pada tahap formative evaluation meliputi self evaluatioan, expert reviews dan one-toone, small group, dan field test. Teknik pengumpulan data yang digunakan adalah walk through, dokumen, observasi, wawancara, dan tes. Penelitian yang telah dilakukan menghasilkan soal matematika tipe PISA konten uncertainty and data dengan konteks Trialmusi yang valid dan praktis. Valid terlihat dari hasil penilaian validator yang dilihat dari segi konten, konstruk, dan bahasa serta pengerjaan siswa pada tahap one-to-one. Praktis terlihat dari pengerjaan siswa tahap small group yang siswa dapat memahami maksud soal. Kemudian dari jawaban siswa pada tahap field test.

Kata kunci: PISA, Design Research, Literasi Matematis

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INTRODUCTION

The Program for International Student Assessment (PISA) is a study of international student assessment programs that are held every three years by the Organization for Economic Cooperation and Development (OECD) or organizations for economic cooperation and development. Through this international study, it can be seen as the extent to which Indonesian students can compete in the current era of globalization.

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Regarding the aspect of mathematical literacy, Indonesia has been following the PISA study since 2000. The results of Indonesia's PISA score can be seen in the figure below.

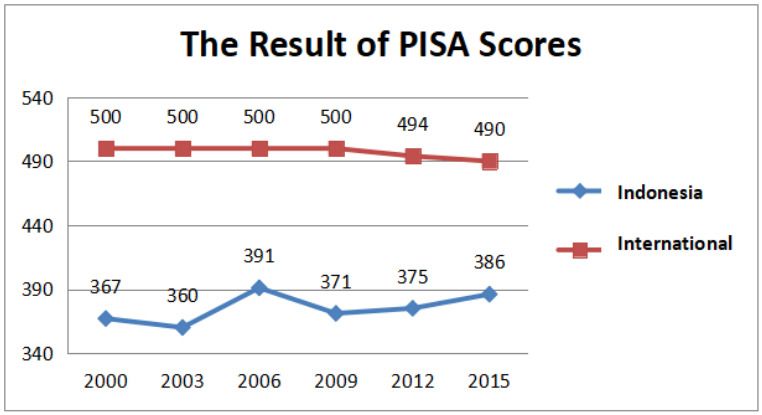

Figure 1. Indonesia's PISA scores

Based on the graph above, the results of Indonesia's PISA scores are always below the International average. There is instability in the results of Indonesia's PISA scores where there are visible decreases and increases. In the last three years, the results of Indonesia's PISA scores have increased (Ministry of Education and Culture, 2016). From the results of the PISA score, it can be concluded that the achievements of Indonesian students lag behind those of the participating countries. The results of the PISA study can be seen as the extent of Indonesian students 'mathematical achievements and also to measure students' abilities and skills (Shiel, et al. 2007; Zulkardi, 2005). This agrees with Kamaliyah, Zulkardi & Darmawijoyo (2013) that Indonesia's involvement in PISA is an effort to see the extent of the development of educational programs in our country compared to other countries in the world.

The Ministry of Education and Culture has prevented this by making several changes to the education curriculum in Indonesia (Murtiyasa, 2015). According to Permendikbud No. 68 of 2013 explains that the Indonesian PISA results are one of the external factors behind the 2013 curriculum changes. So it can be said that PISA is very important because it is one of the factors of curriculum development in Indonesia. Also, one of the principles of curriculum development in 2013 is that the curriculum must be relevant to the needs of life (Ministry of Education and Culture, 2013).

According to Wijaya, Heuval-Panhuizen, Doorman, & Robitzsch (2014) students in Indonesia in solving context-based PISA type math problems and turning them into mathematical problems experienced difficulties. This is due to the PISA questions that demand mathematical literacy skills. This is in line with the low PISA results of Indonesian students due to the weak ability to solve non-routine or high-level problem problems, the evaluation system in Indonesia that still uses low-level questions, and students are accustomed to obtaining and using formal mathematical knowledge in class (Stacey, 2010; Novita, Zulkardi, & Hartono, 2012).

The results of the PISA study in 2015 showed that Indonesia was able to work on level 1.2 and

3 questions with a percentage at level 1 that was 30.7 from the average percentage of PISA participants which was 14.9%. The percentage at level 2 is 19.6% from the average percentage of PISA participant achievement which is 22.5%. The percentage of achievement at level 3 is 8.4% from the average percentage of achievement of PISA participants which is 24.8%. But Indonesia is weak on PISA questions level 4, 5, and 6. With the percentage of achievement at level 4 that is 2.7% of the average percentage of PISA participants which is 18.6%. The percentage of achievement at level 5 is 0.6% from the average percentage of achievement of PISA participants which is 8.4%. The percentage of achievement at level 6 is 0.1% from the average percentage of achievement of PISA participants which is 2.3% (OECD, 2016).

According to the OECD (2014), the results of the 2012 PISA study on uncertainty and data content Indonesia is ranked 63 out of 65 countries with a score of 384. This is reinforced from the results of the 2012 PISA study on content uncertainty and data, students are only able to be at level 2 of 6 PISA levels (Zuhra, 2015). This shows that Indonesian students are still weak in working on PISA questions on uncertainty and data content. The challenge in the learning process is designing the PISA questions type level 4,5, and 6 (Zulkardi & Kohar, 2018). So it is very important to develop the types of PISA questions that are expected to support the material in mathematics learning as a form of contribution in the implementation of the 2013 curriculum so that the learning process is more interesting, it requires learning media. One way to produce an interesting learning process is to utilize video as a learning resource and media (Batubara & Ariani, 2016). This is in agreement with Fadhli (2015) the results of the study indicate that people are more interested in learning to use video than learning only using text media. Therefore the purpose of this study is to produce a statistical PISA type video-based problem with a valid, practical trial context and has a potential effect on the mathematics literacy ability of junior high school students.

METHODS

The method in this study is a research method of development or development research type formative evaluation (Tessmer, 1993). This study develops PISA type junior high school mathematics problems in statistical material in learning valid and practical mathematics. This study consists of two stages, namely preliminary and formative evaluation stages which include self-evaluation, expert reviews and one-to-one (low resistance to revision) and small groups and field tests (Tessmer: 1993; Zulkardi 2006).

The preliminary stage consists of the preparatory stage, which is to determine the place and subject of research, the research location chosen is SMP Negeri 1 Palembang. Next take care of research permits, research schedules, and collaboration with teachers; the analysis phase, namely the analysis of students, the curriculum used in the school, and the analysis of the PISA framework; the design stage, i.e., designing questions using the context of the trial discussion. While the formative

evaluation stage consists of self-evaluation, prototyping (expert review, one-to-one, small group), and field tests.

Data collection and analysis techniques in this study are document analysis, walkthroughs, tests, observations, and interviews. Analysis of the documents at the self-evaluation stage, the researchers themselves analyzed the prototype question sets that produced to find out whether the developed question sets were by the PISA framework, the 2013 SMP curriculum, and students' mathematical literacy abilities. Analysis of walkthrough at the expert reviews stage, the researcher conducted a descriptive analysis by revising it based on the walkthrough or validator notes. Analysis of test results to find out the potential effects of questions developed by researchers on students' mathematical literacy ability seen from aspects of mathematical literacy that arise from student the answer. Observation analysis at the small group stage is used to analyze the practicality data of PISA type math problems in the second prototype obtained based on observations of the answer and findings as students work on the problems. Analysis of interviews at the small group stage used to analyze the practicality of PISA type math problems on the second prototype obtained based on researchers' interviews with students while students worked on the problems. The results of the analysis used to revise the questions made by researchers. The results of the analysis of observations and interviews used to revised the questions developed by researchers to obtain practical questions. Interview analysis at the field test stage used to see the potential effect of PISA type math problems on the third prototype based on the researchers' interviews with students after students work on the problems.

RESULTS AND DISCUSSION

The Preliminary stage includes the analysis of students, curriculum, and PISA framework, designing question instruments. Analysis of students was conducted to determine the ability of eighth-grade students of SMP Negeri 1 Palembang. Students who have analyzed their abilities are subject to research in the one-to-one, small group, and field test stages. In the one-to-one stage, it was obtained 3 students of class VIII.2 of SMP Negeri 1 Palembang with high, medium, and low abilities. At the small group stage, it was obtained the data of 6 students of class VIII.2 of SMP Negeri 1 Palembang, at the field test stage, it was recorded 1 in class VIII, namely class VIII.1 of SMP Negeri 1 Palembang.

The curriculum analysis phase carried out by identifying learning materials related to uncertainty and data content on PISA based on the curriculum and analysis of PISA type mathematical problems done by analyzing the 2015 PISA framework.

The formative evaluation stage, the first stage is the self-evaluation stage. In the self-evaluation stage, the researcher designs PISA type mathematical problems with the integrated context of Damri and Transmusi LRT (Trialmusi). At this stage, the researcher evaluates and examines the initial prototype that has been made at the preliminary stage based on the characteristics that are the focus of the prototype. These characteristics are in terms of content, construct, and language. In terms of

content, the researcher evaluates the questions that have been designed, including Uncertainty and Data content. Next, evaluate the context and predictions of the level whether it is following the basic competencies in the curriculum. In terms of construct, the researcher evaluates the questions that are designed to be presented, readable, and functional. In terms of language, researchers evaluate whether the language of the questions is by Indonesian Spelling, questions do not contain multiple interpretations, along with the limits of questions and answers to questions.

The second stage is the expert review and one-to-one stage, the validation of the questions is examined in terms of content, construction, and language. Besides, researchers conducted FGDs with 32 mathematics and mathematics teachers and students at SMP Negeri 1 Palembang. At this stage, the researcher conducts validation directly to the validators by bringing the video as context and other sets of questions that have been designed. The comments and suggestions obtained are as follows (Table 1):

Table 1. Comments or suggestions for unit 1 and 2

Unit	Comments		
	Z	FGD	YP
Unit 1 First Departure South Sumatera LRT	Question 4 add students' questions to explain why they have to choose the data presentation they make	The video used is too long, take part in the video to be used, Add questions about interpreting data, In questions 1 and 2, the word "from the information above" is omitted.	In questions 1 and 2, it is clear and appropriate to see students interpreting the data Questions 3 and 4 clarify the instructions.
Unit 2 South Sumatera LRT Integrated with Damri and Transmusi	Questions 3 and 4 add student questions to explain the strategy they are using.	The video used is too long, take part in the video to be used The language for questions 1 and 2 is clarified again Question 3 add any transportation.	Questions 1 and 2 are clear Questions 3 and 4 can be understood and add problems explaining why.

The PISA type questions that have been developed and revised based on expert review and one to one are called prototype 2. Then this question is tested to 6 students of class VIII.2 of SMP Negeri 1 Palembang. The six students were formed into 2 groups with 3 members each. At this stage, students see the video from the projector that has been provided.

The small group stage aims to see the practicality of the questions that have been made. Questions are given to students through the problem-based learning process that takes place in 2 meetings. The first meeting the questions that tried were unit 1 while the questions about unit 2 were tried on the second meeting. At this stage, the researcher as a teacher supervises and assists the process of discussion in the running group. Besides, researchers also confirmed the results of student

discussions working on the questions given. Based on the results of the sixth small group, students already understand how to work on the problem, namely, students must pay close attention to the video before working on the problem. From this stage, the researchers also saw students understand well the video provided. The six students also understood the purpose of the problem. At this stage, there were no revised questions. The results from the small group stage are referred to as valid and practical prototype 3. Prototype 3 was tested on students in large groups (field tests).

In the Field Test Phase, it is carried out in Palembang 1 Public Middle School by involving class VIII.1 Palembang Public Middle School 1. Learning to use video-based PISA type questions begins with the teacher distributing LAS that contains prototype questions 3. Before the teacher asks students to discuss, the teacher reads the the answer instructions, one of which is to pay attention to the video before answering the questions given. The video is displayed in front of the class using a projector so, students watch the video simultaneously. After students watch the video, then the teacher directs students to discuss with a group of friends to answer questions. Then after students finish completing all the unit questions the teacher asks group representatives to present the results obtained. Students then exchange opinions about their answers, and the teacher confirms the answers to the truth and errors of the students' answers. When students work on PISA type questions the teacher observes the students' work and asks what strategies students use in answering the questions.

Based on the results of the answer when the first and second meeting field tests obtained the following results:

Question 1 of Unit 1 involves the familiar context of Palembang public transportation, where all information is relevant to the questions that are clearly described. Furthermore, identifying information, and carrying out procedures based on direct instruction in real situations, interpreting and recognizing situations in contexts that require direct conclusions, extracting relevant information from a source and reasoning directly. In Figure 1. there are different answers from 2 groups, Figure 3. answers 26 trips, and while Figure 4 answers 74 trips. The right answer for question 1 is 74 trips. Because the answers are available in the data presented.

Question 2 in unit 1, students asked to analyze the available data. Question 2 involves the familiar context of Palembang public transportation, where all information is relevant to the question that is clearly illustrated.

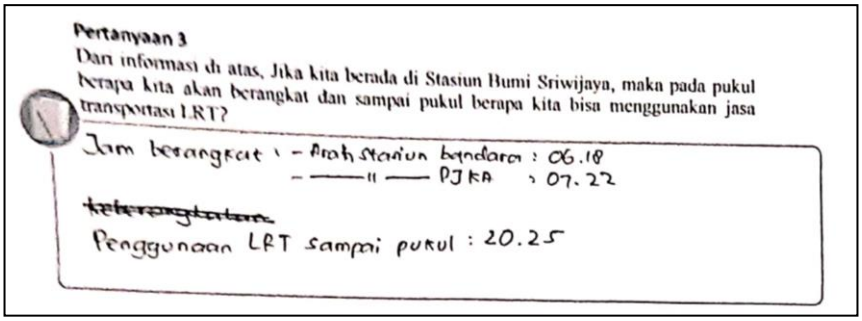

Figure 2. Students' answer unit 1 question 3

In unit 1 question 3, students asked to analyze the available data. Question 3 involves the familiar context of Palembang public transportation, where all information is relevant to the clearly illustrated problems. Furthermore, identifying information and carrying out procedures based on direct instruction in real situations, interpreting and recognizing situations in contexts that require direct conclusions, drawing relevant information from a source and reasoning directly, managing the procedures described, including decisions which sequentially, selects and implements simple problem-solving strategies, interprets and uses images based on different sources of information and direct reasons and reports results, then selects and integrates differences in representation and connects directly to aspects in real situations, utilizing the ability which is developed and reasoned flexibly with insight and knowledge in context.

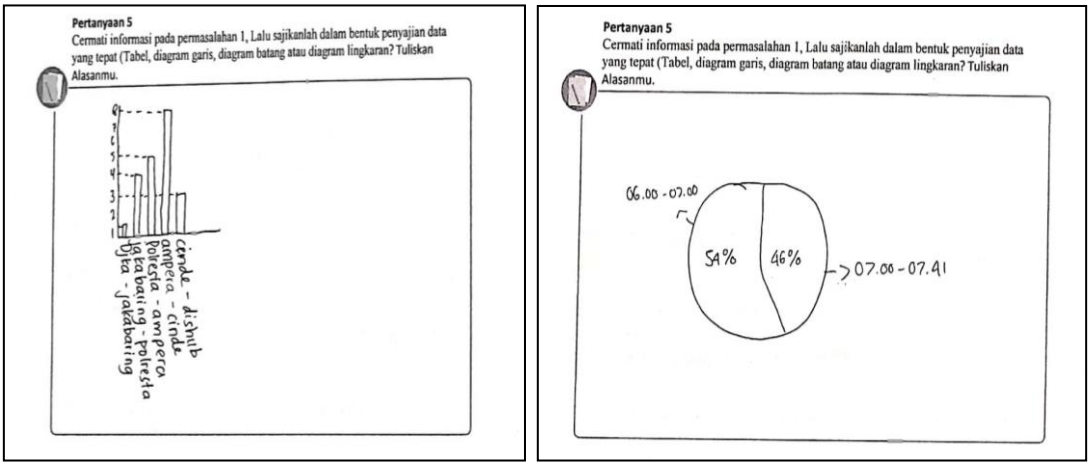

Figure 3. Students' answer unit 1 question 5

In unit 1 question 5, students are asked to present available data. This question involves the familiar context of Palembang public transportation, where all information is relevant to the question that is clearly illustrated. Furthermore, identifying information and carrying out procedures based on direct instruction in real situations, interpreting and recognizing situations in contexts that require direct conclusions, drawing relevant information from a source and reasoning directly, managing the procedures described, including decisions which sequentially, selects and applies simple problem-solving strategies, interprets and uses images based on different sources of information and direct reasons and reports results, then selects and integrates differences in representation and connects directly to aspects in real situations, utilizing the ability which is developed and reasoned flexibly with insight and knowledge in the context.

In question 1 unit 2, students are asked to present available data. These questions lead students to extract mathematical that is essential in analyzing, managing, and solving problems. Students translate from real-world settings to the mathematical domain and provide real-world problems with mathematical structures, representations, and specifications. Question 1 of unit 2 involves a familiar context, namely Palembang public transportation, where all information is relevant to the questions

that are described. Furthermore, identifying information and carrying out procedures based on direct instruction in real situations, interpreting and recognizing situations in contexts that require direct conclusions, drawing relevant information from a source and reasoning directly, managing the procedures described, including decisions which sequentially, selects and implements simple problem-solving strategies, interprets and uses images based on different sources of information and direct reasons and reports results, then selects and integrates differences in representation and connects directly to aspects in real situations, utilizing the ability which is developed and reasoned flexibly with insight and knowledge in context.

In unit 2 question 2, students are asked to analyze the available data. This question involves the familiar context of Palembang public transportation, where all information is relevant to the question that is clearly illustrated. Furthermore, identifying information and carrying out procedures based on direct instruction in real situations, interpreting and recognizing situations in contexts that require direct conclusions, drawing relevant information from a source and reasoning directly, managing the procedures described, including decisions which sequentially, selects and implements simple problem-solving strategies, interprets and uses images based on different sources of information and direct reasons and reports results, then selects and integrates differences in representation and connects directly to aspects in real situations, utilizing the ability which is developed and reasoned flexibly with insight and knowledge in context.

In unit 3 question 2, students are asked to analyze the available data. These questions lead students to extract mathematical that is essential in analyzing, managing, and solving problems. Students translate from real-world settings to the mathematical domain and provide real-world problems with mathematical structures, representations, and specifications. Question 3 of Unit 2 involves a familiar context, the public transportation of Palembang, where all information is relevant to the clearly illustrated questions. Furthermore, identifying information and carrying out procedures based on direct instruction in real situations, interpreting and recognizing situations in contexts that require direct conclusions, drawing relevant information from a source and reasoning directly, managing the procedures described, including decisions which sequentially, selects and implements simple problem-solving strategies, interprets and uses images based on different sources of information and direct reasons and reports results.

In unit 4 question 2, students are asked to analyze and interpret the available data. The question begins with identifying information and carrying out procedures based on direct instruction in real situations, interpreting and recognizing situations in contexts that need direct conclusions, drawing relevant information from a source and reasoning directly, managing the procedures described, including sequential decisions, selecting and implementing the simple problem-solving strategies, interpreting and using images based on different sources of information and direct reasons and reporting results, then selecting and integrating different representations and connecting directly to aspects in real situations, utilizing capabilities developed and reasoning flexibly with insight and

knowledge in context.

Question 5 of unit 2 identifies information and implements procedures based on direct instruction in real situations, interprets and recognizes situations in context, that requires direct conclusions, draws relevant information from a source and makes sense directly, clearly manages procedures described, including successive decisions, choosing and implementing problem-solving strategies (OECD, 2013).

This study aims to produce a valid and practical digital video-based PISA type problem and describe how the potential effects of the problem on the mathematical literacy ability of Grade VIII students of SMP Negeri 1 Palembang. This research resulted in 2 units of questions with 10 questions.

The validity of the questions is based on the results of the revision in terms of content, constructs, and language by the validator at the expert review and one to one stage. In terms of content, the questions are by the characteristics of the PISA questions. In this case, the question content that has been developed is uncertainty and data. The mathematical process contained in the problem is adjusted to the mathematical literacy process in the PISA framework. In terms of construct, the questions developed are by the level of knowledge of students in class VIII and by the characteristics of the level of questions in the PISA framework. Then in terms of language, the questions developed have used good and correct language by EBI (Indonesian Spelling) and do not contain multiple interpretations.

The questions that were developed were based on the results of a small group trial. Based on the small group stage test, it can be seen that students can use the questions given well. Besides, a device that is developed is said to be good if the device is also effective or has potential effects (Plomp & Nieveen, 2007). In this study, the potential effect refers to the benefits or effects provided by the questions developed to the research subjects. The potential effect in this study is seen from the seriousness and results of student answers in solving problems. So that the questions in this study help students in training students to work on PISA type questions, besides that the development of PISA type questions can see the extent of students' mathematical abilities (Jurnaidi & Zulkardi, 2014; Sari, 2015).

CONCLUSION

Based on the results of research and discussion, it can be concluded that this research has produced 2 units of PISA type math problems consisting of 10 questions with a trial context. The prototype of the question has been declared valid and practical. Questions developed have the potential effect of encouraging students to do mathematical literacy activities. Based on the analysis of the results of student answers, mathematical literacy abilities that emerge are communication, representation, reasoning, and argument, while the dominant mathematical literacy ability is reasoning ability. With questions like this students are accustomed to working on problems that require

reasoning in doing so that they can reduce the habits of students who tend to be accustomed to working on routine problems. The valid and practical integrated data from trialmusi. The validation came from the result of validation assessment, which were from context, construct, language and one to one students' assessment. Practical came from the result of student understanding towards small group question

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