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Development of PISA-like Mathematics Problems within Personal-Context for Junior High School Students

Wisnu Siwi Satiti[1*], Dungo Abid Alfatah[2], Fitri Umardiyah[3]
[1,2,3]Mathematics Education, Universitas KH. A. Wahab Hasbullah
[*]Email: siwi.wisnu@gmail.com

ABSTRACT
Mathematics is a basic science that plays an important role in the development of science and technology. Mathematics is used as a means of thinking, developing reasoning power, logical, systematic, and critical thinking. One of the important aspects in mastering mathematics is the ability of students to apply mathematics in various situations in everyday life. Given the importance of mathematics education, various types of tests on students' mathematical abilities have been held, one of them is PISA study. PISA survey especially evaluates on students'ability on applying their mathematics knowledge in solving problems from real life context. However, based on result of latest PISA and severeal pervious studies, show that students in Indonesia are still weak in connecting mathematical concepts that have been studied with problems in everyday life. Therefore, it is necessary to increase the use of PISA-like Mathematics Problems within personal context, especially math problems that are relevant to the real-life context of Indonesian students. Due of that, in this study, the PISA-like Mathematics Problems within personal context will be developed. The type of research used is Research and Development (R&D) research, by adapting ADDIE model. The study was conducted at a class of XI-A SMPN 2 Sumobito Jombang. The results show that the PISA-like mathematics problems are valid and practical. Besides that, the results of the implementation of the PISA-like Mathematics Problems within personal context in this study showed that there were students who rarely even completed non-routine math problems such as the PISA-like mathematics problems.

***Keywords**: Mathematics Problems; PISA; Personal Context; Junior High School.*

INTRODUCTION
In order to improve the quality of Human Resources (HR) then one of the things that affect is education. To improve the quality of education, it can be started by improving the quality of teaching (Sutama et al., 2020). Meanwhile, improving the quality of teaching and learning can be started by setting appropriate learning objectives (Kurniati et al., 2017). Human resources who have thoughts as mentioned above, are more likely to be produced from school educational institutions. Through formal education, students get academic provisions. One of the academic subjects taught in schools that can be used to achieve these goals is mathematics (Jurnaidi & Zulkardi, 2017).

Mathematics is one of the subjects taught at all levels of education. Mathematics is a basic science that plays an important role in the development of science and technology. Mathematics is used as a means of thinking, developing reasoning power, logical, systematic, and critical thinking. Mathematics has an important role in various aspects of our lives, both everyday life and professional life in the world of work (Stacey, 2015). Therefore, mathematics education does not only aim to educate students, but also aims to prepare students with academic competence as a provision for students to carry out their roles in social life (SEAMEO-RECSAM, 2017).

According to Widayanti & Valentino (2017) one of the important aspects in mastering mathematics is the ability of students to apply mathematics in various situations in everyday life. In addition, Pratiwi et al., (2020) revealed that learning mathematics is easier and more meaningful if what is learned is related to phenomena or problems in everyday life. The purpose of school mathematics, both formal and material

for students, is the formation of personality, developing students' reasoning, application in mathematics and problem solving abilities (Suwaibah et al., 2020). Thus, every student who has studied mathematics can use it in everyday life, even though later after graduating from education, students do not work in the formal sector(Nuryanti et al., 2018).

Given the importance of mathematics education, various types of tests on students' mathematical abilities have been held, both national tests and international tests. This aims to measure the extent to which Indonesian students can compete and know the development of education in our country so that they can compete with other countries. One of the evaluation programs for the mathematical ability of children in the world is PISA. The PISA (Program for International Student Assessment) survey is an evaluation program initiated by The Organization for Economic Co-operation and Development (OECD), that is an international organization that works to build better policies for better lives (OECD, 2019). PISA is the OECD's Program for International Student Assessment. PISA measures 15-year-olds' ability to use their reading, mathematics and science knowledge and skills to meet real-life challenges. Indonesia is one of the countries participating in the PISA survey. In addition, (Pratiwi et al., 2020) added that PISA was first held in 2000 to assist countries in preparing human resources to have competencies as expected in the international market.

According to Thohir (2019), based on the results of the 2018 PISA study, Indonesia's 2018 PISA ranking fell when compared to the 2015 PISA results. This 2018 study assessed 600,000 15-year-old children from 79 countries every three years. This study compares the math, reading, and science performance of each child. For the math category, Indonesia is ranked 7th out of the bottom (73) with an average score of 379. Indonesia is ahead of Saudi Arabia which has an average score of 373. Then for rank one, China is still occupied with an average score of 591. According to Wati & Murtiyasa, (2016), the factors that cause student errors in solving PISA questions are the students' low reasoning ability and creativity, especially in solving real context problems taken from everyday life situations. It is in line with the findings of Hidayati et al., (2020) which shows that the results of the PISA survey of students in Indonesia show that students are still weak in connecting mathematical concepts that have been studied with problems in everyday life.

In fact, based on several previous studies as described in the description above, mathematics education in Indonesia does not only aim to equip students with academic knowledge, but mathematics education also aims to prepare students to be able to solve problems from the real world. By referring to the results of the PISA survey which shows that Indonesian students' mathematical abilities are still low, this indicates that students are still weak in connecting mathematical concepts that have been studied with problems in everyday life (Hidayati et al., 2020). Specifically, the difficulties experienced by students in solving PISA type questions have been investigated by Nuryanti et al., (2018) real life to mathematical problems (models), difficulties in doing mathematical operations, and difficulties in interpreting the results of mathematical solutions to real-world problems.

Based on the above description of the results of several previous studies and the results of the 2018 PISA survey, it is necessary to increase the use of PISA model math problems, especially math problems that are relevant to the real-life context of Indonesian students. The appropriate category of PISA questions is the PISA-like Mathematics Problems within personal context. As has been shown in several previous studies Wati & Murtiyasa (2016), Nuryanti et al., (2018), and Hidayati et al., (2020) above show that the ability of Indonesian students to solve mathematics problems using the PISA model in personal contexts still low. Thus, it is necessary to increase the use of PISA-like Mathematics Problems within personal context. Therefore, in this study, the PISA-like Mathematics Problems within personal context will be developed to Support Mathematical Literacy for SMP/MTs Students.

METHOD

The type of research used is Research and Development (R&D) research. According to Borg and Gall in Saputro (2017), Education Research and Development (R&D) is a research approach to produce a new product or refine an existing product. This study adapts the ADDIE development model with five stages, namely analysis, design, development, implementation and evaluation (Sugiyono, 2018). The steps of research with the development of ADDIE in this study if presented in chart form as follows.

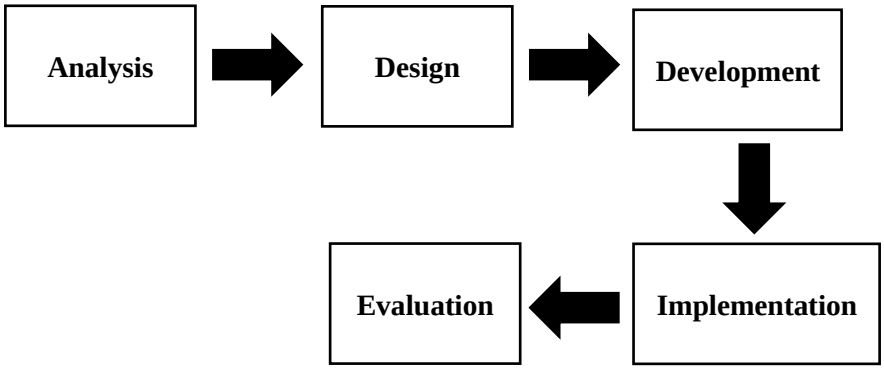

Figure 1. The steps of ADDIE development model (Sugiyono, 2018)

The result of this research is a product in the form of PISA-like mathematics problems employing personal context. The trial process starts from content validation by mathematics education lecturers. Then proceed with content validation by the mathematics teacher as a practitioner. Mathematics subject teachers also conduct an assessment of the practicality of the PISA-like Mathematics Problems within personal context that was developed. After the product developed has obtained an assessment with valid criteria, the questions are implemented (tested) in the real class. The test subjects in this study were a class of XI-A SMPN 2 Sumobito Jombang. This study aims to develop PISA-like Mathematics Problems within personal context to support the mathematical literacy of junior high school/MTs students.

RESULT AND DISCUSSION

The following is a description of the results of the development of the PISA model of mathematics problems employing personal context in accordance with the flow of the ADDIE research model.

Result

Analysis

- Needs Analysis
  Based on the results of the 2018 PISA study, Indonesian students are ranked 72 out of 77 countries with a score of 379 (OECD, 2019). The majority of Indonesian students have not reached level 2 for mathematical literacy. Based on the results of research conducted by Wati & Murtiyasa (2016) it is known that many students cannot complete the personal context PISA model math activities, which is as much as 55.50% of the total research subjects. The same thing was also found in the research of (Kurniati et al., 2017) and Nuryanti et al., (2018). Based on the description above, it is necessary to increase the use of the PISA model of mathematics problems employing personal context.
- Material Analysis
  The material analysis on the PISA-like Mathematics Problems within personal context developed is about the PISA-like mathematics problems employing personal context.
  Based on the needs analysis and material analysis carried out, the researcher felt the need to develop the PISA-like mathematics problems employing personal context to support the mathematical literacy of junior high school students.

Design

The purpose of this stage is to design the basic form of the personal context PISA-like mathematics problems. At this design stage consists of the following steps:

- The formulation of PISA-like mathematics problems
  Develop a framework for making PISA-like Mathematics Problems within personal context. In this case the PISA-like Mathematics Problems within personal context are PISA models of Mathematics Problems that are related to daily life which are sourced from Articles or Journals, then developed.
- Format Selection
  The format selection for this personal context PISA-like Mathematics Problems within personal context is in the form of a printed paper format that is presented to students

Development

At this development stage, the following steps are carried out:

- Examining the PISA-like mathematics problems that have been designed before material validation is carried out.
- Compilation of the content validity questionnaire of the PISA-like Mathematics Problems within personal context that was developed. Validation was carried out by material experts, namely mathematics education lecturers or lecturer of pure mathematics and mathematics teachers. Indicator of the suitability of the questions developed with the characteristics of PISA questions.
- Preparation of a questionnaire for the practicality assessment of the PISA-like Mathematics Problems within personal context developed. The practicality assessment is carried out by the mathematics subject teacher as a practitioner.

Furthermore, the validation of the PISA-like Mathematics Problems within personal context that was developed was carried out. Through this validation activity, an assessment of the developed questions was obtained. To assess the validity, the following references are used:

$$P = \frac{\sum x}{\sum xi}\ x\ 100\%$$

Description:
P : Percentage (valid)
$\sum x$: Total number of answer scores
$\sum xi$: The total number of highest answer scores

In giving meaning and making decisions, the following references are used:

Table 1. The Qualification of Product Validity Level

No	Percentage	Validity Criteria
1.	80%– 100%	Valid/no need to be revised
2.	60% – 79%	Quite valid / no need to be revised
3.	40% – 59%	Less valid / partial revision
4.	0% – 39%	Invalid/ need to be revised

(Syafaáh, 2018)

The PISA-like Mathematics Problems within personal context that was developed is feasible to be implemented if it obtains a minimum assessment of "quite valid" and has been revised according to the validator's suggestion. Based on the results of validation by mathematics education lecturers, the percentage of validity was 85.42% so that it met the "Valid" validity criteria. While the results of the validation by the mathematics teacher, the percentage of validity is 93.75% so that it meets the "Valid" validity criteria. Thus, it can be concluded that the PISA-like Mathematics Problems within personal context developed is valid and feasible to implement.

Based on the results of the assessment by experts, lecturers and teachers as practitioners, the results of the "Valid" assessment were obtained. In the validity assessment indicators there is also a mathematical literacy component, namely the questions developed contain formulate, employ and interpret competencies. With the validation of the material expert being assessed as "Valid", this shows that the personal context PISA-like Mathematics Problems within personal context developed are appropriate to support students' mathematical literacy.

Implementation

The implementation phase will be carried out face-to-face with class XI-A students at SMPN 2 Sumobito Jombang. In addition, students were also asked to fill out a student response questionnaire after using the PISA-like Mathematics Problems within personal context that were developed. At the implementation stage, a practical assessment was also carried out by the mathematics subject teacher as a practitioner.

To assess the practicality of the questions developed, the following references are used:

$$P = \frac{\sum x}{\sum xi}\ x\ 100\%$$

Keterangan :
P : Percentage of practicality
∑x : Total number of answer scores
∑xi : The total number of highest answer scores

In giving meaning and making decisions, the following references are used:

Table 2. The Qualification of Product Practicality Level

No	Percentage	Practicality Criteria
1.	80%– 100%	Practical
2.	60% – 79%	Quite practical
3.	40% – 59%	Less practical
4.	0% – 39%	Impractical

(Syafaáh, 2018)

The PISA-like Mathematics Problems within personal context is declared practical if it gets a minimum assessment of "pretty practical". Based on the results of practicality assessments by practitioners, the percentage of practicality is 92.5% so that it meets the "Practical" practicality criteria. After students work on the developed PISA-like mathematics problems, students are asked to provide responses by filling out a response questionnaire. There are 15 response indicators in the questionnaire given. Students are asked to choose whether they are Very Appropriate (SS), Appropriate (S), Not Appropriate (TS), or Very Unsuitable (STS) with respect to the given indicator.

Based on the results of student responses, it is known that, on all indicators, most of the students gave a Very Appropriate (SS) response to the given indicators. The following is a breakdown of the percentage of students who responded to each indicator: 55.18% of students gave a Very Appropriate response (SS) for the first indicator, then 58.63% of students responded Strongly Agree (SS) for indicator two, 58.63% Strongly Appropriate (SS) for indicator three, 75.87% Strongly Agree (SS) for indicator four, 55.18% Strongly Appropriate (SS) for indicator five, 58.63% Strongly Agree (SS) for indicator six, 58.63% Very Suitable (SS) for indicator seven, 48.28% Very Suitable (SS) for indicator eight, 62.61% Very Suitable (SS) for indicator nine. For indicators ten, thirteen, and fourteen indicators, respectively 75.87% of students gave a Very Appropriate (SS) response. Then for indicators eleven, twelve, and fifteen, each 55.17% of students gave a Very Appropriate (SS) response.

Of the fifteen indicators, in most of the indicators there were no students who gave a Very Inappropriate (STS) response. However, there is one indicator in which there are students who give a Very Inappropriate (STS) response. That is on the indicator "After doing this PISA question I believe that I succeeded in the test" there are 3.44% of students giving a Very Inappropriate response. This will be used as an evaluation material at a later stage

Evaluation

At the Evaluation stage, the researcher evaluates the results of the product trials being developed. In the trial to assess the validity of the product, the results obtained are valid products and do not need to be revised. Thus, the PISA-like Mathematics Problems within personal context that were developed are suitable for use in real-class trials (Implementation). Based on the practicality assessment, "Practical" results were obtained for the PISA-like Mathematics Problems within personal context

Referring to the results of students' responses to the personal context model of mathematics problems developed, in general the products developed received a good response. However, there is one indicator that needs to be evaluated because there are 3.44% of students responding "less" to this indicator. Namely on the indicator "After working on this PISA question I believe that I succeeded in the test". This shows that students lack confidence in solving PISA-like Mathematics Problems within personal context. This indicates that many students are not familiar with and are still unfamiliar with PISA-like mathematics problems.

Discussion

Based on the results of student responses to the PISA-like Mathematics Problems within personal context developed, there are indicators where there are students, although the percentage is only 3.44%, who give a "less" response, namely the indicator "After working on this PISA question I believe that I did well in the test." This indicates that many students are not familiar with and are still unfamiliar with the

PISA model of mathematics. This is in line with several previous studies (Sholihah & Afriansyah, 2017; Novita et al., 2018; Satiti & Wulandari, 2021) which show that many Indonesian students rarely even have completed non-routine math problems like this PISA problem. Therefore, the development of personal context PISA math problems in this study supports efforts to increase the use of PISA-like mathematics problems as a mathematics learning activity. Through the development of the personal context PISA model of mathematics problems, this is also an effort to support the strengthening of mathematical literacy in students

CONCLUSION

Based on the discussion of the research results above, it can be concluded that: 1) The process of developing PISA-like Mathematics Problems within personal context using the ADDIE model by Dick and Carry. This development process goes through several stages, namely analysis, design, development, implementation, and evaluation. 2) The PISA-like Mathematics Problems within personal context developed in this study are included in the valid category. This is indicated by the results of the validation from the mathematics lecturer at 85.42% and the mathematics teacher at 93.75%. The PISA-like Mathematics Problems within personal context developed in this study is said to be valid if the percentage obtained is >80%. 3) PISA-like mathematics problems within personal contexts are not only valid but also practical. This is evidenced by the practicality value of the mathematics teacher getting 92.50% which meets the "Practical" practicality criteria. 4) The results of the implementation of the personal context PISA-like mathematics problems in this study showed that there were students who rarely even completed non-routine math problems such as the PISA-like mathematics problems. Thus, the development of PISA-like Mathematics Problems within personal context in this study supports efforts to increase the use of PISA-like mathematics problems as a mathematics learning activity.

In this study, the development of the PISA-like mathematics problems is limited to the personal context. For further research, other categories of PISA-like mathematics problems with specific contexts can be developed. In addition, the questions developed are based on print media. In accordance with today's technological developments, it is necessary to develop technology-based PISA-like mathematics problems problems.

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