

## DEVELOPING LEARNING DOCUMENTS USING ASSURE DESIGN WITH PROBLEM-SOLVING STRATEGY ON SOCIAL ARITHMETIC MATERIALS TO INCREASE MATHEMATICAL PROBLEM-SOLVING ABILITY

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| Article Info   | Abstract  |
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| <p><b>Received</b> :30 January 2020<br/> <b>Accepted</b> :27 March 2020<br/> <b>Published</b> :29 April 2020</p> <hr/> <p><b>Keywords:</b> learning documents, ASSURE Design, problem solving strategy, mathematical problem solving ability</p> | <p>This research is carried out due to students' low Mathematical Problem Solving Ability (Indonesian: KPMM) and the unavailability of learning documents that are following the demands of the 2013 Curriculum. This research produces learning documents using the ASSURE design with problem-solving strategies to improve students' KPMM. The development model used is the 4D model with validity instruments in the form of validation sheets of the syllabus, lesson plans (RPP), student activity sheets (LAS) and KPMM tests; practicality of the instruments in the form of student response questionnaires, teacher response questionnaires, and observation sheets; and effectiveness of the instruments in the form of KPMM test questions. The data were collected through questionnaires, observations and KPMM tests. The data were analyzed using validity analysis techniques; practicality analysis and effectiveness analysis. From the results of the data processing, the average score of the syllabus validation result is 3,56; RPP 3.60; LAS 3.51; and KPMM questions 3.55. The average scores of the student response questionnaire on limited trials and field trials are respectively 92.85% and 87.41% classified in the 'very practical' category. The average scores of the teacher response questionnaire and teacher observation are 96.54% and 94.31%. Based on the results of the effectiveness test, it can be stated that there are differences in KPMM students between the experimental class and the control class. It can be concluded that the learning documents developed have been valid, practical, and effective to improve students' KPMM.</p> |

## INTRODUCTION

The results of the Program for International Student Assessment (PISA) in 2015 showed that Indonesian students were ranked 62 out of 70 countries in the world, while the TIMSS (Trend in International Mathematics and Science Study) results in 2015 ranked Indonesian students in the 45<sup>th</sup> position out of 50 countries. TIMSS is an international research assessment and design to evaluate educational achievements, especially in the fields of mathematics and science. Mathematical assessment in TIMSS is measured in two aspects; i.e. the aspect of content that is used to determine subject materials in the form of numbers, shapes and sizes of geometry, as well as data; and cognitive aspects to determine the thought processes used by students related to knowing, applying, and reasoning (Rahmawati, 2016).

Based on the results of PISA and TIMSS, it appears that the ability of Indonesian students is still weak in all aspects of both mathematics and science. Students can master routine questions, simple computing, and measure daily contextual knowledge, but are not yet accustomed to problems that require application and reasoning. Therefore, it is necessary to strengthen their ability to integrate information, draw conclusions, and generalize the knowledge possessed to other things (Rahmawati, 2016). Reasoning ability is needed in mathematics learning, which emphasizes aspects of mathematical problem-solving ability (KPMM). KPMM is closely related to the ability of students to read and understand the language of story questions, present in mathematical models, plan calculations from mathematical models, and complete calculations of non-routine problems (Witri Nur Anisa, 2014).

In the world of education, students' abilities are trained through problems so students can improve their various competencies to achieve the goal of content standards (Sumartini, 2016). This is in line with Dahar's opinion (2011), which states that the ability to solve problems is the main goal of the education process. KPMM is essential for every student to have because: (1) problem solving is a general goal of mathematics learning; (2) problem solving which includes methods, procedures and strategies are the core and main process in the mathematics curriculum; and (3) problem solving is a basic ability in learning mathematics (Branca, in Sumartini 2016). The findings of previous studies indicate that students' KPMM is still low (Ulya, 2016; Linggar and Budi, 2016). Correspondingly, the results of the student's initial ability test the researcher conducted at SMPN 3 Pujud showed that the students had a low KPMM.

To improve students' KPMM, the learning needs to be under the curriculum, paying attention to students' characteristics and the learning material itself. 2013 Curriculum states that the implementation of learning in class uses a scientific approach. Furthermore, one learning strategy that can improve students' KPMM and in line with the scientific approach is the problem-solving strategy. This strategy is defined as a series of learning activities that emphasize the process of solving problems faced scientifically (Komariah, 2011). The application of problem-solving strategies is the right step to improve students' KPMM because this strategy contains steps that are in

line with KPMM indicators. This is supported by the findings of previous studies by Sumartini (2016), Ulya (2016), Isti Fauziah, et al. (2017), Herma (2017), Sari (2017), Fikri, et al. (2018), Kaslini, et al. (2018), and Dwiguna et al. (2019) which show that students' KPMM has increased thanks to the use of problem-solving strategies in the learning activities.

Benny A. Pribadi (2011) states that paying attention to the characteristics of students needs to be done to guarantee that learning programs are designed by the conditions and profiles of students who will go through the learning process. To carry out learning programs running as expected, supporting learning tools are needed. The teacher's duty to develop learning tools has been arranged in Minister of Education Regulation Number 16 of 2007 concerning Academic Qualification Standards and Teacher Competence. The implementation of the curriculum is largely determined by the teacher's ability to develop learning documents since these learning documents are implemented in daily learning practices in education units (Sa'dun Akbar, 2013).

In the implementation of learning, learning documents are important. Regarding this, Suparno (in Frisnoiry, 2013) stated that before teaching, teachers are expected to: (1) prepare teaching materials, teaching aids, questions, and directions to stimulate students to more actively learn; (2) study the students' condition and initial knowledge; and (3) understand students' weaknesses and strengths. All of these things will be described in the learning documents through the implementation. This becomes the basis of the importance of developing learning documents because they are one aspect of the learning implementation process.

The facts, in reality, show that not all teachers prepare learning aids properly to plan a learning process. The results of the interview with mathematics teachers in SMP Negeri 2 Pujud, SMP Negeri 3 Pujud, SMP Negeri 11 Pujud, and MTs Al-Imran Nurul Yaqin in Pujud District about the learning tools used at school revealed that teachers faced problems in developing lesson plans that are under the 2013 Curriculum. This is because of teachers' lack of understanding and teachers have not been able to apply models, strategies, methods, and approaches that are in line with the demands of the 2013 Curriculum. The teachers did not develop LAS. The teacher still used the student handbook from the Ministry of Education and Culture as the only source of learning material.

In this regard, it is necessary to develop learning documents that are appropriate to the characteristics of the material, using the 2013 Curriculum learning strategy and the scientific approach that has the potential to improve students' KPMM. With this in mind, learning documents need to be designed so that the device produced can function properly. One appropriate learning design is the ASSURE design. The ASSURE design is a learning design model that creates an effective learning activity (Khasanah, 2012). This is in line with the opinion of Michael (in Benny, A. Personal, 2011) that the ASSURE design is designed and developed to create effective and efficient learning. Benny A. Pribadi (2011) in his book explains that the ASSURE design contains steps such as: (1) analyze learner characteristics; (2) state performance objectives; (3) select

methods/strategy, media, and materials; (4) utilize media and materials; (5) require learner participation; and (6) evaluate and revise.

ASSURE's design has been applied to some researches. Widia Maya Sari and Endang Susiloningsih (2015) conducted a study by applying the ASSURE design model and problem-solving methods but did not specifically say the media they used. In their experiment, it was proven that the ASSURE design with the problem-solving method was able to improve student learning outcomes in mathematics and critical thinking skills. Rostina Sundayana, et al. (2017) in their experiments proved that the mathematical communication skills of students using the ASSURE learning design model improved better. Rostina used the ASSURE learning design model in which other learning models such as the problem-based learning model and the discovery learning model were also involved. It was not somewhat different from the research conducted by Sumliyah, et al. (2017) that proved that the critical thinking ability of students with ASSURE design increased well. Sumliyah, in her research, only employed the ASSURE design without mentioning the use of specific methods and media. Some of those experimental studies have applied the ASSURE learning design with the problem-solving methods and also integrated the learning model of problem-based learning and discovery learning, but have not used the media and have not seen its effect on students' KPMM.

One of the main objectives of learning mathematics is to develop KPMM, so in designing the lesson, it requires strategies that hopefully provide opportunities for students to improve their mathematical abilities such as KPMM. One way to realize this is to get students used to learning through real problems in everyday life. In line with the above efforts, one suitable learning strategy is the problem-solving strategy.

One of the subject materials of mathematics which contains concrete and tangible things related to daily life and problem-solving is social arithmetic. Mastery of social arithmetic material is important for students, but in reality, there are still many students who have difficulty learning.

Noting the importance of learning documents and students' low KPMM, it is necessary to develop learning documents that are valid, practical and effective that can facilitate students to improve their KPMM. Thus, this research is the development of learning documents using ASSURE design by applying problem-solving strategies to social arithmetic materials to improve students' KPMM.

## **METHODOLOGY**

This study is a research-and-development type of research with the 4D development model suggested by Thiagarajan, Semmel, and Semmel. The four stages of the development model include defining, designing, developing, and disseminating (Endang

Mulyatiningsih, 2012). The test subjects were Grade VII students of SMPN 2 Pujud and SMPN 3 Pujud. The instruments used were validity instruments in the form of validation sheets of the syllabus, lesson plans (RPP), students activity sheet (LAS) and KPMM; practicality instruments in the form of student response questionnaires, teacher response questionnaires, observation sheets; and test instruments. The data collection techniques were carried out by (1) validating the learning documents to determine the validity, (2) distributing response questionnaires, (3) doing observations to find out the practicality, and (4) giving the KPMM tests to see the effectiveness of the learning documents.

The data analysis technique used was the validation analysis on the validation sheet to determine the level of validity of the learning documents developed. Practical analyses of the student response questionnaire, the teacher response questionnaire, and the observation sheet were carried out to determine the level of practicality of the developed learning device. Moreover, analyses of the effectiveness of student learning outcomes and students' KPMM were done to determine the effectiveness of learning documents developed. The product developed is said to be feasible to be tested if a minimum level of validity is achieved based on the results of the validators' assessment classified in the valid category.

According to Sa'dun Akbar (2013), learning documents can be used if the percentage of readability is more than 70%. The product developed is said to meet the practical aspects of good if the minimum level of practicality achieved is practical. Furthermore, the learning documents are said to be effective if the percentage of students achievement test (KPMM) reaches the classical learning completeness criteria, which is at least 75% with KKM (minimum score) set at school for mathematics lessons, which is 75. To see the impact of the use of the learning documents produced, a different test of the two KPMM means of the experimental class and control class students was used.

## **FINDINGS AND DISCUSSIONS**

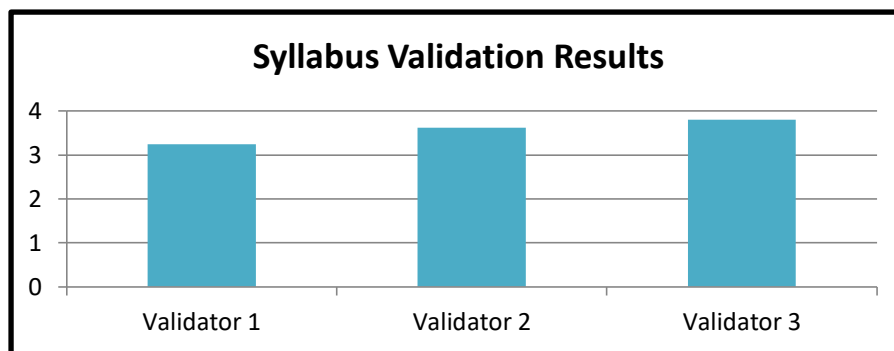
The results of the research on the development of mathematics learning documents are in the form of Syllabus, Lesson Plan (RPP), and Student Activity Sheet (LAS). The learning documents developed to refer to the ASSURE design using problem-solving strategies on social arithmetic materials in class VII Junior High School. This research was conducted to see whether the mathematics learning documents that have been developed meet the valid, practical, and effective categories to improve students' mathematical problem-solving abilities (KPMM). There are four stages carried out in this study under the development model used, 4D model, i.e. define, design, develop, and disseminate.

The results of the define stage include the initial-end analyses, student analysis, concept analysis, task analysis, and objective specifications. In the design phase, researchers design the lesson and make the initial design of the learning documents that are

developed, i.e. syllabus, lesson plans, and LAS, but before doing the initial design of the learning documents, researchers design the lesson using ASSURE design. After designing the lesson, then the learning device design is done. After the learning documents have been designed, the learning device development and validation are carried out by experts.

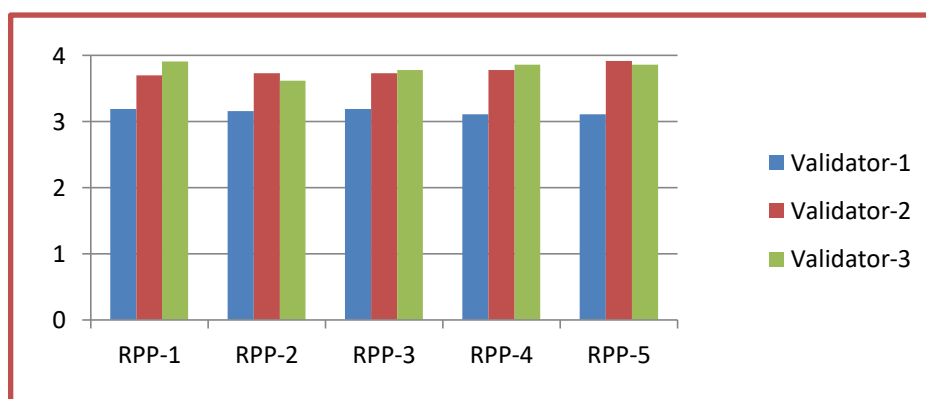
#### a. The Validation Results of the Learning Documents

Based on the validators' evaluation, some facts related to the validity of the learning documents were obtained. The following are the results of the validation analysis of the syllabus, lesson plans, LAS and KPMM questions which are described in the form of diagrams respectively in Figures 1, 2, 3, and 4 below.



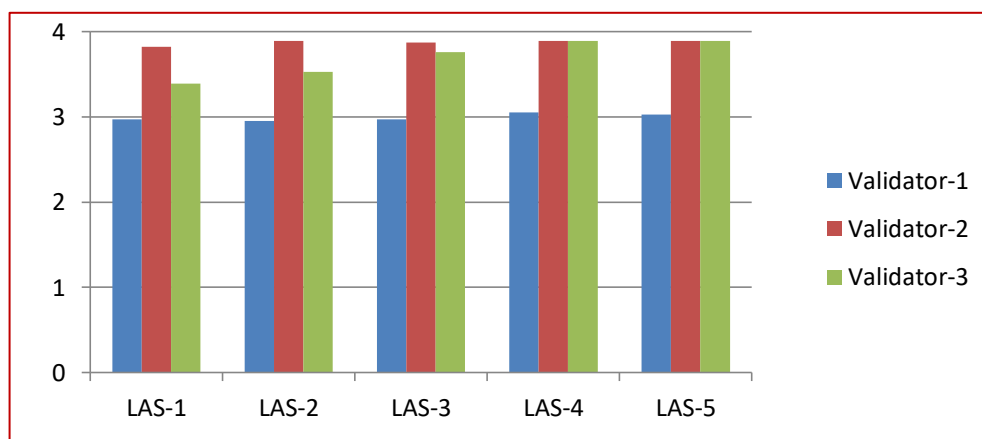
**Figure 1. Syllabus Validation Results**

Based on the results of the syllabus validation in Figure 1, it was found that the syllabus product developed was very valid and not revised. This is based on the validation sheet where the validator did not give suggestions for improvement.



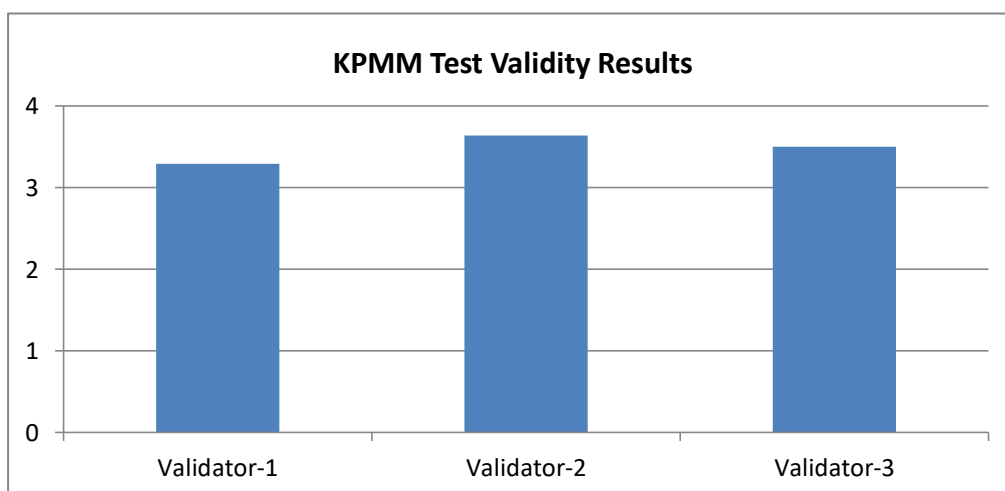
**Figure 2. RPP (Lesson Plans) Validation Results**

The results of the RPP validation in Figure 2 show that the RPP products developed for the five meetings were declared to be very valid with improvements to the sentences that were not appropriate to the IPK and the learning steps, consistent in the use of the subject and the use of capital letters.



**Figure 3. LAS Validation Results**

The results of LAS validation in Figure 3 show that the LAS products developed for the five meetings were categorized very valid. Based on the validator's input, some things that were revised include less contextual problems, the use of language or choice of words that are not following the students' thinking level, the clarity of images, the use of language that causes multiple meanings and incomplete units in the question/test.



**Figure 4. KPM Test Validation Results**

The results of the validation of KPMM tests in Figure 4 show that the KPMM questions developed were stated to be very valid with some revisions including the use of punctuation and the use of language that gave rise to double meanings.

### ***b. Learning Documents Try-out***

The learning device trials were conducted with limited trials, field trials, and effectiveness tests. A limited test was conducted on eight students. Based on the results of the questionnaire of students' responses to LAS, an average percentage of 92.85% was obtained with the LAS criteria developed categorized 'very practical'. Field trials were conducted on 30 students with the results of the questionnaire of students' responses to LAS was 87.41%, teacher responses questionnaire 96.54%, and teacher observation sheets 94.31%. Based on the results of the limited trials and the field trials, it can be concluded that the learning documents developed have met the practical criteria with a very practical category.

The effectiveness test was carried out by looking at the completeness of student learning outcomes and students' KPMM differences. Based on the KKM completeness analysis, it is obtained that the percentage of completeness of student learning outcomes using the learning documents reaches 90.06%. Based on this fact, it can be concluded that the learning documents developed are effective. The impact of using the developed learning documents is determined by seeing the difference in the average of students' KPMM using t'-test. T'-test results obtained a significant level of  $0.001 < \alpha = 0.05$ , meaning that there are differences in students' KPMM between the experimental class and the control class. Based on the effectiveness test, it is concluded that the learning documents developed are effective for learning outcomes and have an impact on improving students' KPMM.

The findings of a study by Kaslini (2018) show that problem-solving strategies can improve Junior High School students' KPMM. This is also in line with research by Isti (2017), Fauziah (2017), Husna (2016) and Herma (2017) which show that the use of problem-solving strategies can improve student KPMM. In this study, before the learning documents were developed, researchers designed the ASSURE design as a guide so that the learning documents developed are under the curriculum, learning objectives, student characteristics, and the selection of strategies and media thus the learning documents could be developed properly. The results of this study prove that learning documents developed using ASSURE design with problem-solving methods on social arithmetic materials can improve students' KPMM. This is in line with Rosina's research (2019) about the comparison of ASSURE and PPSI learning designs to improve students' KPMM. The results of the study said that the increase in KPMM for students who got ASSURE learning designs were better than students who got PPSI.

## **CONCLUSIONS**



Based on the results of the validation of the syllabus, lesson plans, LAS and KPMM test questions for social arithmetic materials, it can be concluded that the learning documents developed have met the valid criteria. Moreover, based on the results of student response questionnaires, teacher response questionnaires, and observation sheets, it can be concluded that the developed learning documents meet the practical criteria. Furthermore, based on the completeness of student learning outcomes (KPMM test), learning documents developed are said to be effective for improving the learning outcomes. Based on the t'-test, it is known that there are differences in KPMM for students who use learning documents that are developed and those who do not use them. It can be concluded that the learning documents developed are effective in improving students' learning outcomes and students' KPMM. Finally, it can be concluded that the learning documents developed have met the criteria of valid, practical, and effective.

The development research conducted has yielded a product in the form of learning documents using the ASSURE design with problem-solving strategies to improve Mathematical Problem Solving Ability (KPMM) on social arithmetic materials. The resulted learning documents consist of a syllabus, lesson plans, and LAS that are considered to have been valid through the validation process, have been practiced through limited trials and field trials, and have been effective through effectiveness tests for students' learning outcomes and students' KPMM.

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