

Smart Education in Mathematics Learning for Elementary School

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ABSTRACT

Understanding on concept is required for learners in Elementary schools. It takes a role as a support system needed in learning process for students and was called as smart education. It is hoped that students would more easily absorb the material received so that it would be easier to work on the problems arise in smart education. Considering these needs, the development of smart education in learning mathematics was required for students especially in the ability of understanding mathematical concepts. The research method in this research used the stage of developing teaching material consisting of three definitions, design and development. At the stage of define, there were first two plans; designing the product design format required consisted of a preliminary studio, student analysis, task analysis and concept analysis. While designing the design format in stage of design was a product format that was developed including cover, basic competencies, assessment indicators, question indicators, questions to be done, as well as scoring instructions; the second was designing the initial draft of the product. The next stage of development was at the stage of development including expert validation, stage I revision, limited trials conducted to understand the product readability before conducting large scale trials..

Keywords: education, question instrument, understanding on mathematics concept

1. INTRODUCTION

In education, the learning process occurs with the interaction between educators and students. Educators plays an important role in the learning process in creating learning processes that are easily perceived by students and are referred to as intelligent education. Learning tools such as giving evaluation questions that lead to students' abilities. It is expected that students could absorb the material received easily so that it would be easier to work on problems that arise in intelligent education [7]. The concept of education in Islam is also oriented to the curriculum and learning process in the classroom. The education curriculum is developed integrally between the development of *fardhu'ain* and *fardhu kifayah*, the implementation of which can be dynamic. As stated in the Qur'an QS. Al-Baqarah: 121.

الَّذِينَ آتَيْنَاهُمُ الْكِتَابَ يَتْلُونَهُ حَقَّ تِلَاوَتِهِ أُولَٰئِكَ يُؤْمِنُونَ بِهِ وَمَنْ
يَكْفُرْ بِهِ فَأُولَٰئِكَ هُمُ الْخَاسِرُونَ

Explaining that "Those to whom We have given the Book recite it with its true recital. They [are the ones who] believe in it. And whoever disbelieves in it - it is they who are the losers." Need for guidance at the level understanding students' competence towards a material requires the existence of guidelines such as student worksheets or referred to in this research here as smart education.

Many teachers were not aware of student worksheets and did not use their ability to develop the worksheets, and it led

to students' weakness in level of understanding. Dewi et. al. [3] explained that student worksheet was one of printed teaching materials in form of sheets containing information and instructions for students to work on questions and learning activities in form of practices. Astuti & Setiawan [2] argued that Student Worksheet (LKS in Indonesian) was a guide for students in understanding the knowledge and concepts of the material that was being and would be studied. The development of smart education in learning mathematics was needed for elementary school students, especially in the ability to understand mathematical concepts.

Based on interviews with teachers in partner schools, teachers generally were still less motivated to create student worksheets that led to lower students' level of understanding. Several factors for this case included the teacher tasks relating to school administration. From the problems above, the author would develop smart education that contained materials, questions and examples of questions relating to elementary school students, especially grade5. Smart Education is designed for students to gain better understanding on the material they had acquired, so as to improve student understanding of concepts.

Based on the previous background, the author would find out the eligibility of Smart Education in the learning process to determine the ability to understand mathematical concepts applied in elementary schools. The ability to understand concepts was one of mathematical skills or abilities that were expected to be achieved in learning mathematics by showing an understanding of the mathematical concepts learned, explaining the interrelationships between concepts and applying concepts or algorithms flexibly, accurately, efficiently, and precisely in problem solving [6]. Understanding and mastery of a material or concept was a requirement for mastering the

next material or concept. From these opinions, concept understanding referred by the authors was the ability to understand in order to correlate the materials and explain the relevance of the concepts that have been learned. The process of transforming information using abstract thinking to conceptually could be done widely.

Triwibowo, Pujiastuti, & Suparsih [8] described indicators of concept understanding as follows: Question items made referred to indicators of mathematical concept understanding ability, namely: (a) restating a concept, (b) giving an example and counter-example of a concept, (c) presenting concepts in various forms of mathematical representation, and (d) applying concepts to problem solving.

While in Permendikbud, viewed from the ability of students, including: (1) restating the concepts that had been learned, (2) classifying objects based on whether or not the requirements that form the concept are met, (3) identifying the nature of operations or concepts, (4) applying the concept logically, (5) giving examples or counter-example of the concepts being studied, (6) presenting concepts in various forms of mathematical representation (tables, graphs, diagrams, drawings, sketches, mathematical models, or ways others), (7) linking various concepts in mathematics and outside mathematics, and (8) developing the necessary and / or sufficient conditions of a concept.

Anderson & Krathwohl [1] state that understanding or comprehension is constructing the meaning of learning material, including what is said, written and drawn by the teacher. Thus, understanding or comprehension included interpreting, exemplifying, classifying, summarizing, concluding, comparing and explaining.

Relevant research is previous research that has been done by several researchers used as a basis for researchers to conduct research that resembles the following:

Research conducted Fitri, Noviana, & Fendrik [5] found that the worksheet in mathematics in grade 5 elementary school with material on the volume of cubes and blocks has been categorized as very feasible supported by the data as The following is the results of the validation on the aspects of the structure of the worksheet obtained a score of 96.25 with a very decent category, on the aspect of didactic requirements a score of 93.13 was obtained with a very decent category, on the construction aspect aspects a score of 93.33 was obtained with a very decent category and on the technical requirements obtained a score of 96.25 with a very decent category.

This study uses indicators applied by Anderson et. al. [1] by linking operational verbs found in bloom's taxonomy. The ability to comprehend mathematical concepts is one of the important objectives in learning mathematics, giving the understanding that the materials taught to students are not just as memorization, but more than that with the understanding of students can better understand the concept of the subject matter itself [4]. The importance of this research is that Smart Education in learning mathematics for elementary school students, especially class V, is expected to facilitate students in understanding the concept of building material, presentation and data collection in the second semester. In addition, it can be considered that Smart Education will be developed, there are discussion of question cards, question material which is discussed in

detail using the help of pictures and there are exercises questions.

2. RESEARCH METHODS

The research to be conducted is a kind of research and development. The product to be developed is in form of smart education to improve understanding on mathematical concepts. The development model in this study was adapted from the modified Four D model, they are Define, Design, Develop, and Disseminate. The stage of Disseminate in this study was not carried out.

The first stage consists of (1) Need Assessment subject matter expert content. (2) Design the initial product design output. The Second Stage, namely (1) Product Development, the subject consists of education and educational needs. Output consists of needs analysis and product description according to needs. The third stage is (1) the subject validation of students and peers. (2) Product Testing Outcome validation (questions, scoring guidelines, grids), product trials, smart education products can improve understanding of mathematical concepts.

To find out the eligibility of smart education in elementary school, students should analyze the data using the formula: Validity of contents with Aiken's V, with the following formula: $V = \sum s / [n(c-1)]$. $s = r - l$ l = lowest validity assessment number (in this case = 1) c = highest validity assessment number (in this case = 5) r = number given by an assessor.

3. RESULTS AND DISCUSSION

This study aimed to determine the eligibility of using Smart Education in elementary school students: After going through the stages in the development of teaching materials in form of student worksheets, smart education products were produced in form of books. The stages of the development of teaching materials consisted of three stages including Defining, Designing and Developing. The development process at the defining stage began with a preliminary study conducted to find out the problems that were the basis for developing smart education products. After understanding the problems that existed in partnership school namely the lack of teachers' motivation in making student worksheets about the ability to understand concepts. Based on the problem identification, the solution could be obtained to develop smart education that contained material and questions and examples of questions that are designed in order to ease students to understand the material they got, so it could improve the ability to understand concepts.

Student analysis was conducted to determine the characteristics of 5th Graders at SDN Langensari 03 Ungaran. Characteristics of grade 5 students was that they prefer concrete objects because of students' knowledge at the stage of concrete operation. By knowing the characteristics of students, it could help authors in adjusting the teaching material that would be made. Task analysis by analyzing the syllabus was conducted to see indicators of competence achievement that should be achieved by students. Then, concept analysis was conducted to find out

the material that would be created for the development of smart education.

Stage of designing was done by designing a book cover, then determining the basic competence for geometry, data collection and presentation. Indicators of competence achievement should be achieved by students. The indicators of question items were compiled so that the questions were in accordance with the question outline. The questions were prepared along with the answer keys and scoring guidelines on separated sheets to ease teachers in making assessment. Then, the initial draft of the product was ready to be tested for the development of smart education to improve the ability to understand mathematical concepts in elementary schools.

Stage of developing was carried out with an expert validity test conducted by 3 validators consisting of 3 lecturers / academic validators. The validation test sheets contained 14 items consisting of 4 criteria, namely the scope of the material, facilitating the ability to understand concepts, the scope of writing question cards and language. From the results of the validator's assessment, one of the criticisms and suggestions was that the picture presented should be taken from a real picture that the author observed directly. After completing the revision in stage I, a limited trial was conducted by distributing questions to 38 students.

The limited trial was conducted at SDN Langensari 03 Ungaran involving 38 students. The questions about geometry, 3 of 10 questions were considered as invalid namely the number 3, 8, 9, and 7 questions were considered as valid namely the numbers 1, 2, 4, 5, 6, 7, 10. In terms of data collection and presentation, 3 of 10 multiple choice questions were declared invalid (number 2, 3, 9) while the other 7 questions were declared valid (number 1, 4, 5, 6, 7, 8, 10). The essay questions about geometry, 5 numbers, were all valid in terms of data collection and presentation.

The results of reliability test on multiple choice questions about geometry obtained score of 0.441 on moderate criteria. While the reliability of multiple-choice questions on data collection and presentation obtained score of 0.663 on high criteria. The results of the reliability of the essay questions obtained score of 0.445 on moderate criteria. While the reliability of the essay questions of the data collection and presentation of the results obtained score of 0.675 on high criteria.

The result of distinguishing power from 7 multiple choice questions in geometry obtained that 5 of 7 questions (number 1, 2, 4, 7, 10) had adequate distinguishing power and 2 numbers (5 and 6) had good distinguishing power. The 7 multiple choice questions in terms of data collection and presentation had adequate distinguishing power (number 5, 6, 7, 8), and 3 of 7 questions had good distinguishing power (number 1, 4, 10). The 5 essay questions in geometry obtained 3 questions with good distinguishing power (number 1, 4, 5) and 2 questions had very good distinguishing power (number 2 and 3). There were 5 questions of data collection and presentation, and 3 of them had good distinguishing power (number 2, 3, 4), and the other 2 had very good distinguishing power (numbers 1 and 5).

Result of difficulty level; 7 multiple choice questions in geometry obtained 2 questions with medium difficulty levels and 5 questions with easy difficulty level. The 7

multiple choice questions of data collection and presentation obtained 2 questions with medium difficulty levels and 5 questions with easy difficulty problems. All 5 essay questions on geometry had easy difficulty level. On data collection and presentation, 2 of 5 questions had moderate difficulty level and 3 problems had easy difficulty level.

Result of the distractor from 10 questions on geometry from number 1 to number 10 indicated that the level of distractor worked well. For 10 questions of data presentation and collection from number 1 to number 10, the level of distractor worked well.

Extensive trials were conducted at SD Sembungharjo 02 Semarang involving 40 students. The 7 multiple choice questions on geometry and 7 multiple choice questions of data collection and presentation were valid. The 5 essay questions on geometry and 5 questions of data presentation and collection were valid.

Result of the reliability on multiple choice questions on geometry obtained score of 0.616 on high criteria. While the reliability of multiple-choice questions of data collection and presentation obtained score of 0.678 on high criteria. Result of the reliability of essay questions on geometry obtained score of 0.615 on high criteria. While the reliability of the essay questions of data collection and presentation obtained score of 0.443 on adequate criteria.

The result of distinguishing power from 7 multiple choice questions on geometry obtained 6 questions had adequate distinguishing power (number 1, 2, 3, 5, 6, 7) and 1 question had good distinguishing power (number 4). While 7 multiple choice questions of data collection and presentation obtained 5 questions had adequate distinguishing power (number 3, 4, 5, 6, 7), and 2 questions had good distinguishing power (number 1 and 2). The 5 essay questions on geometry, there was 1 question with adequate distinguishing power (number 4) and 4 questions had very good distinguishing power (number 1, 2, 3, 5). Whereas 5 questions of data collection and presentation obtained that 3 questions had adequate distinguishing power (number 1, 3, 4), and 2 questions had very good distinguishing power (numbers 2 and 5).

Result of the difficulty level of 7 multiple choice questions on geometry obtained that 1 question with hard difficulty level, 1 question with moderate difficulty level and 5 questions with easy difficulty level. The 7 multiple choice questions of data collection and presentation obtained 7 questions with easy difficulty level. The 5 essay questions on geometry obtained 5 questions with easy difficulty level. The 5 questions of data collection and presentation obtained 5 questions with moderate difficulty level.

Result of distractor from 10 questions on geometry indicated that the distractor worked well. The distractor worked well too in 10 questions of data collection and presentation collection from number 1 to number 10.

Based on research Fitri, Noviana, & Fendrik [5] in further development it is expected that the worksheet with cube and beam material is further developed until the evaluation phase (Evaluations). From these studies the researchers developed Smart Education in learning mathematics for elementary schools until the evaluation stage.

4. CONCLUSION

Research findings show that vertical conflict between Indonesia and OPM has not abated until 2019 this year. Although the Indonesia government now more often mentions term of KBB rather than OPM on various riot activities in Papua, OPM itself claims to be responsible for several problems that occur. It was clearly stated that the OPM demanded Absolute independence from Indonesia because they felt that the results of the Act of Free Choice (PEPERA) were considered to violate the New York agreement and were invalid, with the reason that the replacement of One Man One Vote towards deliberation had been initiated by Indonesia with Indonesia. form the Papera Conference Council (DMP) without involving and not the choice of the people of Papua. Then historically Papua felt there was no historical connection with Indonesia, while surrender of Papua to Indonesia was because Papua itself was a former Dutch colony. The results of this study also show how international response to conditions of Papua and Indonesia. For countries that support Papua independence, such as Vanuatu, Senegal, and Fiji assume that Papua has the freedom to fight for its independence and considers Indonesia's policy towards Papua as a form of colonialism and neo-imperialism. As for the supporting countries of Indonesia, especially the UN members stated that Indonesia has absolute sovereignty over Papua as a result of the act of free choice (PEPERA) in 1969 under the coordination of the United Nations Temporary Executive Authority (UNTEA).

5. RECOMMENDATION

To reduce various separatist acts of independent Papua, Indonesia is obliged to act decisively in eradicating separatist members and try as much as possible to break regeneration of Papua separatists. Steps taken can go through the world of Education, namely by providing appropriate education to Papua children, so there are no more Papua people who do not have the spirit of Nationalism towards the Indonesia State. Through Economic Improvement, so that there are no Papua's who feel economically oppressed, through social welfare so that there is no social gap between migrants and natives, and also through various policy formulations towards Papua. Indonesia is obliged to protect every citizen including the people of Papua, so that in event of discriminatory actions against Papua people, State must be present to protect the Papua People. Government is obliged to build mutual trust between Indonesia and Papua, this is necessary if in the future conflict would return again, then conflict resolution can be resolved properly.

REFERENCES

- [1] Anderson; L.W. (Ed.), Krathwohl, D.R. (Ed.), D. (2001). *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's of Educational Objectives*. New York: Longman.
- [2] Astuti, Y., & Setiawan, B. (2013). Pengembangan lembar kerja siswa (LKS) berbasis pendeka-tan inkuiri terbimbing dalam pembelajaran kooperatif pada materi kalor. *Jurnal Pendidikan IPA Indonesia*, 2(1), 88–92. <http://doi.org/10.15294/jpii.v2i1.2515>
- [3] D. R. Dewi, S. Mulyati, and C. Sa'dijah, "Pengembangan lembar kerja siswa untuk pembelajaran permutasi dan kombinasi dengan pendekatan kontekstual untuk siswa sma kelas xi," 2013.
- [4] Pratama, S., Minarni, A., & Saragih, S. [2017]. Development of Learning Devices Based on Realistic Approach Integrated Context Malay Deli Culture To Improve Ability of Understand Mathematical Concepts and Student s ' Self- Regulated Learning At SMP Negeri 5 Medan. *Iosr-Jr*, 13(6), 18–29. <https://doi.org/10.9790/5728-1306021829>
- [5] R. A. Fitri, E. Noviana, and M. Fendrik, "Pengembangan lembar kerja siswa (LKS) pada mata pelajaran matematika kelas 5 sekolah dasar (penelitian pengembangan dengan materi volume kubus dan balok Di SD IT Al-Fityah)," *J. Online Mhs. Fak. Kegur. dan Ilmu Pendidik. Univ. Riau*, vol. 4, no. 1, pp. 1–12, 2017
- [6] Nurulaen, Y. [2011]. Edisi Khusus No. 2, Agustus 2011. *Jurnal Penelitian Pendidikan*, Edisi Khus(2), 154–163.
- [7] Sarjuni. [2018]. *Konsep Ilmu Dalam Islam dan Implikasinya dalam Praktik Kependidikan. Studi Dan Penelitian Pendidikan Islam*, 1, 47–57.
- [8] Triwibowo, Pujiastuti, E., & Suparsih, H. (2018). Meningkatkan Kemampuan Pemahaman Konsep Matematis dan Daya Juang Siswa Melalui Strategi Trajectory Learning. In *Prisma, Prosiding Seminar Nasional Matematika* (Vol. 1, pp. 347–353).