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The Development of Module Containing Local Culture with Realistic Approach for Mathematical Literation of Elementary School Students

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Abstract

This study has purpose to develop the independent learning modules that support the improvement of mathematics literacy skills of the fifth grade students of elementary school. The module developed was adjusted to the 2013 curriculum and focused on ordinary, mixed, and decimal multiplication materials, containing with local culture using the realistic approach integrated in mathematical adventure stories. This was a research and development with the Thiagaranjan 4D model that was modified into the development stage in a limited test through the steps of define, design, and develop applied to the fifth grade students of SDN Kendal Serut 02, Pangkah, Tegal. The results at the development stage showed a form of additional supplement that is suitable with the characteristics of the needs of the elementary school students, which is loaded with local culture with relevant realistic approach. At the development stage, the module is produced in developing the mathematical literacy which is considered valid by material and media experts. In addition, trials on users showed positive responses from teachers and students in grade V which showed that the Mathematical Literacy Ability of students after learning with the module was better than previous condition (P = 0.000) with an increase in N-gain of 0.4 in the medium category.

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INTRODUCTION

Learning is an active process where students build their own knowledge and seek meaning from what is learned (Fadholi, Waluyo, and Mulyono; 2015). Every learning process in school is always accompanied by competency indicators that need to be achieved. Competencies that must be possessed by humans are high, understanding competencies, collaboration communication and critical thinking which are based on and facilitated by literacy skills (Abidin, Mulyatin, and Yunansah, 2017). Based on the results of the PISA study, it showed that Indonesia is still below the world average in the value of mathematics literacy, which is ranked at 56th out of 65 countries (OECD, 2013). These results indicates that the ability of Indonesian students in formulating, applying, and interpreting mathematical phenomena in various contexts is still low (Istiandaru, Wardono, and Mulyono, 2014).

Mathematical literacy is one of the mathematical skills that Indonesian students need to master to be ready to face real-world problems (Karyadi, Suyitno, Dwidayati, 2018). Mathematical literacy refers to the ability and knowledge of students to take and apply the knowledge and abilities obtained from the classroom into their real-life understanding and experience in situations involving mathematical concepts (Sumirattana, Makanong, and Thipkong, 2017). Therefore, Permendiknas No. 22 of 2006 designs learning that is aligned with the development of the mathematical literacy ability of students.

The process of learning mathematics is inseparable from the media in the form of modules to make students independent. Modules can make students learn independently so they can support the teacher's role in the learning process (Barata, Zaenuri, and Sukestiyarno, 2019). Modules are designed and arranged systematically to organize student learning that allows students to master a unit of subject matter before moving on to the next unit (Maliya, Isnarto, and Sukestiyarno, 2019).

Multicultural mathematical activities that use culture to make connections with mathematical topics can motivate diverse cultures and ethnic students to investigate and gain respect for their own cultural heritage while studying significant mathematical content (Bahri, Zaenuri, and Sukestiyarno, 2018). Mathematics is a form of culture that has been integrated in all aspects of human's lives wherever they are (Tandialing; 2013). In addition, mathematics is not a universal domain of formal knowledge, but is a collection of symbolic representations and procedures that are culturally constructed in certain groups of society (Sirate, 2012).

A realistic approach is intended to make mathematics learning more interesting and meaningful for students by introducing students to contextual problems that are in accordance with students' knowledge and experience (Arsaythambi and Zubainur, 2014). According to Wibowo (2017), a realistic approach is an approach that involves students developing their understanding by exploring and solving problems that are applied in contexts that involve students' interests. Based on the results of research conducted by Septika (2012) in Putra (2016) shows that a realistic approach can improve student learning outcomes in mathematics.

Based on students' development rates on Piaget's cognitive theory (Santrock, 2011) shows elementary school students are at a concrete operational stage, so that the acquisition of close knowledge of their lives through local cultural content and realistic approaches can be meaningful to students. In addition, learning will occur if the child works or handles tasks that have not been learned, but the tasks are within the reach of students who are known as the zone of proximal development (Ibadi, Mariani, and Waluya, 2014).

METHODS

This study was conducted using the 4D Thiagaranjan (1974) research and development method which was modified at the development stage with a limited test. This study aims to produce a module product that is suitable with

the characteristics of the needs of students to improve the effectiveness and productivity of quality of learning with a load of local culture with realistic approach that fits the 2013 curriculum in the form of a mathematical adventure story according to the results of preliminary studies.

Procedurally, the development steps undertaken in this research are definitions including, literature study, field survey, initial initial analysis, student analysis, concepts, and assignments as well as the formulation and specification of competency achievement indicators. Furthermore, the design or product design includes, module objectives and objectives, format selection, and module components. The last stage is the development in the form of product trials in the initial process, field, and implementation.

The definition stage begins with the study of literature to deal with the indicators of the variables to be assessed. A field survey was conducted the introduction of preliminary research questionnaires and teacher and student interviews about the 2013 curriculum. A final preliminary analysis was in the form of a review of field observations, a concept analysis of the study material to be developed in the product. Analysis of the characteristics of students as research subjects which subsequently becomes a reference determines indicators of competency achievement.

The design phase is in the form of determining the characteristics of module development that carried out by setting goals and learning objectives with the module, choosing the format in the form of mathematical literacy development, and the components that obtained in the module. Modules that have been designed are then submitted to the material expert validator and the mathematics media.

The development phase is in the form of a product trial that has been assessed by a validator to determine the practicality of the module in the initial, field, and implementation trials. The feasibility of the product in this study that meets the criteria in the aspects of validity and practicality to achieve effective results from pretest and postest session.

RESULTS AND DISCUSSION

The Define Step

Based on the preliminary research questionnaire, it was found that 5, 5% of students stated that the form of the modules to be read was concise, 11% of students wanted the form of modules with subject matter and practice questions, and 83.5% of students wanted the form the module contains subject matter and practice questions in the form of adventure stories. Furthermore, 78.5% of students said they would read every day a fairy tale module containing adventure stories and learning materials.

Fairy tales in lessons open up a new way of learning. Based on the results of a poll conducted on 86 teachers showed that they agreed to use fairy tales in the process of learning mathematics (Anderson, 2009). Realistic is defined as the context of problems that can be thought by students which among others are the world of fantasy or fairy tales. Every formal world of mathematics can provide a context that is suitable for a problem as long as they are real in students' minds and can be felt real by themselves (Panhuizen, 2005).

Fairytale stories have the capacity to stimulate emotions and force student involvement in the reading process which is one of the basic ways of thinking in organizing information and ideas, understanding culture and stimulating human consciousness (Livo, 2003). The characteristics of a realistic approach that is using contextual problems, using models, using student contributions, interactivity, and integrating with other topics or concepts (Asikin and Junaedi, 2013).

The Design Step

The product produced in the form of modules containing local culture realistic approach in the concept of a mathematical adventure story on fractional multiplication material for fifth grade elementary school students. The module product review covers

physical design, story design, material design, visual design, and activity components in it.

The module cover (a) contains the title of the story, the module's purpose, illustrations, and objectives, and the author, while the back cover (b) contains the story prologue and a summary of the contents of the module. The entire module contents are served out using the Corel Draw X7 application. The illustration of the front and back covers of the module is as in Figure 1.

Figure 1. (a) Front Cover of the Module, (b) Back Cover of the Module

The paper size used for printing the module is A4 (21 cm x 28 cm) with a weight of 80 grams. The text design in the module includes size, type, and space. The module mostly use a font type with a size of 12 pt, and in infrequently 18 pt out of 12 pt. The images and illustrations used in the module were obtained from the google search site and the illustrations were made by image illustrators with the consideration of bringing more life to the story and delivering the subject matter information. The consideration of the design chosen for the module was based on the availability and needs as well as adjustments to the characteristics of the fifth grade students.

Istanti (2015) explains that the components contained in the module consist of opening or introduction, core, and end or closing sections. The module component in the introduction contains module purposes, preface, material description, module description, character introduction, table of contents, objectives, and a brief description of mathematical literacy, characters collaboration, and a realistic approach. Figure 2 shows the elements of module purposes page from introduction section.

Figure 2. The Module Purposes Page

Based of figure 2, describing that module made to 2013 curriculum assistance towards grade V elementary student. Explained that student expected can make collaboration in matehmatic literation activity with reading mathematics adventure story on this module. Next, explained of organizer team such as writer, adviser, theory and media expert validator, illustrator, and layouter module. Figure 3, shows of module description.

Figure 3. The Module Description Page

Based on figure 3, describing of elements in the module such as, that module completed with knowledge corner which provides explanatory mathematics related story. Next, there are collaboration corner for training discussion students. Completed to picture illustration for turn on the story. Figure 4, shows of The Character in the story.

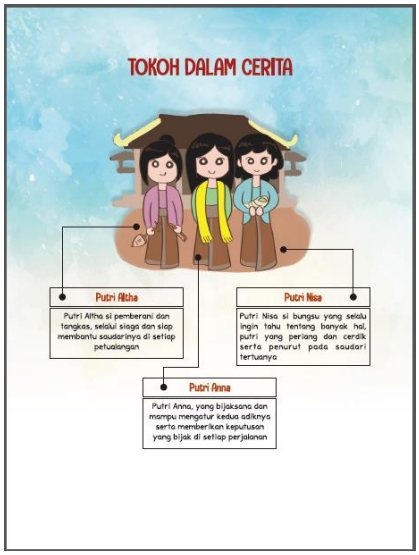

Figure 4. The Character In The Story Page

Based on figure 4, describing the main character in the story raised. That character are Princess Anna, Princess Altha, and Princess Altha along with their personality. Figure 5, shows of The Mathematics Literacy Abilities.

Based on figure 5, describing of the mathematics literacy abilities definition. Furthermore, it is explaining of mathematics literacy ability indicators on the process domain.

Figure 5. The Mathematics Literacy Abilities Page

The main section contain the fairy tale of mathematical adventures and story illustrations, the integration of fractional multiplication material in the story, the cultural corner in the traditional game, the knowledge corner, the cooperation corner, and independent practice. The elements in the module include the characters consisting of the main and supporting characters, the story line, the theme of the story, the emotional impact and imagination, the realistic elements, the use of the concept of fraction multiplication, and the relationship with other mathematical concepts. Figure 6 shows of stories and illustration (a) and integration material in the story (b).

Based on figure 6, describing about first story design on every chapter completed with supportive illustration iages. In every chapter was given story that brought students to understanding multiplication fraction. For example in chapter 1 (a) telling about the three royal princesses who playing in the flower garden palace which has been arranged setting division for every flower from various region. Based on storyline, student introduced to ordinary fraction multiplication with ordinary fraction (b).

Figure 6. (a) Stories and Illustrations, (b) Integration of Material in The Story

Based on material explanation trough story, than student student invited to deepen the knowledge corner. Furthermore, students will to finishing math literacy problems. Figure 7, shows of *cultural corner (a), dan cooperation corner (b).*

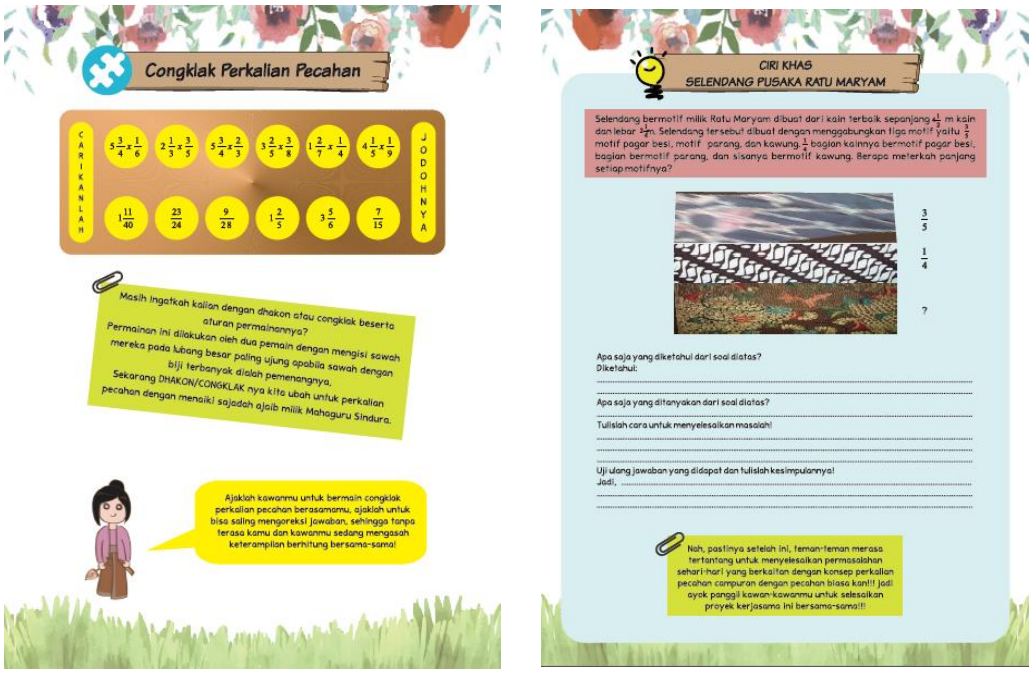

Figure 7. (a) Cultural Corner, (b) Cooperation Corner

Based on figure 7, showing about cultural and collaboration corner on every chapter. On picture 7(a) aimed at sharpening concepts understanding student related to material explained trough adventure story. Next, picture 7(b) showing collaboration corner in the form of math literacy problem solving will still related to storyline. On the 7(b) showed form of queen Maryam's heirloom scarf that has been stolen Mak Lampir. On the collaboration corner, student trained for determine the area of each motif on that heirloom scarf with implementation multiplication fraction concepts. Figure 8, shows of idependet practice on every chapter. The

evaluations are formed to remain integrated with the content of story.

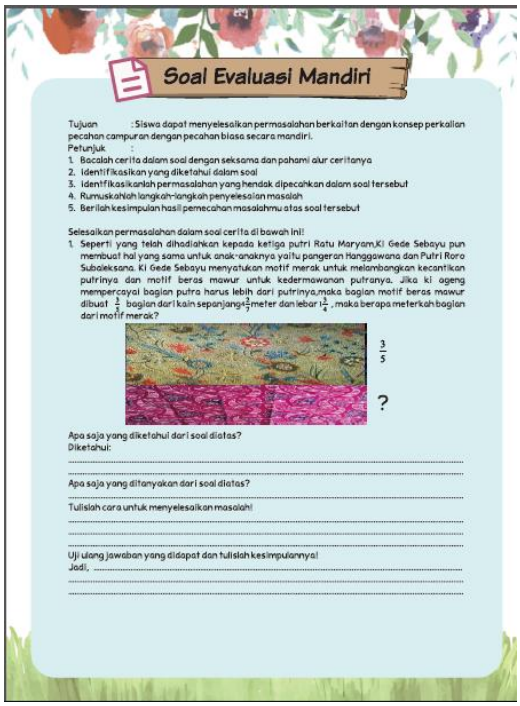

Figure 8. The Independent Practice Page

Based on figure 8, showing about independent practice problems on the form of to increasing math literacy elementary student ability. As a basis for development, the researcher designed a module that aims to develop indicators of mathematical literacy, which include communication, mathematizing, devising problems, using symbols, as well as reasoning and argumen.

The validity of the module containing local culture with realistic approach is in very good criteria from the acquisition of scores by material experts of 146 with a percentage of 83%. The score has exceeded the minimum score decided by the material experts, which is at 119. The assessment was divided into several aspects that are rated A with the category of very good, including the completeness of the material, the accuracy of the material, activities that support the material, facilitation of cooperative character, organizing the material and following the scientific systematics. In addition, the aspects of the value of B are categorized as good, including the facilitation of mathematical literacy skills and the use of notations, symbols, and units.

Evaluation by media experts is also in very good criteria with a score of 104 with a percentage of 95% and has exceeded the minimum value of media experts that is equal to 73.3. Aspects of assessment by media experts include, cover, introduction page, main section, and closing.

The Develop Stage

The development stage was carried out with three trials. Initial trials were conducted at SDN Bedug 01 by taking the response of 3 students and 1 teacher. Student response scores on aspects of the display in the very good category with a percentage of 75%. content aspect get the category of very good with a percentage of 83%. In addition, the results on the score of the response of the teacher was in the very good category with a percentage of 85%.

Field testing which is the second test was carried out on 6 students and 1 teacher in fifth grade SDN Kendal Serut 01. Based on the results of the response of students, it was found that the module display aspect obtained a very good category with a percentage of 96%, meanwhile, the module content aspect obtained the very good category with a percentage of 94%. Furthermore, the score on the response of the teacher was in the very good category with a percentage of 97%.

Some notes and input from the response of students and teachers in the initial and field trials were sharpened through in-depth interviews, including in the writing and design that were followed up in the revision process. The revised product was tested on a field implementation test using module-based assistance at SDN Kendal Serut 02. The results of this trial are presented in Figure 9 in the form of validity and practicality of the developed modules.

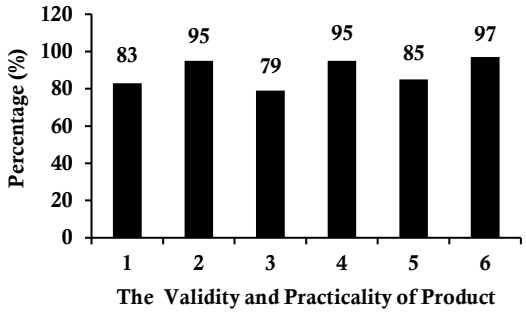

Figure 9. The Validity and Practicality of Product

Based on Figure 9, the aspects of product validity is presented in aspects 1 and 2, namely material expert validation and media expert validation. Furthermore, aspects of product practicality on aspects 3, 4, 5, 6 are the students' responses in the initial trial, the teacher's initial test responses, the responses of the students in the field trials, and the teacher's responses in the field trials.

Review of Product Effectiveness

The effectiveness of the module in developing students 'mathematical literacy can be seen from the emergence of mathematics literacy indicators in the final ability test accompanied by the completeness learning achievement of the students, there are differences in mathematical literacy abilities before and after module-based mentoring, and an increase in mathematical literacy abilities. The minimal completeness criteria (KKM) is determined at 65.

The initial conditions of the fifth grade students of SDN Kendal Serut 02 viewed from the initial mathematics literacy ability test showed the study sample came from a normally distributed population with an average value of 59, therefore, it was found that 11 students included in the high literacy ability, there were 20 students at moderate ability and 5 students were at moderate ability.

The analysis of the results of individual completeness tests of mathematical literacy of students who have received module-based assistance using a one-way test with a significance level of 5% obtained tcount = 3.359 which is greater than t_{table} = 2.977, therefore, it can be concluded that students are declared to have completed KKM 65 with the percentage of students who passed the minimum completeness criteria at 80%.

The analysis of the average difference after and before obtaining module-based assistance using paired sample test with t_{count} = -9,943 with a significance of 0,000 <0.05, it means that there are significant differences between before and after using the module based assistance. The average increase in mathematical literacy ability seen from the N-gain test obtained 0.4 with the medium category. Based on the calculation, it was found that 6.7% of students showed high N-gain scores, 66.7% of students showed moderate N-gain scores, and 26.7% of students showed low N-gain scores. Next presented in Figure 10, the level of increase in N-gain scores for students who take module-based learning.

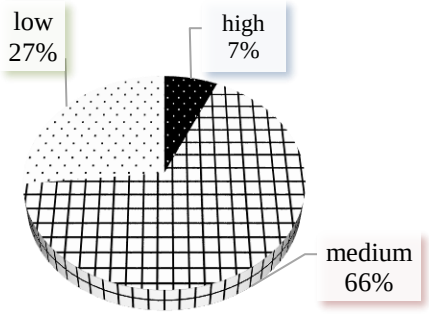

Figure 10. The increase of N-Gain Score in the Math Literacy Ability of Students

Afriyani, Mulyono, and Asih (2018) explained that the ability of mathematical literacy includes the domain of content (space and form, change and links), the process domain includes, communication, mathematizing, representation, reasoning and argument, devising strategies, using symbolis, and using matematics tools) and context domains (educational, personal, work, social and scientific). Analysis of the results of mathematical literacy capabilities seen from indicators in the process domain can be seen in Figure 11.

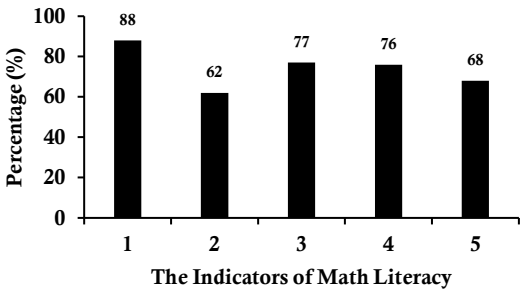

Figure 11. The Indicators of Math Literacy

Based on Figure 6, it can be seen that the achievement of five indicators of mathematical literacy in the process domain analyzed include 1 is communication, 2 is mathematizing, 3 is devising strategy for problem solving, 4 is using symbolis, 5 is reasoning and argument. In indicator 1, the criteria are very good. Students have been able to analyze the information presented from the problem and are able to understand the problem in the question to be solved.

In indicators 2, 3, 4, and 5 obtained good criteria. The ability of students to turn real world context problems into mathematical sentences is already good. Students have been able to provide strategies in solving and applying the concept of fractional material in solving problems of everyday life well. Students are good at writing down units and arithmetic operations that are used in problem solving. In addition, students have also been good at giving logical reasons at the end of solving the problem presented in the problem.

Learning objectives with modules are: 1) students are able to learn independently or with as little help from the teacher, 2) the role of the teacher does not dominate and is not authoritarian, 3) accommodates various levels and speeds of student learning, 5) students can measure their own level of mastery of the material (Setiawan and Sukestiyarno, 2018). Based on the results of the test of the effectiveness of the product shows that modules containing local culture realistic approach has effectively improved the mathematical literacy ability of students who get mentoring learning. This is in line with the results of research by Somayasa, Natajaya, and Candiasa (2013) that the development of modules is effective in improving student learning outcomes.

CONCLUSION

The results of the validation by the expert indicated that the module containing local culture with realistic approach has met the validity standards reviewed from the readability of the content/ material and the attractiveness of the design or appearance. The module was also tested for readability and attractiveness by users, namely students and teachers in three stages. The effectiveness of the product is measured from the cognitive results of students on the assessment of emerging mathematical literacy indicators of students, completeness of student learning, and an increase in the ability of beginning and end of mathematical literacy of students.

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