Validity of Mathematic Learning Teaching Administration on Realistic Mathematics Education Based Approach to Improve Problem Solving

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Abstract. The purpose of this study is to produce a learning tools based on Realistic Mathematics Education that is valid, practical, and effective against the problem solving abilities of students in class VII. Learning Tools are developed Lesson Plan (LP) and Student Worksheets (SW). This research is a development research with Plomp model of the which consists of three stages items, namely preliminary research, development, and improvement. At the development stage, the learning tools design and evaluation is carried out through formative evaluations.

1. Introduction
Mathematical learning that Occurs at this time in school still lacks the opportunity for students to develop reviews their problem solving ability in accordance with the objectives of mathematics learning. The lack of willingness of students to study mathematics in fact, because the lesson is difficult students' mathematical problem ability is still not good [1]. Because students don’t understand applicative question that need high order thinking skill [2].

Our preliminary study showed that student’s math problem solving ability is low. (Table 1)

| No. | Class | Average Problem Solving Ability Test Results |
|-----|-------|---------------------------------------------|
| 1   | VII A | 57.73                                       |
| 2   | VII B | 54.32                                       |
| 3   | VII C | 52.14                                       |
|     | Average of all Classes | 54.73                                      |

To improve problem solving ability, we need to improve the ability of understanding problem, making math model, problem solving, interpreting solution, our preliminary study, we need to improve. Based on a preliminary study, we need to improve students’ problem solving abilities by producing learning tools.

The learning tool is Lesson Plan (LP) and Student Worksheet (SW). The availability of learning tools greatly influences the success of learning, the better the learning tools is used, the better the results obtained by students. But the problem is that the learning tools used by the teacher is not fully in
accordance with what is needed by the students, even though the teacher has varied using the learning method, but still cannot show the maximum results.

To improve problem solving ability in learning, the teacher is required to have knowledge, special ability and professional attitudes. The teacher must be able to use the learning approach so that students can understand the concepts that have been taught.

The purpose of this study is to produce a learning tools based on the Realistic Mathematics Education approach that is valid, practical, and effective against the problem solving abilities of students in class VII. In addition, this research is expected to be useful for teachers and students in learning mathematics in schools. The results of this study are in the form of lesson plans designed to follow the steps of learning based on Realistic Mathematics Education and SW designed in accordance with the principles and characteristics of the Realistic Mathematics Education approach. The LP and SW that were developed were limited to Social Arithmetic material for grade VII junior high school.

The approach based on Realistic Mathematics Education showed different results. It is caused Realistic Mathematics Education uses contexts that are not only Illustrations but also real world contexts, Realistic Mathematics Education using models from contexts such as images then represented in the form of lines, ratios, tables and so on. Realistic Mathematics Education contexts is chosen to develop a variety of different strategies and students always reflect constantly [3].

In the approach learning of the Realistic Mathematics Education, the instructional sequence is understood as “the learning line” which is the problem of context used as a first point to get the students' informal reasoning. It means that the context is a source for new mathematics, then formal mathematics is engaged in the curriculum and instruction of Realistic Mathematics Education with a context that serves as a first point realistically to support student involvement and create students' thinking. Then, this context is combined with problems, representations, and sequential strategies [4].

Problem solving is a mental process complexly involving visualization, imagination, abstraction, and association of information. Therefore, problem solving can help the students to improve and develop their abilities in the aspects of application, analysis, synthesis, and evaluation through the process of learning mathematics [5].

In doing the learning process, the students need a learning device. Learning devise needed in the learning process are LP and SW. The lesson plan (LP) is a guide to the steps that will be done by the teacher in the learning activities arranged in the activity scenario. LP is essentially a short-term planning for estimating and projecting what should be done in learning. The LP needs to be developed to coordinate the learning components, they are basic competencies, standard material, indicators of learning result, and assessment [6]. According to Trianto in Lauria “students’ Worksheet is guideline of students used to conduct investigations or problem solving activities”. Generally, SW contains working instructions, experiments that can be done at home, material for discussion, crosswords, portfolio assignments, and practice questions as well as all forms of instructions that are able to engage students doing activity in the learning process [7].

To achieve a good learning tools there are several characteristics, which states that there are three characteristics that need to be considered, such as: content, language, and appearance aspects. The content aspect begins by providing contextual problems that exist in daily life. In addition, student worksheets provide instruction to students who can help them solve problems. The first instruction is asks students to understand the problem by identifying what is known and asked about the problem. The second instruction is asks students to plan a solution by building a mathematical models of the problem. The third instruction Asks students to solve the problem using the models that has been found [8].

Problem solving is a mental process that requires a person to think critically and creatively to look for alternative ideas and specific steps for each obstacle and as a step to develop mathematical knowledge based on problems related to mathematical problem solving and one of the metacognitive aspects of consciousness is [9].
2. Materials and Methods
This type of research is the development of research. By using plomp model it consists of three phases, namely the initial investigation phase (preliminary research), the phase of development or manufacture of prototypes (development or prototyping phase), and the assessment phase [10]. In the first phase or the phase of the initial investigation an analysis of needs and Contexts (need and context analysis) is carried out. The second phase or the phase of making prototypes is carried out the design, development and formative evaluation (design, development and formative evaluation). Formative evaluation steps start from self-evaluation (self-evaluation), expert review, one-to-one evaluation, small group evaluation and field tests.

This Preliminary phase is needed to get information about problems in learning where there is a gap between the expected goals and the situation. At the preliminary stage this is done with several activities in it as follows:

Table 2. Preliminary Research Activities

| Research Activity | Criteria / objectives | Description of activities | Result |
|-------------------|-----------------------|---------------------------|--------|
| Preliminary Analysis | • Requirement Analysis items, namely gathering information from mathematics learning in junior high school in the form of problems as a basis for product design | Interview, Observation of teachers and students, literature review | Product framework / product overview |
|                     | • Curriculum Analysis, the which is the adjustment of the learning tools to be developed with the 2013 curriculum | Validation sheet and a list of revisions | |
|                     | • Student and teacher analysis, that is, knowing the characteristics and comparing students’ mathematical abilities and students’ abilities | | |

Validation learning tools based learning Realistic Mathematics Education approach consists of two things, namely the validation of content and construct validation. Validation means that the contents of the correspondence between the products produced by the syllabus subjects, i.e. determine if learning is developed in accordance with the KD and determine compatibility between products produced with the elements specified development. Validation of constructs relating to the use of language, sentence structure, vocabulary, level of difficulty and clarity of learning tools developed.

Aspects of the LP and SW validated by experts can be seen in Table 3 and Table 4.

Table 3. Aspects LP Validated by Expert

| Rated aspect | Method of collecting data | Instrument | Purpose |
|--------------|--------------------------|------------|---------|
| Components and CSP format | LP to provide validation sheet validator | Validation sheet and a list of revisions | To know the contents and construct validity LP-based approach designed RME. |
| Activity-based learning approach to RME | | | |
| Language and writing | | | |
Table 4. Aspects SW which Validated by Expert

| Rated aspect                               | Method of collecting data                  | Instrument                      | Purpose                                                                 |
|--------------------------------------------|--------------------------------------------|---------------------------------|-------------------------------------------------------------------------|
| Didactic aspect or presentation            | SW provide validation sheet to the validator | Validation sheet and a list of revisions | To determine the validity of RME-based SW which has been designed to obtain information about all aspects of content development SW |
| Aspects of the material and content        |                                            |                                 |                                                                          |
| aspects of language                        |                                            |                                 |                                                                          |
| graphics aspect views                      |                                            |                                 |                                                                          |

3. Results and Discussion

This type of research is the development of research. By using plomp model It consists of three phases items, namely the initial investigation phase (preliminary research), the phase of development or manufacture of prototypes (development or prototyping phase), and the assessment phase [10]. In the first phase or the phase of the initial investigation an analysis of needs and Contexts (need and context analysis) is carried out. The second phase or the phase of making prototypes is carried out the design, development and formative evaluation (design, development and formative evaluation). Formative evaluation steps start from self-evaluation (self-evaluation), expert review, one-to-one evaluation, small group evaluation and field tests.

The result of this research are:

3.1. Preliminary Investigation Phase

Initial investigation phase carried out in order to determine the shape and characteristics of the learning tools that will be developed. This phase was planned several activities including needs analysis, curriculum analysis, analysis of the concept and analysis of learners.

Based on needs analysis obtained information that the LP and existing SW need to be refined to suit the demands of the curriculum of 2013. For the LP and SW can help teachers and learners in the learning and learning outcomes of students can be obtained with the maximum. In addition SW also need to be equipped with the issues and activities of learners solving problems so that they can help students understand the material being studied. SW also need to contain problem solving exercises so that learners can practice developing their creative thinking ability.

Based on the analysis of the curriculum, it is known that there are five items in the second half that comparison, social arithmetic, lines and angles, triangles and rectangles, and presentation of data. The material was taken to the development of the learning tools in this study is a matter of social arithmetic. The material selected for the materials studied arithmetic social match with problem-based learning.

At the stage of concept analysis carried out activities to identify, specify, and systematically compile the main material to be learned by the learners. The materials are arranged in a hierarchical manner. The material is primarily an arithmetic social with sub-material sales price and the purchase price, profit, loss, and even, the percentage of profit and a percentage of income, discount and a percentage discount, gross, net, and tare, as well as a percentage of net and tare, and tax and interest single.

Based on analysis of learners can be conclude that learners not been actively involved in learning. Many students who have not participated in learning to the maximum, it is characterized by the many students who carry out other activities apart from learning activities. Learners also found that learning implemented yet provide opportunities for learners to be actively involved. Additional information is obtained learner has used SW, but SW has not helped the students to understand the material optimally. The material in SW served directly and proceed with the exercise. According learners SW display is also not attractive so it needs to be given variation to be attractive. Learners want SW interesting and colorful.
3.2. Prototype Development Phase

The purpose of this development is producing math learning tool for the students class VII on the material-based social arithmetic valid Realistic Mathematics Education, practical and effective. The stages are implemented to generate learning tools-distance defenders for learners math class VII on the material-based social arithmetic valid Realistic Mathematics Education, practical and effective is as follows.

After learning indicators formulated, as well as the main concepts established through a needs analysis, curriculum analysis, analysis of the concept and analysis of learners who performed on the stage of the initial investigation, it can be designed in accordance with the learning tools needed. The following will describe the characteristics of the LP and based SW designed Realistic Mathematics Education.

3.2.1. Design Lesson Plan (LP)

LP is designed with reference to the preparation of LP guidelines contained in Mathematics Education Realistic Permendikbud number 103 of 2014 of the Defense-distance on Primary and Secondary Education. LP developed is based on KI, KD consisting of several indicators. The components are contained in the same LP with existing LP that contains the identity, core competencies, basic competencies, indicators of achievement of competencies, learning objectives, learning materials, approaches and methods of teaching, learning activities, resources and assessment of students.

Learning activities, consists of three stages: introduction, core and cover. In the preliminary events are open learning activities, apersepsi and motivation. At the core kagiatan activity which is in accordance with the phases of problem-based learning approach and steps Realistic Mathematics Education. The phases of problem based learning activities are oriented learners on issues, organize the students to learn, guiding investigations individuals and groups to develop and present the work and analyze and evaluate the problem solving process. While, steps include examining the scientific approach, ask, gather information, reason or associates and clicking communication.

3.2.2. Design SW

SW math-based Realistic Mathematics Education has the size of 21 cm x 29.7 cm (HVS paper size A4). This size was chosen because it adapts with the size of SW used by students. Also, it is caused that there will be several columns that should be filled by the students. The large size will give easiness for the students to use it. The typeface used in SW is Comic Sans MS. It was chosen for the writing of this type is not too formal and it will be seen clearly although made small font. Meanwhile the size of the font used is 11-44. The font size is depended on the position of writing in SW. SW presentation contains a preface, table of contents, instructions in using SW, basic competence, the activities of students, information, practice questions and a bibliography. SW learning activities are begun by presenting the problem that should be solved by the students. The problem solving steps in SW will be done by students by following instruction in SW. By doing these activities, it is expected for the students challenged and trained to solve problems. Then, for the parts of SW developed is same as the previous SW but the different is on the form and learning activities.

For the cover of SW, it is included the illustrations picture that describe learning materials. The cover is made with an attractive colour display. Also, SW is featured a preface, table of contents and instructions for the use of SW. The instructions contain a guide to the students in the use of SW.

Learning activities in SW is began by asking the problem. The problem presented is a problems of daily life of the students. Those problem must be understood by the students. After that, the students should look for the solving of the problems by doing activities that should be guided by SW. Through these steps, the students will find a concept and they were asked to draw conclusions from solving processes that have been implemented and draw the conclusions.

After that, there will be information that can be read by students and compared with the process of solving the problem and the process of solving the problems that have been done. The students can correct any errors or validity of the implementation of the problem solving steps guided by several
information. In solving the problem, the students were asked to discuss in groups. The problem solving process is began with writing down the information known of the problem, identify the steps of solving that will be implemented, implement the solving and draw conclusions. At the end of SW, there will be exercises that should be done by students individually. In doing the exercise, the students are no longer guided but they must be able to make the solving of the problem with his own thoughts.

Learning activities page is displayed by giving full-colour. The main background used is a combination between white and blue colour. Every problem given is also related to the problems presented. Meanwhile typeface used on problems is Comic Sans MS with size 12-18. The inscription on the activities are black and the title of learning are given various combinations including blue, green, red, purple and orange. Sub-title material is made Clarendon Blk BT typeface with size 22 by giving green for it.

For Exercises, it is presented after completion of the learning activities in a material. Problem is given in the form of problems that should be solved by students individually to increase the understanding and ability of students in solving problems related to the material that has been studied. Display of exercises the colour, it has the same colour with the problems or learning activities. SW is also featured with a list of references providing a source of reference materials used to make mathematical SW based Realistic Mathematics Education. Bibliography is not given the colour as well, and it is only white and grey. According to Syarifuddin states that the drafting of the first or concept maps can help students in the learning process and solving mathematical problems and also give them a positive effect. [11]

Learning tools which have been developed subsequently named Prototype 1 which consists of Prototype 1 and Prototype LP 1 SW. Furthermore, formative evaluation conducted in Prototype 1 learning tools.

3.3. Evaluation of Individual Learning Tool

Self-evaluation of learning tools carried out to see if there were any mistakes made when creating the first prototype learning tools. Things were considered in the evaluation of the clarity of the writing itself, among others, a typist's error, misuse of the term, the picture clarity and punctuation errors.

3.3.1 Individual evaluation LP

Having conducted its own evaluation, discovered several errors contained in the Prototype 1 LP. The error is then repaired.

3.3.2 Individual evaluation SW

Having conducted its own evaluation, discovered several errors contained in the Prototype 1 SW. The error is then repaired.

3.4. Learning Learning tools Validation

Prototype1 learning tools that has been designed and evaluated completed its own validation. This validation is carried out by competent experts in their respective fields. Prototype 1 SW LP and validated by five experts consisting of three experts of mathematics education, one linguist and one of the experts in educational technology.

Prototype1 LP and Prototype 1 SW validated by five experts. Validation Prototype 1 LP by five experts cover all aspects, but for Prototype 1 SW mathematician validate the content and presentation aspects, linguists validate aspects of language and education technology experts validate kegrafikaan aspect.

3.4.1 Validation Results LP

During the validation process Prototype 1 LP there were some revisions carried out based on the suggestions of the validator. Having seen various inputs and suggestions from the validator, carried out
repairs on the lesson plan based on advice from the validator. Among the suggestions validator there are several similar suggestions are suggestions on improvement measures of learning activities.

Repairs are carried out are the steps of learning activities are made more operational. Other validators suggestion is that the summary presented learning materials is eliminated. On learning materials Prototype 1 LP, written summary of the material. The following are considered in the process of validation of LP by experts.

| No. | Aspect                          | Percentage | Criteria      |
|-----|---------------------------------|------------|---------------|
| 1   | Identities subjects             | 96%        | Very Valid    |
| 2   | KI and KD                       | 92%        | Very Valid    |
| 3   | Formulation of indicators of learning | 92%   | Very Valid    |
| 4   | Formulation of learning objectives | 86.67% | Very Valid    |
| 5   | Election learning materials     | 89.33%     | Very Valid    |
| 6   | Election Strategy learning      | 94%        | Very Valid    |
| 7   | Election learning resources     | 90%        | Very Valid    |
| 8   | Election instructional media    | 84%        | very Valid    |
| 9   | Steps Learning Activities       | 90.55%     | very Valid    |
| 10  | Judgment                        | 82%        | very Valid    |
| 11  | Language and Writing            | 86%        | very Valid    |
|     | **Average**                     | **89.29%** | **Very Valid**|

Overall LP developed said to be very valid with an average of 89.29%. Thus, it can be concluded that the mathematics lesson plan based Realistic Mathematics Education to learners have a valid class VII. Prototype 1 LP that are valid subsequently named Prototype 2 LP.

3.5. Results Validation SW

Prototype 1 SW validated by five experts who validate conformity with their respective expertise. During the validation process, there are some suggestions to revise SW. Furthermore SW revised based on suggestions from the validator.

Based on input from the validator, then carried out a revision of the Prototype 1 SW. Before being validated there are still problems in SW are not appropriate. Repairs were carried out on the basis of advice from validator SW is the problem which is not in accordance replaced. Repairs on the issue is also accompanied by improved illustrations used.

Another suggestion from the validator is that at every step of activities should be given clear instructions to students so that students understand the commandment and can do activities as expected. After rectified the problem and the command, then orders the activities become more clear and understandable. The portions were also improved in SW is positioning KD. Before improving the position of KD on SW displayed before the title material. Validator advice in terms of language one is to change the language in the instructions for use SW. Suggestions validator terms kegrafika's one of them is to reduce the image on the cover.

Once implemented improvements in Prototype 1 SW, then SW back left to the experts to be validated. Based on the validation shows that the aspects of the presentation and appropriateness of content, SW obtain the validity of 90.33% or the category of very valid. So we can say that it has a valid SW developed in terms of presentation and appropriateness of content. Further validation results SW by educational technology experts validity values obtained 80% were in the category valid. It is claimed that SW was valid in terms kegrafikaan. Moreover, the value validation SW by linguists is 91.43% which is the category of very valid. It is known that the kegrafikaan aspect, SW developed was valid.
Overall, the average value of the validity SW fifth dai validator is 88.02% who are in the category of very valid. It can be concluded that based math SW Realistic Mathematics Education for learners developed class VII valid.

4. Conclusion and recommendation
Based on the development process has been implemented, the obtained results in the form of learning tools-based mathematical learning Realistic Mathematics Education for Social Arithmetic material class VII in the form of LP and SW are valid.

Based on the activities that have been carried out, it may be advisable learning tools math learning problem based on material Arithmetic Social class VII in the form of LP and SW developed was valid by experts so that it can be used in the learning of mathematics in the prototype later in school and expected no trial continued in another school to look at the practicalities and effectiveness of a wider range of learning tools are developed.

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