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DEVELOPING COMPUTER BASED NON ROUTINE PROBLEM TO TRAIN THE STUDENT EMPLOYING FUNDAMENTAL MATHEMATICAL CAPABILITIES AT 9TH GRADE SMP N 2 BELITANG III

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Abstract

This study aimed to develop computer based non routine problem which valid, practice, and has the potential effect to train the student employing fundamental mathematical capabilities at 9th grade SMP N 2 Belitang III. Subjects in this study are all students in IX.4 SMP N 2 Belitang III. This research using walkthrough (in expert review step), documentation, test, and interview. Walkthrough used to obtain the comments by the experts about computer based non routine problem which has developed by researcher. with Documentation used to complete necessaries data. Test used to know about the potenstial effect. Interview will be do in one to one evaluation, small group, and field test step.

Keywords: *developing computer based non routine problem, the student employing fundamental mathematical capabilities.*

INTRODUCTION

In Kurikulum Tingkat Satuan Pendidikan (KTSP) there are purpose of mathematics learning such as a) Knowing matehamtical concept, explain the unity of those concept or the algorhytma flexibly, accurates, efficiens, and appropriatein problem solving; b) Using the pattern and nature of reasoning, mathematical manipulation in making generalizations, compile evidence, or explain ideas and mathematical statements; c) Solve problems that include the ability to understand the problem, devised a mathematical model, solve the model and interpret the obtained solution; d) Communicate ideas with symbols, tables, diagrams, or other media to clarify the situation or problem; e) Have respect for the usefulness of mathematics in life, a curiosity, concern, and interest in studying mathematics, as well as a tenacious attitude and confidence in solving problems.

To achieve these objectives the student should be able to use the skills as defined by the Organisation for Economic Co-operation and Development (OECD) (2010: 18-19) which is also based on mathematical process standards in the National Council of Teachers of Mathematics (NCTM) (2000). The seven basic math skills that are a) communication; b) mathematising; c) representation; d) reasoning and argument; e) devising strategies for solving problems; f) using symbolic, formal, and technical language, and operations, and g) using mathematical tools.

It is hard to do but it is not impossible to do. Efforts can be made when learning by using instructional media and the questions that can help students use these skills.

Studies also have been conducted that directly or indirectly intended to encourage students to employing fundamental mathematical capabilities. For example Suandito, Darmawijoyo, & Purwoko (2009) encourages students to use basic math skills through non-routine matters at Xavier High School 4 Palembang; Tandilling (2012) using a non-routine matter to measure the ability of mathematical communication, mathematical understanding, and self regulated learning of students in the learning of mathematics in high school; Annisah (2011) use questions that focus on content Quantity PISA to measure students' mathematical reasoning abilities; Kamaliyah (2012) using a model of PISA questions were focused on the matter of level 6 to grade IX junior High School 1 Palembang; etc.

To determine the extent to which students use basic math skills, Indonesia following the Programme for International Student Assessment (PISA), a program to assess the ability of students ages 15 years in reading literacy (reading literacy), literacy mathematics (mathematical literacy), and science literacy (scientific literacy). PISA issued by the Organisation for Economic Co-operation and Development (OECD). To assess the ability of the PISA students using non-routine problems, questions that can not be answered immediately but have to use an analysis at previous.

. Yeo (2009: 9), said "It should also require the problem solver to use heuristic strategies to approach the problem, to understand it and to proceed to a solution. Most importantly, the problem should be capable of stimulating enough interest in an individual to want to attempt a solution". Non-routine matter usually describe the relationship between math and real life rarely raised (Arslan and Altun (2007: 50). So, can we say about non-routine as a matter that can attract students to do it because this problem is usually associated with real life but rarely presented in the daily lessons in the classroom.

In the first year of Indonesia following the 2000 PISA, Indonesia ranks 39th out of 43 participating countries with an average value of 367 in math. In 2003 the value of Indonesia in the field of mathematics has decreased to 360 and is ranked 38th out of 41 participating countries. In 2006, the value of Indonesia in the field of mathematics was 391 and was ranked 50th out of 57 participating countries. However, in 2009 the value of Indonesia in the field of mathematics again decreased by an average of 371 and was ranked 61 out of 65 participating countries (Stacey, 2011). These results can be said to be low. This is due to the learning of students rarely get to use non-routine matter as contained in the PISA.

The same thing was also said by Kesumawati (2009) that the international standard test material in this case is PISA tested everything yet mastered by students. Many questions can not be answered because the students were given the test material is not routine problems (problems requiring mathematical reasoning ability). Rarely invited students to analyze and use mathematics in everyday life. Not a few teachers are still heavily dependent on the selection of textbooks included in the test material for evaluating students when mathematics textbooks that exist today little load non-routine matters (Suandito, Darmawijoyo, & Purwoko, 2009:2; Tandilling, 2012:25).

The problem that students learning in school tend to be tailored to the needs of graduation at the UN. Though PISA testing this question of the use of mathematics in its application in life and does not measure the overall curriculum that exist in the country. PISA shows approach the phenomenon more specifically than the school

curriculum (Wu, 2010: 35). This is where the gap between the content of the curriculum found in Indonesia with issues tested in the PISA mathematical literacy (Zulkardi, 2010). Many issues in the UN only in the low and medium level PISA. This further strengthens the assumption that the required non-routine problems for students.Mathematical Sciences Education Board and the Board on Mathematical Sciences, National Research Council, (1989:70) menyatakan bahwa "To assess development of a student's mathematical power, a teacher needs to use a mixture of means: essays, homework, projects, short answers, quizzes, blackboard work, journals, oral interviews, and group projects". But of course to use a mixture of these questions is not easy. Teachers should prepare one by one essay, homework, projects, short answer, quizzes, assignments on the board, journals, interviews and group work. Around this, the necessary tools can be used to prepare all of it in a special container. One such tool is the computer.

In tests using questions that are non-routine, the use of computers as possible to do what is expressed by Stacey (2012: 11) as follows:

"A major initiative for the 2012 survey is the introduction of the optional computer-based assessment of mathematics CBAM. This follows the development of assessment of electronic reading (2009) and computer-based assessment of scientific literacy (2006). In CBAM, specially designed PISA units are presented on a computer, and students respond on the computer. They are also able to use pencil and paper to assist their thinking processes."

In the computer-based assessment in mathematics (CBAM) designed non-routine matters are presented at a computer, and students to provide answers on the computer. But we can also arrange for students to answer questions using a pencil and paper. The use of computers in education in line with one of the principles of the Education Unit Level Curriculum (SBC) that is responsive to the development of science, technology, and art (Mulyasa, 2006). According Gotoh, (2012: 7737), the development of environmentally network computer brings a big trend for education reform, which is to strengthen educational content, changing education and evaluation methods. Computers can also be used for playing games, for word processing, for LKS, to paint or create graphs, and for use as an educational software (Papanastasiou and Ferdig, 2006: 366). Computers can improve the process of visualization in education, for example can make a variety of mathematical graphs (Papanastasiou and Ferdig, 2006: 366; Ulovec, (2012:7521).

According to Davidsson, Sørensen, and Allerup (2012: 269-270) there is something more interesting in a test using a computer. The test uses a computer may be sparked by this attractive potential advantages such as eliminating the printing and distribution of books for the price of student assessment answer. Computer-based tests also allow for more in-depth assessment of competence such as carrying out experiments and simulations. Fuglestad (2005: 1) says ICT tools as an open and flexible software, not made for a specific topic or to teach certain specific tasks. ICT tools in question is computer software that allows the user to plan and decide what to do.

From the studies mentioned above, the researchers developed a non-routine problems in the form of paper-based. No one has been in the form of computer-based. In SMP Negeri 2 Belitang III has a computer room consisting of 20 units of computers.

This further strengthened the researcher to conduct the study with the title "Development of Non-Routine Problem-Based Computer Simulations to Train Using Basic Math Ability Students of SMP Negeri 2 Belitang III".

Based on the above, the problem in this study were 1) How to develop a computer-based non-routine matter valid, and practical to use basic math skills to train junior high school students? and 2) How about the potential effects of non-routine-based computer that has been developed to use basic math skills of students of SMP Negeri 2 Belitang III? The purpose of this research is 1) Generate a matter of routine non valid computer-based, and practical to use basic math skills to train junior high school students, and 2) Knowing about the potential effects of non-routine-based computer that has been developed to use basic math skills of students of SMP Negeri 2 Belitang III. We hope this research can be useful for 1) Teachers, as input to a reference in developing non-routine problems to content with other innovations, 2) Students, as a measure to practice basic math skills and increase knowledge of students regarding matters setipe, and 3) other researchers, as consideration for a more in-depth study of the non-routine problems in mathematics at the junior high.

This research is a development, to produce a non-routine matter for the computer-based training and application of basic math skills which meet the criteria of the product that is valid, practical, and has a potential effect. This development is done in SMP Negeri 2 Belitang III in the second semester of academic year 2012/2013. This is the subject matter of the development of computer-based non-routine to train students use basic math skills with the junior class IX IX respondents graders of SMP Negeri 2 Belitang III. Develop procedures that 1) the preparation phase (preliminary), at this stage the researcher to determine the location, time, and subject of research, reviewing some of the literature on development studies that have been done relating to the planned research, analyzed the junior high curriculum framework associated with PISA, contact teachers subjects in the school that will be the research and ask the necessary information, and 2) the prototyping phase flow formative evaluation. Using evaluative formative stages Tessmer (1993), namely:

1. Expert review

At this step was the validation of computer-based non-routine matter to practice basic math skills students use class IX SMP developed by researchers. At this stage, the improvement of the computer-based non-routine matter to practice basic math skills students use class IX after junior math education professors, and fellow students in mathematics education proptotipe initial study of computer-based non-routine questions and provides responses in the form of notes. The expert in this study are Prof Salman A.N., Moch Lutfianto, M.Pd., Edi Susanto, S.Pd..

2. One-to-one evaluation

At this step, computer-based non-routine matter to train students use basic math skills class IX SMP has been made, tested on five students separately. Then asked about the responses and comments on the non computer-based routine. The responses are used to improve computer-based non-routine matter. After repair of stage one-to-one evaluation continued to stage small group.

3. Small group

At this step the students are asked to comment on a matter of computer-based non-routine which will be repaired and tested in field trials (field test).

4. Field test

Field test is field testing a realistic situation. At this stage will be dianaslisis to determine how potential effects of computer-based non-routine matter for basic math skills class IX students of SMP Negeri 2 Belitang III.

The groove design formative evaluation as follows:

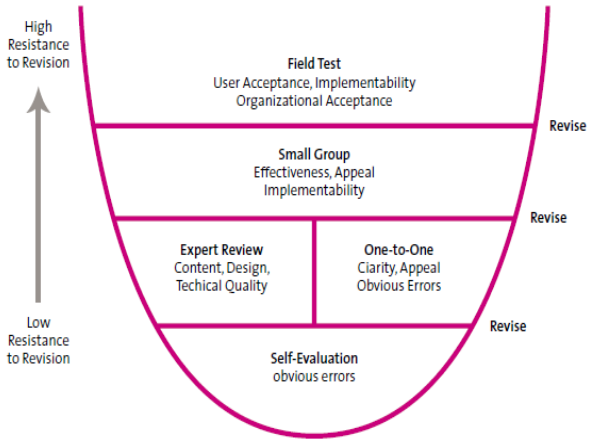


Figure 1. Groove design formative evaluation (Tessmer, 1993; Plomp, 2007)

Data analysis techniques are used:

1. Data analysis Walkthrough
   Analyzed the results of the expert review Which Which is valid or not valid then be repaired. Obtained non-routine questions about computer-based valid.
2. Analysis Document
   Analyzed whether paper based non-routine problem-based computer, the lattice about computer-based non-routine, non-routine questions about the card is a computer-based, problem assessment rubric of non routine computer-based in accordance with the curriculum. Also analyzed whether there is a match between a computer-based non-routine matter that will be developed with the documents in question. Then viewed from the schedule according to research whether the planned time that has been done. Photos and video are used as comparison data.
3. Test Results Analysi
   Test data that shows the scores obtained by students in non-routine work on the problems of computer-based analysis based on the scoring rubric is then calculated as> 75% of students earned a total score of ≥ 45 on the 60. If> 75% of students earned a total score of ≥ 45 of the 60 non-routine problem-based computers have potential effects to train students use basic math skills.
4. Analysis Interview
   Interview data were analyzed to obtain input as a prototype revisions that have been made.

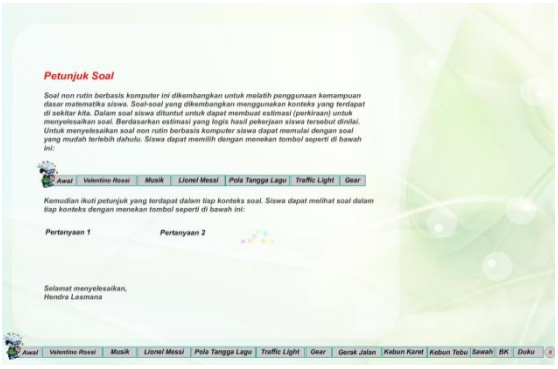
The success criteria

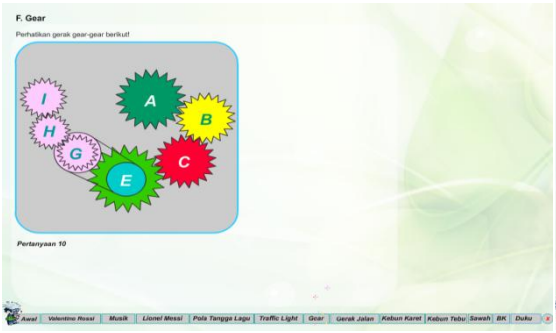
Criteria the expected success of this research is computer-based non-routine matter that valid and practical as well as having a potential effect on train to use basic math skills. Validity and practicality of non-routine problems based computer can be seen by looking at the results of the validation expert (expert review), one-to-one formative evaluation on flow evaluation, small group and interview. Practicality means more usable by students, can be administered and interpreted properly. Can

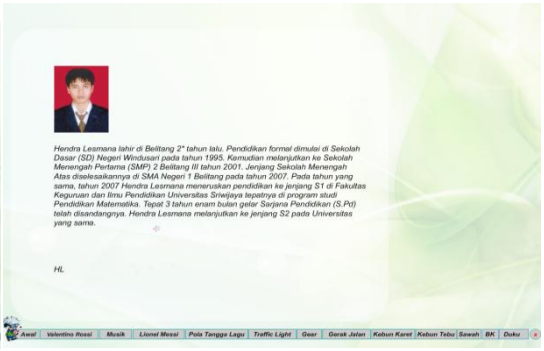
be known about the potential effects of the results of the field test and interview. Interview results were analyzed whether the students feel about having a potential effect to improve basic math skills.

MAIN SECTION

This is some overview of the computer based non routine problem:







This is the comment of the expert (revised yet).

a. Prof Salman A.N.

Question 1:

Should be corrected because it can lead to sentences about double since the end of the video interpretation not necessarily coincide with the time racers to the finish line. If the question is when Hayden crossed the finish line, it just made the phrase the question that way.

Question 2:

Information about the speed should be raised at the end of the video in order to make it easier to estimate the answer.

Question 3 and Question 4:
Not all students understand about music and understand the meaning of the graph tone. Therefore, should be shown (played) ahead of time how the sound of the guitar, keyboards, piano, bass, and drum tones with graphics and links. Question is better directed to the combination of musical tones and graphics.

Question 5:
Should be made more specific questions such as "In addition to outwit goalkeeper, explain why Messi kicked to the point".

Question 6:
Figure on about hard to understand that it is difficult to determine from which improper aspect. Try added caption names the x-axis and y-axis so that the axis is known to have stated time and improved wording, eg "From the fourth image in the sequence below, only three of which were true that a presentation of the tone in the new grid to the music played. Which presentation drawing the wrong tone? Write down your reasons".

Question 7:
At 7 questions should be on every image, including on the clue images, the width of the column stating tempo tone is the presentation that was played piano tones are created equal.

Question 8:
Add to any information that the same colored lights set on during the same time.

Question 9:

- Provide information that school starts at 07:00 and Andi must pass through the intersection of five to get to school from his home. In addition, information needs to be added that the average speed Andi from home until at the intersection (red light before stopping hit), eg 60 km / h. Then the average speed of the current passing through the traffic lights at the intersection up in school, say 50 km / h.
- We recommend that the distance from home to school can be changed so that the answer varies depending on conditions on the ground. When the time arrived at the intersection Andi directly meet the green light, then Andi was not late to school. If the time until the red light at the intersection of the light, it could be too late Andi.

Question 10:

- Should fix the animation for gear F and G so that its position as a gear position D and E, F and G is the gear is the circle.
- Better not from H instead of I, which is connected with the 55 other gear.

Question 11 and Question 12:
Clothing participants march in the video was made more polite. Should be told how many times yells and motion path contained in the video. Or should create a video that presents a series of course (starting from the beginning yells up to the beginning of the next chant).

Question 13:
Should be told in advance about the former relationship leads bark and old rubber trees to be able to help students work on this matter.

Question 14:
Add information that trickle discharge rubber latex is considered relatively constant.

Question 15:
Editorial matter of replacing "Based on the above video, approximating how many rubber trees located on an area of 1 hectare? Write down your reasons".

Question 16:
Provide information about how many steps it takes from one tree to another tree nearby.

Question 17 and Question 18:
In the video shown much hope on a clump of sugar cane as well as the distance between the clumps of sugar cane.

Question 19:
Provide live video stating interval rice so that students can estimate how many days of the harvest.

Question 21:
Provide information to estimate the depth of the gutter.

b. Moch Lutfianto, M.Pd.

1. Problems include non-routine matter, but there is a matter of record that should apply universally or in other words, not only can be done by people Belitang alone.
2. Should prepare a paper answer sheet for students.
3. At the scene dipenuhkan text clues about the show until right (justify).
4. Add slow music before the question to make it more interesting.
5. Create an animated button like on the button "Lionel Messi".
6. For questions:
   Question 1: Show the first question while the video is playing.
   Question 2: OK
   Question 3: OK
   Question 4: OK
   Question 5: Problem fixed try number five.
   Question 6: OK
   Question 7: OK
   Question 8: The light was blinking yellow traffic light does not blink? Try studied.
   Question 9: Add a description of the time in school.
   Question 10: Replace the phrase about the "Where is the direction of rotation of the gear last? "
   Question 11: OK
   Question 12: OK
   Question 13: OK
   Question 14: OK
   Question 15: OK
   Question 16: OK
   Question 17: OK
   Question 18: Add the word "daily" in question.
   Question 19: OK

Question 20: OK
Question 21: OK
Question 22: OK
Question 23: Leave a space between the words in the question mark behind him.
Question 24: OK

CONCLUSION

This research not yet finish so only on expert review could be presented. This because there are changes from 12 problem become 24 problem so it become constraint enough to this research. Also of course in expert review step is take too long time cause waiting replied by the expert.

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