Learning mathematics assisted by adobe flash software to improve mathematical reasoning ability students on geometry concepts

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Abstract. This research is motivated by the very importance of integrating technological innovation in learning. This research aims to develop interactive learning based on Adobe Flash CS6 in order to improve students' mathematical reasoning abilities. The method used in this study is the Research and Development (R&D) method with steps (1) self-evaluation, (2) prototyping (expert judgment review, one-to-one, and small group), and (3) fieldtest. The population in this study was grade VII students of SMPN 2 Luragung and SMPN 1 Maleber, Kuningan District, West Java. Samples were selected through a purposed random sampling technique. The experimental class was taught using adobe Flash-based interactive learning media, while the control class was taught using classical learning. Data obtained by using the pre-test and post-test to get data on the results of increasing students' mathematical reasoning abilities. Based on the results of data analysis, it is obtained: The development of adobe flash-based mathematics learning media has fulfilled the effective and valid criteria as suitable learning media applied in improving students' mathematical reasoning abilities. Based on field tests there is a significant increase in the average between students who use Adobe Flash media and those who do not use. In other word Adobe Flash based learning media can effectively improve students' reasoning abilities in geometrical concepts.

1. Introduction
The learning process has an important role in the world of education is to increase knowledge and skills. One of the learning that must be followed by elementary to middle students is learning mathematics. Mathematics learning has an important role in the learning process because mathematics as a science of arable in learning mathematics is a source of knowledge and servants of other sciences, Wahyudin [1] found that one tendencies that causes students failed to master well the main points discussion in mathematics is students are less understanding and use good in reasoning solve the given problem-based on the above objective that one of the objectives of the mathematics course in school is to use reasoning on patterns and traits, perform mathematical manipulations in generalizing, compiling evidence, or explaining mathematical ideas and statements. This means that mathematical reasoning is
the foundation for obtaining or constructing mathematical knowledge. In modern times like today, what is needed is not only mathematics as arithmetic, but also mathematical literacy is needed related to mathematical reasoning and problem solving [2]. National Council of Teacher of Mathematics [3] says that in the implementation of learning math, teachers should pay attention the five mathematical abilities are: connections, reasoning, communication, troubleshooting (problem solving), and representation. Reasoning is a basic mathematical skill that must be mastered students, because with reasoning can help students in solving mathematical problems encountered both in school and in daily life. A mathematics teacher should develop students' reasoning abilities in the process of mathematics learning, but the facts on the ground based on the results of research on students' reasoning ability are still lacking. Based on the results of research TIMSS (Trends in International Mathematics and Science Study) 2015, junior high school students who stated that the average achievement of students' reasoning skills in general are at a low level. The difficulties and misconceptions found are mostly related to understanding the meaning of variables, using rules of manipulation, and formulating and making generalizations. This is related to students' reasoning processes related to algebra or geometry reasoning[4].

Mayer [5] stated a multimedia instructional message is a communication containing words and pictures intended to foster learning. The media that can be used to send messages between thebook or computer usagelearning media is an integral component of the system learning, learning media cannot be separated from the process learning. Interactive multimedia can be used in learning activities because it is quite effective improve learning outcomes of learners. One way that is thought to be suitable to overcome it is to use Adobe Flash CS6 based learning media. Adobe Flash CS6 media development on matter building materials to improve mathematical reasoning ability Junior High School. This media facilitates teachers to implement interactive and meaningful learning so that students can improve their ability to draw conclusions from the mathematical problems presented. Study emphasized the vital role of computer simulation in developing academic achievement, providing awareness of scientific concepts, and modifying misconceptions [6]. Previous research has been conducted by Pakhurrozi [7] which found that Jigsaw-flash media learning can create the process on learning more interesting, enjoyable, and meaningful.

2. Research Methods

2.1. Analysis of learning media instruments

This research process using Researchand Development (R & D) method. According to Tessmer[8]Research and Development (R & D) steps includes (1) self-evaluation, (2) prototyping (expert review, one-to-one, and small group), and (3) field test. At the preliminary stage, the researcher analyzes the obstacles that teachers experience in learning, Junior High School curriculum analysis, and available facilities and infrastructure.

2.1.1. Formative Evaluation Phase

Self-Evaluation Phase: At this stage, the assessment by the researchers themselves, the result of the designing of adobe flash-based mathematics learning media CS 6to support mathematics learning Junior High School student class VII Curriculum 2013. From this stage will be obtained prototype I.

2.1.2. Expert Reviews Phase

At this stage the design of material content and instructional media created by researchers is validated by experts and teachers of mathematics as stakeholders. Aspects of assessment used for the questionnairesmaterial expert include content quality and objectives, instructional quality, and instructional design [9]. There are experts consisting of mathematics lecturers and math teachers who validate learning media in terms of content. As for validation of media experts validated by two lecturers of Technology and information. Products designed and organized will be viewed, assessed and evaluated. Validity test conducted is the content validity test, construct validity test, and language
validity test. Suggestions from validators are used to revise the design and the composition of the questions the researcher makes, from this stage and also after through Focus Group Discussion (FGD). In parallel (simultaneously), also performed stage one-to-one. At this stage prototype I was tested to 5 students as a tester who was asked to learn the concept of geometry by using learning media based on adobe flash CS6 program that was being developed and also asked to give comments / responses to their problem. The results or findings obtained at the expert review stage and one-to-one are taken into consideration in revising the prototype I. After the revised prototype I will produce prototype II. From the process of validation and focus group discussion (FGD), prototype I was revised and obtained by prototype II. From the results of the above assessment it appears that in terms of the material is very good, almost no problem, in terms of construct exist some things that need to be improved, while in terms of language rather a lot to be improved.

Prototype II is further tested in small group stage. At this stage, 20 students from SMP 2 Luragung were asked to learn the concept of geometry by using instructional media based on adobe flash CS6 program and solve the problems in prototype II and also commented on the problem that has been done. The comments and findings of this small group stage are taken into consideration in revising Prototype II. The result of revision of prototype II is called prototype III or also called field test stage, the researcher conducting trials to see the effectiveness level of learning media in improving students' mathematical reasoning ability.

2.2. Quantitative Analysis

The population in this research is the students of class VII SMPN 2 Luragung as the control class and the students of class VII SMPN 1 Maleber as experimental class year 2018/2019. The experimental class is taught with Adobe Flash learning, while the control class is taught by classical learning. The students who are the subjects of research sit in the same class, and the class divisions are not pre-eminent classes so students have equal ability. This research is a quasi experiment (quasi experiment). Samples are not taken at random. The sample subject is a class of study in the classroom, if the classroom arrangement is randomized, it is feared to interfere with learning activities. The data in this study will be collected through reasoning ability tests, observations, questionnaires and interviews. Data relating to students' reasoning abilities were collected through tests (pretes and postes) based on Holistic Scoring Rubrics. Observations were made to see student and teacher activity during the learning process taking place in the experimental class observed through the guidelines on the observation sheet. Meanwhile, the interview aims to find out the subject's answer about the problems in oral learning. This research design is One Group Pretest-posttest Group Design by Sugiyono [10].

3. Results and Discussion

3.1. Results

From FGD results and revision of prototype, it found minor revisions to be then applied to the next stage of media development. All input suggestions from teachers and students are collected and used as a reference for better media improvement. Based on the results of the test field is known: (1) Based on reasoning ability included in the category of excellent numbered 9 students (17.31%), high category amounted to 26 students (50.00%), medium category was 12 students (23.08%) and low category were 5 students (9.62%). The research variables used are two independent variables and dependent variable. The
independent variable in this research is Adobe Flash learning media and the dependent variable is students' reasoning ability. Data collection methods used in this study there is a test method, the test used an instrument that can measure students' mathematical reasoning abilities. Before the average difference test, then investigated in advance the normality and homogeneity of the sample as a test of basic assumptions of the study, based on the results of normality test results obtained.

### Table 1. Data normality test

|                | Statistic | df | Sig.  | Statistic | Df | Sig.  |
|----------------|-----------|----|-------|-----------|----|-------|
| Gain Kontrol   | .094      | 26 | .200’ | .966      | 26 | .530  |
| Gain Eksperimen| .109      | 26 | .200’ | .963      | 26 | .456  |

*This is a lower bound of the true significance.

### Table 2. Data homogeneity test

| Levene Statistic | df1 | df2 | Sig. |
|------------------|-----|-----|------|
| 2.175            | 1   | 50  | .147 |

Based on homogeneity test results obtained sig value. The ability of mathematical reasoning is 0.147. Because of all the Sig values. > 0.05 then both data is homogeneous. Because all the data meet the basic assumption test that is normal and homogeneous, then the next test using parametric statistics test. The purpose of the first study was to know the difference in average students' reasoning ability, between students who received Adobe Flash learning and students who received conventional learning. Previously based on normality and homogeneity test results showed that the data were normal and homogeneous distributed so that hypothesis testing continued using t test. The following t test results in table 5:

### Table 3. Mean differences test of reasoning ability

| Learning Group | N  | Mean | t   | Sig. (1-tailed) | H₀  |
|----------------|----|------|-----|-----------------|-----|
| Kontrol        | 26 | 4.927| -2.597| 0.024           | Rejected |
| Eksperimen     | 26 | 5.925|      |                 |      |

Based on the results of the test in Table 6 we get the probability or sig value. (one-tailed) of 0.024 is smaller than α = 0.05 so H₀ is rejected, meaning that there is a difference in mean reasoning ability that is significant between students who receive learning Adobe Flash with students who received conventional learning, the average students' experimental reasoning ability is higher than the conventional class.

### 3.2. Discussion

This study produces adobe flash based mathematics learning model for junior high school students who have been developed based on the steps. Based on the description of the preparation stage and test the validity of the content of the expert show that the problems developed are in accordance with the basic competency indicators of the Ministry of Education. Based on the result of student’s answer
analysis during field test, from 5 description, very good category was 9 students (17.31%), high category was 26 students (50.00%), medium category 12 students (23.08%) and low category as many as 5 students (9.62%); so it can be concluded most students have good mathematical reasoning ability. This can be seen from the answers and reasons given on the answer sheet. Reasoning indicators such as analyzing mathematical problems, make generalizations of a problem and solve non-routine problems, provide explanations by using mathematical statements, integrating facts and mathematical procedures to obtain the final solution. The following features are presented in Adobe Flash-based learning media:

![Figure 1. Display of adobe flash learning media](image1)

![Figure 2. Question to measure reasoning ability](image2)

Based on the findings of the above analysis, students can make a logical conclusion and conclude the concept of building a flat side space (geometry) in accordance with the construction of knowledge they get in learning. It is different with research conducted by [11-12] that was used available teaching aids such as Geogebra, Cabri 3D, Google Sketchup. Students who have difficulty developing their reasoning skills are given the facility to repeat the material and interactively they can explore the material step by step. In line with Dwair research which states [13] there were statistical significant differences between the average of the experimental group and the control group, the percentage of alternative perception of geometry concepts were increased due to the computer assisted instruction. This is also reinforced by Sagita [14] stated that it concluded that developed of teaching aids using Adobe Flash CS6 on triangle can improve student achievement.

One of the foundations of learning goals to be achieved is to deliver students to the Proximal Development Zone (ZPD) according to the theory of Vygotsky (Nurjanah) [15], which states that learning can produce mental processes that can only be stored when someone interacts with an adult or collaborates with friends my age. Utilization of technology in general has been proven to improve students' mathematical reasoning skills. This is in line with Yuliardi [16], who states that software-assisted mathematics learning can effectively improve students' mathematical skills. It is stated that software used in development the animation in teaching aids is Macromedia Flash, a software that can create graphic media, this facilitating their transmission to any user connected to the network [17-18]. Based on the description that has been explained before, it can be concluded that the adobe flash-based learning model that has been developed has the potential for a positive effect on increasing students' mathematical reasoning abilities.

4. Conclusion

Based on the results of data analysis, it is obtained: The development of adobe flash-based mathematics learning media has fulfilled the effective and valid criteria as suitable learning media applied in improving students' mathematical reasoning abilities. Valid can theoretically judging from the results of the validator's assessment, which is all validators stated the matter has been good-based on content, construct and language. Based on the result of research and discussion above, it can be concluded: (1) There is a significant difference between control and experiment class. (2) Improved
students’ experimental reasoning ability is better than control class. Learning with Adobe Flash media learning is recommended to be applied in mathematics learning process in junior high school.

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