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Development of Macromedia Flash-Based Learning Media Using the Student Team Achievement Division Learning Model to Improve Students' Spatial Ability and Resilience at MTs Mardiyah Islamiyah Panyabungan

Putri Dahlena Pulungan, Faiz Ahyaningsih, Izwita Dewi
Postgraduate Mathematics Education study program, Medan State University
Medan, North Sumatra, Indonesia

Abstract
This study aims to: (1) analyze the validity, effectiveness and practicality of learning media based on Macromedia Flash that has been developed; (2) Describe the improvement of students' spatial abilities through the development of learning media based on Macromedia Flash; (3) Describe the increase in student resilience through the development of learning media based on Macromedia Flash. This research is categorized into the type of research and development research (research and development). This development research was carried out at MTs Mardiyatul Islamiyah Panyabungan, which is located on Jalan Sipolu-Polu, Panyabungan in the even semester of TP. 2020-2021. The subjects in this study were 8th grade students of MTs Mardiyatul Islamiyah Panyabungan. The results showed that: (1) The developed learning media had met the valid, practical and effective criteria; (2) The increase in students' spatial ability was obtained from the increase in the average of the indicators of students' spatial ability in trial 1, in trial 2 and from trial 1 to trial 2; (3) An increase in the mean of students' Mathematical Resilience between trials, from 12.80 in trial 1 to 12.89 in trial 2.
Keywords: Learning media development, Student Team Achievement Division, Spatial Ability, Resilience
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INTRODUCTION

To achieve the national development goals in the field of education, teachers must act as the front line in order to produce quality human resources. According to the Ministry of National Education, a teacher in carrying out and managing the learning process in the classroom is highly required to achieve the expected goals. The efforts made by teachers in learning according to Sudjana and Rivai (in Fillanio, 2013) are to create a pleasant atmosphere for quantum learning, to involve and solve student problems in learning. So its implementation or in the learning process as a teacher must create a pleasant and interesting atmosphere.

According to Indiyani (2013: 56) this spatial ability is not only an ability that must be mastered by students in order to understand the concept of building space, but the spatial ability itself indirectly affects mathematics learning outcomes. Furthermore, Shermann (in Nasution, 2017: 44) revealed that he found a positive relationship between mathematics learning achievement and spatial ability, to be able to support the improvement of students' spatial abilities, the learning provided must support students to carry out real activities involving geometric objects and drawing them. The involvement of these elements must be sought in the learning that will be selected or designed. From the expert quote above, it can be seen that spatial ability is an important ability for students to have in learning mathematics. A person is said to have good spatial ability if he has five dimensions according to Maier (in Subroto, 2012: 257), namely: 1) the dimension of perception ability, 2) the dimension of visualization ability, 3) the dimension of rotation ability, 4) the dimension of relational ability, and 5) orientation ability dimension.

Regarding students' spatial abilities, the results of an interview with a mathematics teacher at MTs Mardiyah Islamiyah Panyabungan, Mrs. Nur Aisyah Lubis, said that students' spatial abilities were still lacking because students were still weak in imagining and interpreting something that was still abstract into images in the mind so that students had difficulty solving question. This conclusion was drawn by the teacher from student learning outcomes when given a question about building space.

In addition to cognitive aspects, affective aspects are also very important to consider in achieving effective mathematics learning. One of the affective aspects is mathematical resilience. According to Sugandi (2017) mathematical resilience is another important internal factor in learning mathematics besides the factor of mathematical understanding ability. In line with that, as for external factors that can affect mathematical understanding abilities, Cahyani and Fitrianna (2017) state that the failure of teachers to convey material is caused when the teacher's learning process does not arouse the attention and activities of students in participating in lessons, especially mathematics. The same thing happened at MTs Mardiyah Islamiyah Panyabungan. The results of the initial observations showed that students' mathematical resilience was still low. This condition is seen when the teacher explains, many students are yawning, sleepy, and not eager to listen to the teacher's

explanation.

Efforts that can be made by teachers are using learning media in the material presented. In line with Ibrahim's opinion (in Arsyad, 2015: 173) which explains that the use of learning media in the field of mathematics is very important because it can foster a sense of pleasure for students and renew their enthusiasm. mathematics that can be operated by students to foster a higher interest in learning mathematics.

One of the media that can be used is multimedia. Arsyad (2011: 170) suggests "multimedia can be a combination of text, graphics, animation, sound and video". According to Samsudi (2015: 74) in multimedia it can be seen that text, images, animation and digital video appear together at one time and use bottons as interactive tools. One of the multimedia that can be used is Macromedia Flash. Macromedia Flash is an application software for animation that is used for the internet and thus can be used in the development of interactive multimedia for CD production, networking and use on the web.

Furthermore, learning media must be effective, which means that the media developed must have an impact on students in this case according to the opinion of Aleslami, Minarni, and Fauzi (2021: 257) the effective category in terms of (1) classical student learning completeness; (2) achievement of learning objectives; (3) learning time and (4) student response. From the quote above, it can be seen that the effectiveness of the media is seen from the results of classical student learning mastery, achievement of learning objectives, learning time and student responses.

The reality on the ground shows different facts. Learning media are often ignored by teachers for various reasons, such as limited time to make teaching preparations, difficulty finding the right media, unavailability of funds and others. This fact was obtained from the author's observations on October 11, 2021, it was found that the average learning process that occurred in the classroom did not utilize multimedia learning media. Reading books are the only source of learning. The tendency of teachers is still fixated on the lecture method that makes students passive. Textbooks are used as the only source of learning for students. Based on the results of interviews, the lack of use of multimedia in the learning process by some teachers was due to time constraints, and it was difficult to prepare the media to be used.

In addition to the media, the right learning model must also be considered by the teacher. The application of appropriate learning models is also very possible in improving the quality of learning. One way that can be done is through cooperative learning. The STAD learning model is part of cooperative learning that can trigger students/students to actively cooperate, motivate students to support each other and help each other in mastering the abilities taught by educators, this model helps activate students in the learning process. STAD is learning in groups consisting of 4-5 people, representing all parts of the class in terms of academic performance, gender, race and ethnicity. This learning model will encourage students to cooperate in activities such as discussions or peer teaching (Trianto, 2009).

The 2013 curriculum applied in Indonesia requires a scientific approach in teaching and learning activities. The scientific approach is a learning mechanism to facilitate students to gain knowledge or skills with scientific method procedures.

METHOD

Research Pattern

The research to be carried out is categorized into the type of research and development (research and development). R&D is a method used to produce certain products, and to test the validity, practicality and effectiveness of these products (Sugiyono 2010:407).

Subject

The subjects in this study were 8th grade students of MTs Mardiyatul Islamiyah Panyabungan. The object of this research is the learning media of mathematics based on Macromedia Flash.

Data Analysis

Learning Media Validation Data Analysis

The technique used to analyze the results of the validation of the quality of learning media is descriptive qualitative, namely by looking at the feasibility assessment of learning media from the results of the study. The quality of the feasibility of the learning media developed is seen from the assessment of the expert team validators on the learning media.

Data Analysis of the Effectiveness of Learning Media

The analysis of the effectiveness of learning media aims to make a decision whether it is necessary to carry out further trials in the development stage of learning media. The effectiveness of the learning media used in learning is determined based on the achievement of indicators in the form of: (1) learning success or student learning completeness; (2) achievement of learning indicators; and (3) student responses to the use of the developed learning media.

The formula for calculating individual student learning completeness is as follows:

$$KB = \frac{T}{T_t} \text{ x } 100\ \% \qquad \text{(Trianto, 2009: 241)}$$

Information :
KB: complete learning
T : the number of scores obtained by students
Tt : total score

The formula for calculating the achievement of indicators in learning is as follows:

$$T = \frac{S_i}{S_{maks}} \text{ x } 100\ \%$$

Information:
T : percentage of achievement indicators
Si : total student scores for item i
Smaks: the maximum number of scores for the i-th item

The formula for calculating the percentage of student responses is as follows:

$$PRS = \frac{\sum A}{\sum B} \times 100\ \% \qquad \text{(Borich dalam Herman, 2012: 5)}$$

Information:

PRS : The percentage of students who gave a positive response to each category that was asked

$\sum A$: Proportion of students who choose

$\sum B$: Number of students (respondents)

Practical Analysis of Learning Media

The practicality of the learning media developed in this study was measured using student response questionnaires and teacher response questionnaires to the use of media developed in the learning process. Macromedia Flash learning media developed in this study is said to be practical if the average score obtained from the questionnaire obtained from the teacher is at least good.

Instrument

Learning Media Validation Sheet

The learning media validation sheet is a research instrument used to measure the validity of the developed product. The validation sheet will be filled out by experts who are commonly referred to as validators. The assessment criteria are a score of 1 (not good), 2 (poor), 3 (good), and 4 (very good).

The validation set for the product used is seen from the results of the agreement (three) experts in their respective fields.

Spatial Ability Test Validation Sheet

The data collected with this validation sheet is data about the validity of the spatial ability test. Validation of spatial ability is given to 2 experts called validators. Validators are asked to put a checklist (√) on the rows and columns that correspond to categories Valid, Valid With Revision, Invalid.

Spatial Ability Test Trial

Spatial ability test instruments in the form of pre-test and post-test were used to assess the improvement and effectiveness of learning media through the quality of student learning outcomes at the beginning and after completion of the learning carried out.

Data Collection Techniques

Test Method

The tests that will be used in this study are divided into two, namely pre-test and post-test. Pre-test is a test given to research subjects before learning activities are carried out by applying the developed learning media. This test aims to see how far the subject has mastered the existing material.

Questionnaire Method

According to Arikunto (2009:151) the questionnaire is a number of written questions that are used to obtain

information from respondents ". In this study, three questionnaires were used, namely the Student Response Questionnaire, the Media Practicality Questionnaire and the Resilience Questionnaire given to students to determine students' toughness in learning mathematics. The answer choices are “Always”, Often”, “Sometimes”, or “Never”.

Interview Method

Interview or what is often known as an interview is an activity carried out through a dialogue conducted by the interviewer to obtain information from the interviewee. This interview was conducted with the mathematics teacher. It aims to obtain information related to the learning process that occurs in grade 8 MTs Mardiyatul Islamiyah Panyabungan.

Documentation Method

In this study, the documentation method was used to collect facts, device data, and textbooks that were used as a source of previous learning as study material for product development.

Learning Media Development Procedure

Define

The define stage is the stage to define and define the learning requirements. This define stage includes five main steps, namely student analysis (learner analysis), media needs analysis, concept analysis (concept analysis) and formulation of learning objectives (specifying instructionalobjectives) and formulation of learning tools.

Design

The design stage aims to design learning media. Selection of appropriate media to present the content of learning. This process includes the adjustment of concept analysis and task analysis to the characteristics of students, sources of production, distribution plans regarding the nature of the media.

Develop

Validation of expert judgment

Validation of learning media is carried out to determine the feasibility of learning media, validation is carried out by several experts. The expert in question is a validator who is competent to assess learning and provide input or suggestions to improve the learning media that have been made.

Field trial

After obtaining valid learning media from experts, then a trial was carried out at MTs Mardiyatul Islamiyah Panyabungan. This stage is carried out to see the effectiveness of the learning media that has been developed. The trial design used in this study is a one shot case study or also known as a one group posttest-only design.

The data obtained from the results of the first trial were analyzed and used as a reference for revision of the learning media for the next trial until it was concluded that the effective criteria had been met.

Disseminate

The dissemination process is a final stage of development. The dissemination stage is carried out to promote the development product so that it can be accepted by users, either individuals, groups, or systems. Dissemination can be done in other classes with the aim of knowing the effectiveness of using learning media. Dissemination is also carried out through a process of delivering limited products to relevant learning practitioners in a particular forum.

RESULT AND DISCUSSION

Learning Media Development

This research has succeeded in developing mathematics learning media on environmental materials using the development model of Thiagarajan, et al, which is better known as the four-D or 4-D model. The learning media developed in this study include the Learning Implementation Plan, teacher's manual, Macromedia Flash learning media, student worksheets, students' spatial ability tests and students' mathematical resilience questionnaires. All learning media were developed based on STAD type cooperative learning. The learning media developed is in line with the media developed by Syahbana (2012), namely lesson plans, worksheets and learning outcomes. There are differences in the media developed in this study with Syahbana. This difference lies in the development of the teacher's manual and Macromedia Flash learning media in this study, while Syahbana's research did not develop the media. Another difference is that Syahbana compiles learning outcomes test questions, while in this study the tests that are arranged are spatial ability tests which are based on spatial indicators.

In developing the media in this study, a validation process was carried out by the validator and statistical validation in the field to meet the requirements for good media. The fulfillment of the aspect of validity is in line with the opinion of Akker (1999: 10) which states that validity refers to the extent to which the design of the media is based on the latest state of technology, art, or science ('content validity') and the various components of the media are consistently related to each other.

In addition to validity, effectiveness is also required as a good media requirement. In this study, three

indicators of effectiveness were determined, namely the achievement of student learning completeness, student activities and student responses. In trial 1 there is 1 indicator that does not meet the specified requirements, namely the achievement of student learning mastery, while in trial 2 the three indicators of effectiveness have met the specified requirements. This is in line with the opinion of Nieveen (1997) which states that effectiveness refers to the way students carry out curriculum experiences and student achievement outcomes in accordance with the goals set by the developer.

Student Spatial Ability

The summary of the results of the data analysis of students' completeness in the posttest trial 1 is presented in Table 1.

Table 1. Results of Posttest Spatial Ability Trial 1

Information	Total students	Percentage (%)
Complete	24	75,0
Not Complete	8	25,0

From Table 1. it can be seen that the percentage of students who complete is 75%, while the percentage of students who do not complete is 25%. Furthermore, the description of students' spatial ability in terms of spatial ability indicators in trial 1 is presented in Table 2.

Table 2. Spatial Ability of Trial Students 1 in terms of indicators

Indicator	Trial 1		Total average
	Pretest Average	Posttest Average	
Spatial Orientation	9,38	11,75	10,56
Spatial Visualization	11,50	13,31	12,41
Spatial Perception	13,75	15,13	14,44
Mental Rotation	8,29	9,63	8,96
Spatial Relations	13,75	15,13	14,44

From table 2. it can be seen that the average pretest on the Spatial Orientation indicator is 9.38 while the posttest is 11.75 so that the total average is 10.56. The average pretest on the Spatial Visualization indicator is 11.50 while the posttest is 13.31 so that the total mean is 12.41. The average pretest on the Spatial Perception indicator is 13.75 while the posttest is 15.13 so that the total average is 14.44. The average pretest on Mental Rotation is 8.29 while the posttest is 9.63 so that the total average is 8.96. The summary of the average total spatial ability of these students can be presented in Figure 4.5.

Then the summary of the results of the data analysis of students' completeness in the posttest trial 2 is presented in Table 3.

Table 1. Results of Posttest Spatial Ability Trial 2

Information	Total students	Percentage (%)
Complete	29	85,3
Not Complete	5	14,7

From table 3. it can be seen that the percentage of students who complete is 85.3%, while the percentage of students who do not complete is 14.7%. Furthermore, the description of students' spatial ability in terms of spatial ability indicators is presented in Table 4.

Table 4. Spatial Ability of Trial Students 2 in terms of indicators

Indicator	Trial 2		Total average
	Pretest Average	Pretest Average	
Spatial Orientation	10,65	12,24	11,44
Spatial Visualization	12,88	13,94	13,41
Spatial Perception	15,29	15,53	15,41
Mental Rotation	8,78	9,92	9,35
Spatial Relations	15,29	15,53	15,41

From Table 4. it can be seen that the Spatial Orientation indicator at the pretest is 10.65 while in the posttest it is 12.24 so that the total average is 11.44. The average pretest on the Spatial Visualization indicator is 12.88 while the posttest is 13.94 so that the total average is 13.41. The average pretest on the Spatial Perception indicator is 15.29 while the posttest is 15.53 so that the mean t-total is 15.41. The average pretest on Mental Rotation was 8.78 while the posttest was 9.92 so that the total average was 9.35.

Student Mathematical Resilience

The results of the student's mathematical resilience questionnaire on trial 1 and trial 2 have been summarized into each indicator. The summary of students' mathematical resilience results per indicator is shown in Table 5.

Table 5. Results of Analysis of Increasing Mathematical Resilience in Trial 1 and Trial 2

No	Indicator	Average mathematical resilience		Enhancement
		Trial 1	Trial 2	
1	Diligent attitude, confident/confident, hard working, not easy to give up in the face of problems, failures and uncertainties	11,61	11,74	0,13
2	Desire to socialize, easy to give peer help, and adapt to the environment	12,61	13,09	0,48
3	Generating new ideas or ways and looking for creative solutions to challenges	13,61	13,18	-0,02
4	Using the experience of failure to build self-motivation.	12,95	13,18	0,22
5	Demonstrate curiosity, reflect, research, and utilize various sources	12,80	12,84	0,04
6	Have the ability to speak, self-control and be aware of his feelings	13,14	13,35	0,21

From table 5. it can be seen that the highest increase is found in the indicator of the desire to socialize, easy to give peer help, and adapt to the environment, which is 0.48. This shows that the communication indicator in learning mathematics is an indicator that is easy to improve. Meanwhile, the indicator of Generating new ideas or ways and seeking creative solutions to challenges decreased by 0.02. This shows that from trial 1 to trial 2 the most difficult thing is to make students diligent in working on math problems. Furthermore, an increase in the indicators of Perseverance, confident/confident, working hard, not giving up easily in the face of problems, failures and uncertainties by 0.13; improvement of indicators Using the experience of failure to build self-motivation. of 0.22; improvement of indicators Shows curiosity, reflects, researches, and utilizes various sources by 0.04; and an increase in indicators of having language skills, controlling themselves and being aware of their feelings by 0.21.

Overall there was an increase in the average mathematical resilience of students between trials, from 12.80 in trial 1 to 12.89 in trial 2. So it was concluded that the average mathematical resilience of students between trial 1 and trial 2 increased by 0, 09 points.

The average increase in students' mathematical resilience in trial 1 was 0.49. While the average increase in mathematical resilience in trial 2 is 0.54. Based on these data, overall there is an increase in mathematical resilience from trial 1 to trial 2. However, there is one indicator that has decreased, namely the indicator of being diligent in doing mathematical tasks by 0.02. If these results are related to the conclusions of Mandur's opinion (2013: 4), namely mathematical resilience appears when students complete math tasks with confidence, responsibility, perseverance and never give up, then in general students in trial 1 are more likely to come up with new ideas or ways. and looking for creative solutions to challenges than students in trial 2.

CONCLUSION

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