

DEVELOPMENT OF INTERACTIVE MULTIMEDIA BASED LEARNING MEDIA ON SET MATERIALS

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Article History

Received: 09-07-2021

Revision: 02-08-2021

Accepted: 23-09-2021

Published: 20-10-2021

Abstract. This research aims to find out the development of interactive multimedia-based learning media in the material of class VII MTs Negeri Ambon. This research uses Research and Development with development models proposed by Thiagarajan, Semmel, and Semmel. The development research stage consists of 4 stages known as 4D models, namely define, design, develop, and disseminate. The results of this study showed that interactive multimedia-based learning media was declared very valid, judging from the final results of the assessment of media validators and materials by 89% with criteria that are very valid or worth using without revision. Interactive multimedia-based learning media is stated to be very practical with the dissemination of student response questionnaires, meeting positive categories. Obtaining scores of 86.43% with very practical criteria and worthy of use without revision, interactive multimedia-based learning media is otherwise quite effectively used in known learning from student N-Gain results of 0.66 or 66% with moderate categories. Interactive multimedia-based learning media developed meets the valid, effective, and practical categories. It deserves to be used in mathematics learning on set material for students of class VII MTs. Negeri Ambon.

Keywords: R & D, Interactive Multimedia, Set

Abstrak. Penelitian ini bertujuan untuk mengetahui pengembangan media pembelajaran berbasis multimedia interaktif pada materi himpunan kelas VII MTs Negeri Ambon. Penelitian ini menggunakan Research and Development dengan model pengembangan yang dikemukakan oleh Thiagarajan, Semmel dan Semmel dimana tahapan penelitian pengembangan terdiri dari 4 tahap yang dikenal dengan model 4D yaitu tahap define (pendefinisian), design (perancangan), develop (pengembangan), dan disseminate (penyebaran). Hasil penelitian ini menunjukkan bahwa media pembelajaran berbasis multimedia interaktif dinyatakan sangat valid yang dilihat dari hasil akhir penilaian validator media maupun materi sebesar 89% dengan kriteria sangat valid atau layak digunakan tanpa revisi. Media pembelajaran berbasis multimedia interaktif dinyatakan sangat praktis dengan penyebaran angket respon siswa, memenuhi kategori positif dan memperoleh nilai persentase sebesar 86.43% dengan kriteria sangat praktis atau layak digunakan tanpa revisi, 3) media pembelajaran berbasis multimedia interaktif dinyatakan cukup efektif digunakan dalam pembelajaran yang diketahui dari hasil N-Gain siswa sebesar 0.66 atau 66% dengan kategori sedang. Media pembelajaran berbasis multimedia interaktif yang dikembangkan memenuhi kategori valid, efektif dan praktis sehingga layak untuk digunakan dalam pembelajaran matematika pada materi himpunan untuk siswa kelas VII MTs. Negeri Ambon

Kata Kunci: R & D, Multimedia Interaktif, Himpunan

How to Cite: Riaddin, D & Umasugi, A. (2021). Development of Interactive Multimedia Based Learning Media on Set Materials, *Indo-MathEdu Intellectuals Journal*, 2 (2), 72-84. <http://doi.org/10.54373/imeij.v2i2.19>

INTRODUCTION

The development of technology and communication today has presented computers as a medium of learning. Students must be able to master computers with the help of teachers or anyone because they are getting lessons with computer support, and students will still face challenges in their lives to become computer users. The development of technology, especially this computer, can be used in education. Computers can accommodate students who are slow to receive lessons because they can provide a more effective climate in a more individualized and less boring way (Sanusi et al., 2015). Multimedia technology cannot be denied that it can give an impression in learning media because it can integrate text, graphics, animation, audio, and video (Rudiawan et al., 2015). Today, there is a computer-based interactive learning program that has more value than ordinary printed materials. One of them is interactive multimedia. Interactive multimedia is multimedia that is equipped with a controller that can be operated by the user so that users can choose what they want for the next process (Wulandari et al., 2017).

Interactive multimedia in learning can positively impact and have tremendous benefits in facilitating the student learning process. Computer Technology Research (CTR) shows that a person can only remember what he sees by 20%, 30% of what he hears, and 80% of what he hears, sees, and does simultaneously. This means that interactive multimedia-based learning media allows students to achieve learning outcomes of 80% of what they learn (Sanusi et al., 2015). Therefore, the application of computer-based learning can be used to increase student learning motivation which will later affect student learning outcomes.

The low learning outcomes of students against math subjects are usually because many math subjects are abstract, so students need visualization to gain clarity about the material they are studying (Kamsurya, 2019). According to the Programme for International Students Assessment (PISA), Indonesia still has relatively low material mastery. It also affects the low learning achievement of students in math lessons. Low material mastery becomes a problem that must be found solutions, especially for teachers and prospective teachers (Widjayanti et al., 2018). Mathematical learning materials that are considered suitable with the help of interactive multimedia are set materials. In mathematics, sets are one of the most fundamental concepts. Set theory is used to explain numbers and is also very important for solving equations, graph interpretation, probability theory, and statistics. addition, set concept also supports the explanation of the concept of geometry, the geometry of the field, and the geometry of space.

The observations in MTs Ambon class VII, showed that the average student did not do activities that support learning. The learning process is relatively simple and less interesting (Saputri & Kamsurya, 2021). Lack of variation in conveying materials and maximum utilization of school facilities. So that during the learning process, students pay less attention to the material delivered by the teacher. It is evident when students are given a question regarding Venn diagrams if students see the difficulty in describing Venn diagrams, enrolling each member of each set, and distinguishing between slice, combined complement, and difference operations. This is because students are still less able to understand the material properly, so that the steps in completing it are also less precise.

Research Safitri et al. (2013) indicates the potential effects of learning media using Macromedia flash on understanding student concepts. So it can be concluded that the learning media-based Macromedia flash subject triangle that researchers develop effectively used in mathematical learning. Istiqlal (2018) successfully developed interactive mathematical multimedia that has excellent quality according to the assessment of material and learning experts, media experts, and 32 students of class X with a score of 106.03 from a maximum score of 125, while the percentage of idealization is 84.82%, so it is worth using as a learning medium. This research aims to find out the development of interactive multimedia-based learning media on set material.

METHOD

The type of research used is research and development (R&D). Research and development is a research method used to produce a particular product and test its effectiveness (Sugiyono, 2014). The products resulting from this research take Macromedia Flash Professional 8 program (software) intended for students of class VII MTs. Negeri Ambons on the material set of the sub-subject subject to the operation of the set. The development used in this research is a development model put forward by Thiagarajan, Semmel, and Semmel, where the development research stage consists of 4 stages known as the 4D model (Four D Model). The development of 4D models consists of 4 stages, namely, define, design, develop and disseminate.



Figure 1. 4D Model Development Steps

The subjects in this study were all students of class VII-9 MTs Negeri Ambon, which amounted to 35 students. The instruments used in this study are pre-test and post-test instruments, questionnaires, observations, and documentation. The data collection process is conducted data validity test, data practicality test, and effectiveness test. The validity test is obtained from a validation sheet based on the assessment of expert validators. The information obtained through this instrument is used as input in revising the learning media developed to produce a valid final product. Practicality test data is obtained from research instruments in the form of student response questionnaires. Practicality test data is needed to find out if a product that has been developed can be applied in classroom learning activities. Effectiveness test data is obtained from research instruments in the form of test items that students do after conducting the learning process using media developed. Effectiveness test data is used to find out if the resulting product can deliver the expected results.

Validated data analysis is creating and analyzing that data and percentages for validation of each criterion/item.

$$P = \frac{X}{X_i} \times 100\%$$

Information:

P : Percentage sought

X : Respondents' answer scores in one item

X_i: Maximum answer score in one question item

The formula used for the overall item questionnaire data:

$$P = \frac{\sum X}{\sum X_i} \times 100\%$$

Media practicality is measured based on the results of assessments from practitioners in the form of student response questionnaires to the media to state the or absence of products applied in the field based on perceptions and experiences.

$$\bar{X} = \frac{\sum_{i=1}^n \bar{A}_{ij}}{n}$$

Information:

X : Total average

A_{ij} : Criterion value

n : Lots of criteria

Determines the overall category of criteria by matching the total average with the predefined category (Arsyad, 2016).

$RS < 0.5$	= Very not positive
$0.5 \leq RS < 1.5$	= Not positive
$1.5 \leq RS < 2.5$	= Quite positive
$2.5 \leq RS < 3.5$	= Positive
$RS \geq$	= Very positive

The percentage data obtained is then converted into descriptive qualitative data using validity criteria (Yusri & Husaini, 2017).

Table 1. Media Validated Criteria

Percentage (%)	Validity Criteria
81 – 100%	Very valid, no need to be revised
61 – 80%	Valid, no need to be revised
41 – 60%	Valid enough, it needs a little revision
21 – 40%	Less valid, it needs a lot of revisions
0 – 20%	Invalid, total revision required

Source: Ridwan (2010)

The instruments used in the product effectiveness test are pretest and post-test assessments. Increases in pretest and post-test values can be known by analyzing data using the N-Gain equation (normalized gain) with an ideal score value of 100 (Sudijono, 2007).

$$N - Gain = \frac{Skor\ Posttest - Skor\ Pretest}{Skor\ Ideal - Skor\ Pretest}$$

The high low of normalized gain (N-Gain) is further interpreted into the following classification of gain values (Nismalasari et al., 2016).

Table 2. Interpretation of Gain Value

Percentage (%)	Criteria
$0.70 \leq g \leq 100$	Increase in height
$0.30 \leq g < 0.70$	Moderate increase
$0.00 < g < 0.30$	Low increase
$g = 0.00$	There was no increase.
$-1,00 \leq g < 0.00$	There has been a decline

The division of N-gain categories in the form of a percent (%) can be seen in the following table (Nashiroh et al., 2020)

Table 3. Category of Interpretation of Effectstivan N-Gain

Percentage (%)	Criteria
< 40	Ineffective
40 – 55	Less Effective
56 – 75	Effective enough
> 76	Effective

The flow design of interactive multimedia-based learning media development using 4D models is described as follows.

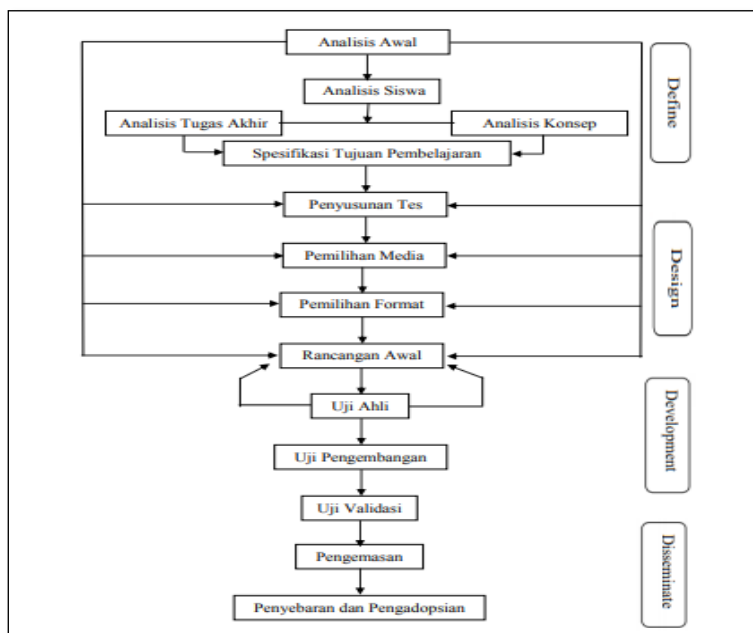


Figure 2. 4D Model Development Flow

The stages of learning media development namely (1) the define stage consists of early-end analysis, student analysis, task analysis, material analysis, learning objectives, (2) design stages consisting of preparation of tests, media selection, format selection, initial design, (3) development stages; at this stage produced the final form of learning media after going through revisions based on input from experts and data on trial results, and (4) disseminate stage; The deployment process is a final stage of development. This stage promotes development products to be accepted by users, whether individuals, a group, or a system. This stage is done to disseminate Macromedia flash learning media products that have been developed.

RESULTS

Define Stage

Final Initial Analysis (Needs Analysis)

The initial analysis of this development research is to find and establish the basic problems faced in mathematics learning in MTs Negeri Ambon.

1. Teachers only use whiteboards and sometimes use the help of manila cantons and power points as a medium of learning.
2. The methods used in math learning are lectures, discussions, and assignments.

3. Learning looks monotonous, because the average student does not do activities that support learning. At the time of the learning process is relatively simple and less interesting.
4. Lack of variation in conveying materials and maximum utilization of school facilities. So that during the learning process, students tend to be lazy and less excited in following the learning process so that students pay less attention to the material delivered by the teacher.

Student Analysis

Student analysis is carried out to find out the characteristics of students by the design and development of learning media. Based on results. Observation, the characteristics of students of class VII-9 MTs Negeri Ambon have a passive response. Some students are not enthusiastic about learning activities. Students tend not to focus on the material delivered by the teacher, some are busy chatting with their countrymen, and some are even looking for reasons to leave the classroom because they feel bored.

Task Analysis

In this stage, for students to achieve basic competencies, then first must be analyzed the task used as a reference in designing the task to be completed by the student. The task in this learning is in the form of evaluation tests that are analyzed based on the learning objectives listed in the learning implementation plan with the material set of the sub-subject subject of the set operation.

Material Analysis

The activities carried out in this step are to identify, detail, and systematically arrange the main materials that students will learn. The subject matter in this study is a set that includes the operation of the set of slices, combined, complement, and difference. Based on the fact that students prefer to learn if the subject matter delivered by the teacher is more concise but easy to understand.

Learning Objective Analysis

The learning objectives are formulated to convert the objectives of material analysis and task analysis into basic competencies expressed by behavior. The preparation of these learning objectives is based on the basic competencies and indicators listed in the curriculum.

Design Stage

This stage resulted in the design of a medium. This stage aims to produce a media plan to be developed.

Preparation of Tests

The test preparation is formulated based on material analysis and task analysis listed in the achievement indicator. The intended test is a test of learning results on the set material. Learning outcome tests are based on the results of analysis of learning objective specifications to determine the level of effectiveness of the developed product. Test learning results are arranged in a description with the number of questions as many as 3 questions.

Media Selection

Media selection has adjusted the results of the analysis of material has been done and adjusted to characteristics of students. The media used in this learning is an interactive multimedia-based learning media with the help of Macromedia Flash Professional Software

Format Selection

The selection of media formats is intended to design or design the content of learning media tailored to the learning materials and curriculum 2013 used. The selected media development format is a concept that can include all learning objectives of the set, including the operation of the set of slices, combinations, complements, and differences.

Early Plans

Preliminary design results at this stage include the design of the media used to obtain the data needed in the development process. Learning media planning refers to the results of analyses that have been done at the defining stage and other previous stages at this stage of planning. This stage will produce a product in the form of an initial draft of media that will be developed at the development stage. The results of the learning media design at this stage are learning media based on the condition of students who prefer more concise material but contain all the goals of the learning process.

Development Stage

This stage produces the final form of learning media after going through revisions based on input from experts and trial results data.

Expert Validation

The next stage that is done after the design stage is the validation stage by the validator. All media designs and instruments before being tested in school must first be validated. Expert validation results are used as a basis for revising media. Mater 1 expert validation

results obtained a percentage value of 54.3% with criteria valid enough and need a little revision. Material expert validation result 2 obtained a percentage value of 78.4% with valid criteria and did not need to be revised.

The results of media expert 1 obtained a percentage value of 70% with valid criteria and did not need to be revised. Media expert results in 2 obtained a percentage value of 89% of the criteria is very valid and does not need to be revised. Based on the validation results, media experts conclude that this interactive multimedia-based learning media is suitable for use (tested in the field) as advised.

Media Trial Stage

The revised media was further tested in class VII MTs. Ambon with a student number of 35 people. Based on the trial results, student response data, and student learning outcome data on learning with set material. Learning outcome tests are given to students to determine the level of mastery of pretest and post-test results on set material using interactive multimedia-based learning media.

Table 4. Pretest Scores and Posttest Student Learning Outcomes

No	Aspects	Pre-test	Post-test
1	Number of students	35	35
2	Average value	30.47	76.02
3	Maximum value	71.42	96.42
4	Minimum value	0	57.14

Based on the results of N-Gain calculations there was a significant improvement in student learning outcomes after using interactive multimedia-based learning media because the N-gain value obtained was 0.66 or 66%. Table 4 shows that N-Gain is located between $0.3 \leq (N \text{ Gain}) \leq 0.7$ with the medium category.

Student Response Questionnaire Results

The results of the questionnaire analysis obtained from the student response questionnaire are positive to the learning media that has been developed. Of the 35 students with 12 statements, the final average score was obtained at 3.46 and obtained a percentage score of 86.43% with very valid criteria without needing revision. Thus the criteria for the practicality of learning media in interactive multimedia-based learning media can be said to be achieved.

Desseminate Stage

The dissemination stage is the dissemination stage and is the final stage of this research and development stage. At this stage, the researcher disseminates the resulting learning media

at the end of the development stage. But in this process, due to the researcher's incompetence and lack of time and adequate funds, the researcher only conducts deployments at the research site.

DISCUSSION

Interactive multimedia-based learning is one of the learning resources based on Information and Communication Technology. Learning with multimedia can motivate students' thoughts, feelings, attention, and willingness to learn. Multimedia has interactive capabilities, so this medium can be one of the good alternatives as a tool in learning (Putri & Rakhmawati, 2018). Learning media is said to be valid if the analysis results are by predefined criteria. A learning medium is said to be valid if the results correspond to the criterium, in the sense that it has parallels between the test results and the predefined criterium (Arikunto, 2012).

Based on the results of data analysis from the validation process and the theory description above, the learning media developed can be categorized as valid because aspects of the learning media show a percentage value in a valid category based on predefined criteria. The results of validation data analysis with the final percentage obtained a value of 89% from material experts and media experts with very valid criteria, without the need to be revised. So that the media can be tested in the field, media criteria that are worth choosing are media that are aligned and by the needs of the learning task.

In the trial results, respondents gave a positive response, with a percentage of student response scores of 86.43% with practical criteria, without the need to be revised. Practicality criteria for developed learning media are achieved. Aspects of practicality can be met if: (1) experts and practitioners state that what is developed can be applied and (2) reality shows that what is developed can be applied. This is reinforced by validator assessments that say developed media is worth using with little or no revision (Wahyuningsih, 2012)

Development products in the form of multimedia-based learning media are effective because they are proven to improve shiva learning outcomes. Thus the criteria for the effectiveness of the developed learning media have been achieved. This indicates that students can absorb lessons and increase their knowledge by using developed learning media. The validity of a test is very influential on the results of student learning tests. Learning outcomes will reflect the student's ability to meet the achievement stage of the learning experience, to achieve the basic competencies of learning outcomes serves as a clue about the behavior changes that students will achieve in relation to the learning activities carried out,

adjusted to the basic competencies and materials studied (Fitria et al., 2017). Learning is said to be effective if it meets its main requirements, namely 1) the percentage of student learning time is very high devoted to learning activities, 2) the average behavior of carrying out high tasks among students, 3) accuracy between the content of teaching materials with the ability of students, and 4) developing a familiar and positive learning atmosphere (Trianto, 2009). Test learning outcomes to students to measure the level of effectiveness of learning media developed (Wulandari et al., 2017).

The use of interactive multimedia can also increase students' learning spirit, with students' enthusiasm for the use of interactive multimedia concentration and their learning interests increased to receive the material well. Therefore, there is an increase in student learning outcomes due to interactive multimedia with the help of computers (Isroila et al., 2018). Interactive multimedia is very suitable for learning to improve the quality of students' learning both during the process and results (Wulandari et al., 2017). Potential effects of learning media using Macromedia flash on understanding student concepts are 78 in the good category. So it can be concluded that the learning media-based Macromedia flash subject triangle that researchers develop effectively used in mathematical learning (Safitri et al., 2013).

CONCLUSION

Based on the results of data analysis and discussion, it can be concluded that the development of interactive multimedia-based learning media in the material of class VII MTs. Negeri Ambon uses a 4D development model consisting of 4 stages: defining, defining, designing, developing, and disseminating. Meanwhile, based on validity test data, the final percentage of material and media validation is obtained by 89% with very valid criteria or worth using without revision. While the practicality test with the dissemination of student response questionnaires, meeting positive categories, and obtaining a percentage score of 86.43% with criteria is very practical or feasible to use without revision. This suggests that interactive multimedia is practically used in the learning process. While the effectiveness test falls into the category is quite effectively used in the learning process because the N-gain value of student learning outcomes is 0.66 or 66% with a moderate category. This shows that interactive multimedia developed is feasible by meeting validity, practicality, and effectiveness categories. It can be said to be suitable for mathematical learning in the material set of class VII MTs Negeri Ambon.

RECOMMENDATIONS

This study's results recommend that future research can develop the material used to be wider, the design of learning media is even more interesting, and researchers' ability to make learning media. Dissemination of research products in interactive multimedia-based learning media should be carried out in other MTs/Junior High Schools so that the last stage of dissemination of development research can be fulfilled

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