

**O Desenvolvimento De Matérias De Aprendizagem Matemática Faculdade De Ensino E
Educação**

**The Development Of Mathematics Learning Media Materials Faculty Of Teaching And
Education**

**El Desarrollo De Medios De Aprendizaje De Matemáticas Materiales Facultad De
Enseñanza Y Educación**

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Resumo

Todo campo da ciência requer mídia relevante para o seu campo. O material de ensino usado ainda é geral, até que sejam necessários materiais de ensino específicos para o campo da ciência para serem eficazes em seu uso na aprendizagem. O objetivo desta pesquisa é desenvolver materiais de mídia para aprendizagem de matemática no corpo docente de ensino e educação da Universidade Batanghari Jambi. Esta pesquisa utiliza a abordagem de pesquisa e desenvolvimento (P&D) realizada na Universidade FKIP Batanghari Jambi. Os sujeitos da pesquisa são alunos do 6º semestre de 2017/2018. O modelo de desenvolvimento usado é o modelo de desenvolvimento instrucional (IDM). Após o desenvolvimento, era necessário validar o especialista em design, o especialista em material e o especialista em mídia. Em seguida, faça um teste individual, em grupo pequeno e em campo. O resultado da pesquisa baseada na validação pelo especialista são especialistas categorizados como viáveis com o percentual de elegibilidade para validação de design 92,71%, validação de mídia 89,78% e especialista em material 92,5%. Continua com o teste individual com percentual 97,2%, pequeno grupo 93% e teste de campo 88,63%. A conclusão do resultado da validação e o teste realizado para que os materiais matemáticos dos meios de aprendizagem sejam usados corretamente.

Palavras-chave: Material Didático, Modelo de Desenvolvimento Instrucional, Meios Matemáticos de Aprendizagem.

Abstract

Every field of science requires media that is relevant to its field. Teaching material that used is still general, until teaching materials that are specific to the field of science are needed to be effective in their use in learning. The aim of this research is to develop of mathematics learning media materials in faculty of teaching and education in Batanghari University Jambi, this research is using research and development approach (R&D) conducted at FKIP Batanghari University Jambi. The research subjects are 6th semester students 2017/2018. Development model that used is instructional development model (IDM). After the development has been done it needed validation by design expert, material expert, media expert. Then do one to one learner test, small group, and field trial. The result of the research based on validation by the expert is experts categorized as feasible with the percentage of eligibility for design validation 92.71%, media validation 89,78% and material expert 92,5%. It continue with one to one test with percentage 97,2%, small group 93%, and field trial 88,63%. The conclusion from validation result and the test that has been done so the mathematic Learning media materials is properly to used.

Keywords: Teaching Material, Instructional Development Model, Mathematic Learning Media.

Resumen

Cada campo de la ciencia requiere medios que sean relevantes para su campo. El material didáctico que se utiliza sigue siendo general, hasta que se necesitan materiales didácticos específicos del campo de la ciencia para que su uso en el aprendizaje sea eficaz. El objetivo de esta investigación es desarrollar materiales de medios de aprendizaje matemático en la facultad de enseñanza y educación de la Universidad de Batanghari Jambi, esta investigación está utilizando el enfoque de investigación y desarrollo (I + D) realizado en la Universidad Jambi de FKIP Batanghari. Los sujetos de investigación son estudiantes del sexto semestre 2017/2018. El modelo de desarrollo que se utilizó es el modelo de desarrollo instruccional (IDM). Una vez realizado el desarrollo, necesitaba la validación del experto en diseño, experto en materiales y experto en medios. Luego haga una prueba de aprendizaje individual, un grupo pequeño y una prueba de campo. El resultado de la investigación basada en la validación del experto es que los expertos se clasifican como factibles con el porcentaje de elegibilidad para la validación del diseño 92.71%, la validación de medios 89,78% y el experto en materiales 92,5%. Continúa con una prueba individual con un porcentaje del 97,2%, un grupo pequeño del 93% y un ensayo de campo del 88,63%. La conclusión del

resultado de la validación y la prueba que se ha realizado para que los materiales matemáticos de los medios de aprendizaje se utilicen correctamente.

Palabras clave: Material didáctico, modelo de desarrollo educativo, medios de aprendizaje matemático.

1. Introduction

Teaching materials will be successfully delivered if the teachers use appropriate learning materials. The role of learning media is very important for delivering learning materials. Therefore, it can be easily comprehended based on the media used. According to Gagne in (Sadiman., 2014) state that media is various component type in student environment that can be stimulate the student to learn. This is showed that media can support and motivate the student to learn. This will certainly be appropriate if the media used is in accordance with the material presented.

However, the teaching material that sells in the marketplace is still general, so that creativity is needed in mathematics learning media courses, the teacher is using reading material sources that still general and not yet specifically addressing the mathematics learning media as a whole. So student is tend to be difficult to create mathematics learning media in accordance with the subject matter being studied. The good material teaching it can stimulate the student to innovate in making mathematic learning media until the abstract mathematic material will easy to understand. To achieve those thing it needed a teaching material that can inspired and innovate in making mathematic learning media material.

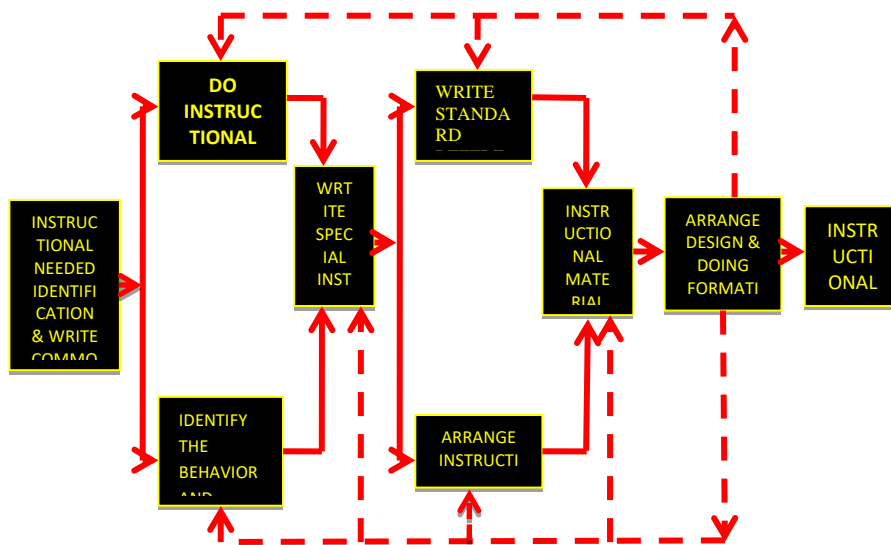
Based on the fact that showed above, it needed to design the development material of teaching and learning. In the development it needed to studied How mathematic learning media material in FKIP Batanghari University Jambi? How to develop mathematic learning media material in FKIP Batanghari University Jambi? The aim of this research is to develop of mathematics learning media materials in faculty of teaching and education in Batanghari University Jambi.

Instructional Development Model (IDM)

Instructional Development Model (IDM) have characteristic that each instructional development step model has practical purpose than to theoretical purpose. Then to this instructional development model having analysis needs analysis to identify learning problems and look for problem solving.

Structure of development model can be seemed like in Figure 1 below.

Figure 1. Instructional Development Model (IDM).



(Suparman, 2004).

Based on the figure 1 so the steps of Instructional Development Models are:

- Identify instructional needs and formulize general instructional objectives. This step is the initial step in identifying instructional process done in higher education. Data collection in this step used deep interview, field observation, and documentation. Based on the data analysis, the developmental form and instructional objectives can be formulized.
- Conducting Instructional analysis. This step is an explanation of general behavior to special behavior that logically and systematically organized. The analysis is done to classify materials that will be learnt.
- Identifying initial behavior and initial characteristics. This step is done to understand the students' behavior before the development in order to compare students behavior after and before the development.
- Note Specific Instructional Objectives by discussing objectives and aims determined. The formulation of instructional objectives is a base of test writing and instructional strategy.
- Writing guide test for standard. Writing standard guides aims to examine students' skill maximally to achieve the target. Test writing that can used as a tool to measure the level of students achievement in achieving instructional objectives.
- Arranging instructional strategy. In this stage, students will develop strategy used in instruction. From arranging introduction process, core activity, closing, media, timing

and measurement tools.

- g) Developing Instructional materials. Developing instructional materials is to develop materials in the form of material collection that are suitable with objective determined in the form of printed hand out.
- h) Designing and conducting formative evaluation. In this stage, students are writing measurement instruments and conducting formative evaluation towards instructional materials developed. Furthermore, the factor that is being evaluated is the strategy of instructional activity in mathematic.
- i) Obtaining the desired instructional system.

The result from this stage is a product in printed book. It is completed with other instrument required. Instructional development model is a simple model and understandable because all the steps are clear and enable to be revised any time. Do not think that a model is a best because it may be best and suits for certain condition (Suparman, 2012).

Relevance of Instructional Development Model

Instructional development model (IDM) is become as model for developing design system in mathematic learning media material. IDM model have clear steps, simple, understandable steps, and will have output or product because have the steps in formative evaluation.

Teaching materials

Quoted from Educational journal, (Sukiyasa, 2016) stated that learning process happened in the class is determined by some learning component, there are: learning purpose, teaching material, method and media, evaluation, students, teacher. It was previously described in (Depdiknas., 2006), that teaching material is one of the learning system components that hold the important role in helping the student reach the standard and basic competency. Then according to Lestari (2013) Teaching material is a set of goals or learning tools that contain learning material, methods, boundaries and how to evaluation the method designed in systematically and interesting in order to achieve the expected goals, is achieve the competency or sub competency with all its complexity.

Learning material is any form of material that used to help the teacher/instructor in executing teaching and learning activities in class, the material can be in the form of a written material or un-written learning material (Majid, 2007). Teaching material or learning material (instructional materials) mainly consisting of knowledge, skills and attitudes that students must learn in order to reach the competency objectives determined (Hamdani, 2011). Thus, teaching material is important for development model.

Learning media

According to (Asyhar, 2012), in etymology, media derived from Latin, is a plural form of the word "medium" which means "middle, mediator, conveyer". of message mediator or message conveyer from the sender to message's receiver., according to Bovee in (Asyhar, 2012), is used because the media function as intermediary or introduction a message from the sender (sender) to the receiver (receiver) message. Then according to Gerlach and Ely in (Arsyad, 2015) stated that if media is understood mainly means human, materials or incidents that build conditions of students. It enables students to obtain knowledge, skill and attitude or behavior. Briggs in (Sadiman., 2014) argued that media is any physical tools that can present message and stimulate students to learn.

Thus, based on some previous explanation from the expert, it can be concluded that instructional media is anything that can enhance motivation, stimulation, and enables students in understanding material conveyed especially understanding mathematics through mathematics instructional media.

2. Methodology

The method that used in this research is Research Method and Development method (R&D). The method R&D is research method that used to produce product or certain affectivity product test. To obtain the particular product, then it is required to conduct an examination or assessment to examine its effectiveness. From the examination results it can be known whether the resulted product can be used by other people or not. In this research become a subject is student college that registered in lecture on mathematics learning media in the even semester of the 2018/2018 school year at the Mathematics Study Program Faculty of Teacher Training and Education, Batanghari University, Jambi. Development of teaching materials is carried out in several stages there are: 1) preliminary study, 2) developmental planning, 3) validation, evaluation and revision, 4) Implementation. The validation and formative evaluation are required to see the validity of teaching materials. The validation and

formative evaluation are done by some experts such as (1) one to one experts that is material experts, instructional design experts and multimedia experts, (2) one to one learner that is personally examination that is conducted to user subject or students as the user of the product. The students consists of three students that have low, medium and high skill, (3) small group that is the examination to small group regarding on the instructional principles suitability with usage principles. The examination is conducted to 9 male students. They are divided to three groups based on their skill category. The skill categories were low, medium and high skill, (4) field trial that is the examination that is conducted in the field. It was conducted to 20 students.

3. Result

1. Analysis of Necessity and Formulation of Objectives

In this analysis level, do spreading the questionnaires needs also interview that has a function to collect the data related to a problem that faced by lectures and students. Based on the analysis of questionnaires results, it shown that students show experiences a difficulty in understanding of making a media learning that fulfill with mathematics, because not all of the media is suitable for mathematic material. Then the result of analysis from the interview with lecture, it show that nowadays teaching material still using general learning media research in the words meaning of media learning to all study field until no yet media learning books that explain in specific to mathematic material.

The purpose in the teaching material development is after following subject of mathematic learning media, the student is expecting can create and use mathematic learning media in teaching.

2. Instructional analysis

Instructional analysis is a process explaining general behavior to specific behavior that arranged in logically and mathematically. The results of instructional analysis are: a). description of Mathematics Learning Media Concept, b) explains Properties based on Wide Concepts (Area binomial multiplication, area of surface, game with area's concept), c) explain Properties based on Concepts of Length (Slide Ruler, Number Lines, Balance Sheet, and Cuisenaire Bars), d) explains Properties based on Volume Concepts (Volume cuboids, beams, prisms, tubes, cones, and balls), e) explains Properties based on Measurement Concepts (wheel Meter, spirometer, ball clamp, calipers, determine phi value, angular value of trigonometric functions, clinometer), f) explain Properties based on Arithmetic Concepts (calculating tools, numeric pattern, numeric operation, GCD and LCM), g) explains Properties based on Geometry Concepts (two dimensional figures, tessellation, geoboard, flat mirror), h) explains Properties based on Possible Theory, i) explains Properties based on The Game (Dominoes, squares and magic stars, frog jumps, hanoi towers), j) explains Properties

based on Information And Communication Technology (using E-Learning, Audio Visual, Toolpak Analysis).

3. Identification behavior and initial characteristic

The target group or students participating in the mathematics learning media courses are students who are enrolled at the University Of Batanghari (UNBARI) in the sixth semester of Academic Year 2017/2018. Students' college behavior will use the material that have the background heterogenic education, like from High School, SMK and MA. They had motivations and high willingness and pleasure to learn mathematics learning media.

4. Formulating Specific Instructional Objectives

From general instructional purpose above, so can be explains specific instructional purpose as below: a) student college can describe mathematic learning media concept, b) student college can describe Properties based on Wide Concepts (area, binomial multiplication, area of surface, game with area's concept), c) explain Properties based on Long Concepts (Slide Ruler, Number Lines, Balance Sheet, and Cuisenaire Bars), d) explains Properties based on Volume Concepts (Volume of cubes, beams, prisms, tubes, cones, and balls), e) explains Properties based on Measurement Concepts (Meter wheel, spirometer, ball clamp, calipers, determine phi value, angular value of trigonometric functions, clinometer), f) explain Properties based on Arithmetic Concepts (counting tools, numeric pattern, numeric operation, GCD and LCM), g) explains Properties based on Geometry Concepts (two dimensional figures, tessellation, geoboard, flat mirror), h) explains Props based on Possible Theory, i) explains Properties based on The Game (Dominoes, squares and magic stars, frog jumps, hanoi towers), j) explains Properties based on Information And Communication Technology (TIK using E-Learning, Audio Visual, Toolpak Analysis).

5. Measurement Tools

Measurement tools using test that consist of middle test semester, test semester, participation and competency test.

6. Formulating Instructional Strategy

Formulating a strategy of Mathematic learning media consists of three activities which is introduction, main activity, and conclusion. However, in teaching is using variation method with teaching times, media that used and needed tools.

7. Developing Instructional Materials.

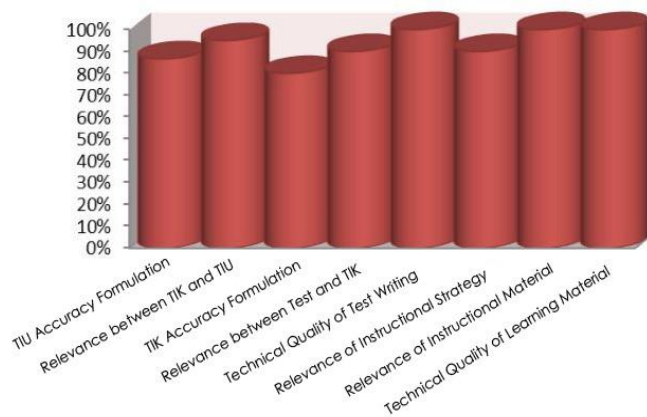
Prepare the teaching material is currently needed the material is fulfilling with appointed purposes. Teaching material which has been arrange and develop based on MPI model, so it needs validity from those teaching material so needed to see the validity. There are the results of validity which consist of validation and formative evaluations are:

a. Expert test (one to one expert)

1) Instructional Design Expert

Validation results from instructional design experts based on the indicators illustrated in Graphic 1:

Graphic 1. The result validation of Learning Design Expert.

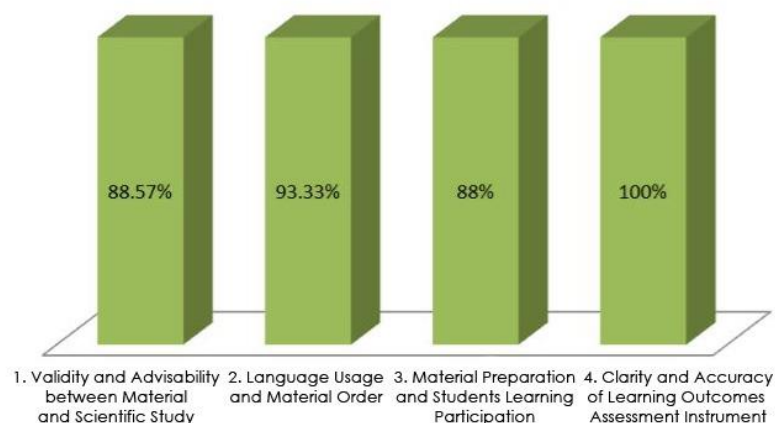


Source: Own Research

2) Material experts

The result validation by material expert based on indicator on learning teaching material is illustrated in Graphic 2.

Graphic 2. Graphic result validation of Material experts.

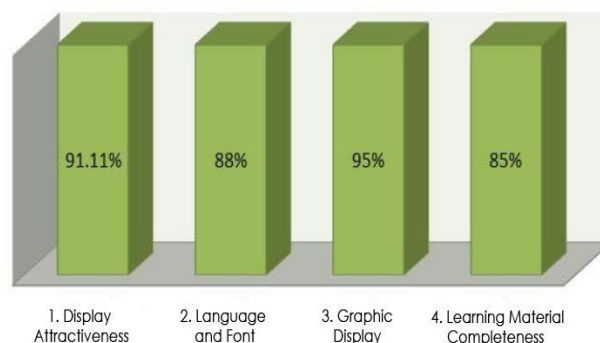


Source: own research

3) Media experts

There are the result validations by media on draft of learning material and learning is used in the illustration of Graphic 3.

Graphic 3 result validation media experts.



Source: own research

- 4) Revision and suggestion from expert
 - a) Revision of design expert/education technology

Pictures and graphs must be presented in text and must be clear. Further, the language must be clear and understandable. The sequence in the activity with sequence of TIK until will appear the steps in each activity that related to TIK that has been set.

- b) Revision material experts

There are some corrections in the learning material they are: typing, picture layout. Those parts have been already repaired and already approve by material experts, until it can be recommended to continue for individual test level.

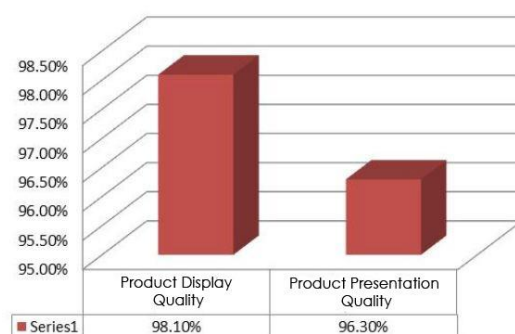
- c) Revision Learning media experts

The learning media expert is suggested to combination of one color with other color that harmonized and already repaired and learning media expert is recommended to individual trials.

b. Individual trials (one to one learner)

Individual trials (One to one learner) test results were obtained from assessment was illustrated in Graphic 4.

Graphic 4. The result of individual trials

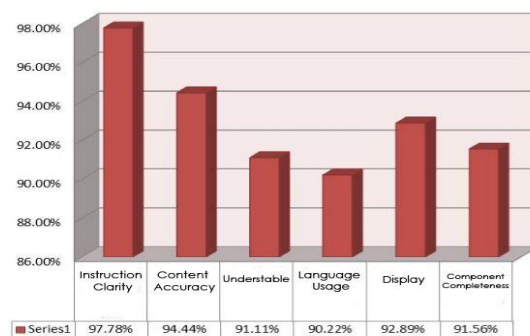


Source: own research

c. Small groups trials (small group)

Response of subject on small group trials (small group) that takes based on indicators can be illustrated in graphic 5:

Graphic 5 responses subject of small group trials (small group).

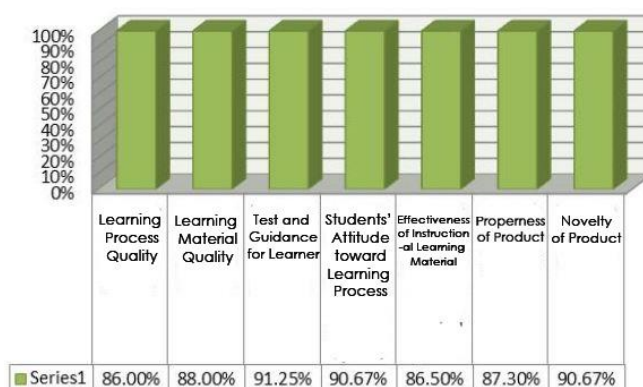


Source: own research

d. Field group trials (field trial)

Field trials result (field trial) is in the value of 7 (seven) indicators set out in the following Graphic 6 below:

Graphic 6 responses of field trials (field trial).



Source: own research

4. Discussion

Role of instructional media

In faculty of teaching and education (FKIP) Batanghari University Jambi, mathematics lectures material media learning is not yet using special book that become mathematic learning media. So that the students still confuse and the materials are not maximally conveyed. The result of those is showing that need to return back and it fulfill it with the condition and the name of the subject that must to learn in the thing of learning strategy that used with seeing the student characteristic that following the subject of mathematic learning media.

In arranging the learning material it needed to learn in entire both aspect of necessity, user (student), material, learning strategy and evaluation. Because in practice of teaching material has an important role in learning process that live because in law and knowledge sources and achieve the target that has been set in each subject. Moreover, learning material is in the set of the position as a tools or the facility to achieve the instructional purpose that has been set. Based on this condition, the arranging of learning material must be known to general instructional purpose that set. Seeing the nowadays condition, so it needed to make an innovation one of them is development of learning material that fulfilling the material, students' characteristic and ability.

Procedural in developing of teaching material media learning.

The development procedure using Instructional Development Model (IDM), the IDM model is very clear in the steps and fulfill with the condition of the development of mathematic teaching material media learning. The step starts from the needs analysis, which shows that students need a learning media jar because the teaching materials used are still general in nature so that they are in accordance with the needs of students and general instructional objectives can be made. The general objectives are described in the form of instructional analysis to determine competencies that should be controlled by students. However, it is necessary to pay attention to the next step is to analyze the characteristics and initial abilities of students so they can predict the start and end of teaching materials. To achieve the general objectives set, proceed to the step of determining specific instructional goals and benchmark reference tests so that they can determine the material to be used. In the process of using requires steps to develop learning strategies that guide the application of teaching materials. Thus it will be able to take steps to develop learning materials containing learning materials and to test the feasibility of teaching materials, a formative evaluation step will be carried out which is expected to be able to assess the developed teaching material products.

Research Limitations

Each product that development not a there is no perfect certainly has advantages and disadvantages. Not one of teaching material that develops is the only source of learning. It is the same thing with mathematic material media learning this not this is not the only source of learning for students. Because of it, it suggesting for using other relevant sources with subject material of mathematic learning media until can complete each other. Then from ten steps to eight is formative evaluation and not continue to the not continued in step nine and ten. The research only do in limited to the subject of mathematic learning media in Batanghari University (UNBARI) Jambi that have characteristic and the initial ability to suit the research subject.

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Percentage contribution of each author in the manuscript

Zilyadaini - 100%