Development of science thematic learning media discovery learning model based on science, technology and society (STM)

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Abstract
The aim of research to develop instructional supplement in the form of thematic learning media discovery learning models based STM (science, technology and society) are valid and interesting.The background of this development the lack of use of the media used in teaching natural science is limited to only using textbooks and whiteboards.This development uses the ADDIE model development procedure which includes 5 steps, namely: (1) analyze, (2) design, (3) development, (4) implementation, (5) evaluation. Data analysis technique used is the analysis of qualitative data and quantitative data analysis. Qualitative data analysis was obtained from the validation results of material experts, media experts, learning design experts and teacher. Analysis of quantitative data obtained from questionnaire scores and student learning outcomes tests. Based on data analysis, it shows that the thematic learning media developed are valid and interesting to use in learning.

Keywords: Thematic Learning Media, Discovery Learning, STM

INTRODUCTION

The rapid development of science and technology can be used as well as possible to assist the learning process, including developing learning tools. Learning tools are a number of materials, tools and media that will be used to assist the process of delivering material in learning (Patmi & Sina, 2019:

337-346). Technology is one of the important factors to create an effective learning process, because using technology can make the process of learning activities more diverse and interactive that can be used to help the learning process (Pertiwi & Sumbawati, 2019: 88-97). Technological developments can also be used to develop good learning media to be used in learning activities so that the process of delivering material can be well received, so that the material presented is easy to understand and understand by students (Febryana & Pujiastuti, 2020: 265–276).

Education that supports future development is education that is able to develop all the competencies of students (Hasanah, Rajagukguk, & Shafa, 2020: 24-30). The quality of education is influenced by several things, especially the availability of learning facilities, the use of time, and the use of learning media(Lubis, Rajagukguk, Kirana, & Rahayu, 2021: 14-22) One of the benefits of learning media is to make the learning process clearer and more interesting, this is because the media can display learning material in the form of sound, images, or in the form of video (Falahudin, 2014: 104-117). Teaching materials made through media programs will be clearer, complete, and interesting. Learning media is a tool that has an important role that can be used by educators to help deliver material in the learning process to students (Aini, Anggoro, & Putra, 2018: 287-296).

Media, if understood in broad terms, are humans, materials, or events that build conditions that enable students to acquire knowledge, skills, or attitudes (Zulfan, 2016: 22–30). In this sense, teachers, textbooks, and the school environment are media more specifically, the notion of media in the teaching and learning process tends to be interpreted as

graphic, photographic, or electronic tools for capturing, processing, and rearranging visual or verbal information (Budiman, Arifin, & Marlianto, 2019: 133-139).

Thematic learning is one of the techniques of integrated learning that links the concepts of some subjects with a unifying theme.Themes are tools to introduce various concepts and knowledge to students as a whole, so that they are meaningful for their lives. Trianto (2015: 151-152) arguesthat in accordance with the child's developmental level, thematic learning is learning to pay attention and adjust the provision in accordance with the concept of the child's developmental level.With thematic learning, students will be trained to relate one information to another, so that they can deal with cross-environmental situations, knowledge, and devices with a pleasant atmosphere and make students learn actively and directly involved in real life (Suyanto, 2013: 252). Learning thematic emphasis on the involvement of students in active learning process so that learners can gain direct experience and trained to discover the various knowledge they learn for themselves. Through direct experience, students will understand the concepts they are learning and relate them to other concepts that they have understood.

In the curriculum 2013, the concept of the material in each field of study has not been described in detail. The 2013 curriculum prioritizes the role of students in the learning process. The teacher serves as a facilitator, so that in its application, student-centered learning can foster interaction between teachers and students or vice versa (Magdalena, Cahya, Ramdani, & Anggraini, 2021: 141-157). The material contained in the student's book

is also less broad and deep, making students less able to master the concept because the material concept of each learning meeting is different. As is well known, Natural Science is the study and translation of human experience about the physical world in an orderly and systematic way with regard to real life, related to the phenomena of the physical world and the real environment, not only school residents but also the general public (BSNP, 2017) as stated by the National Research Council (1996: 20) that Learning Science is an active process.

Learning science is something student to do, not something that is done to them". Science is a product and process that can not be separated. "Real Science is both product and process, inseparably Joint" (Agus. S. 2003: 11). Therefore, learning media is needed to improve students' understanding of the material provided by the teacher. Media are objects that are manipulated, seen, heard, read or discussed along with instruments that are used properly in learning activities, which can affect the effectiveness of instructional programs (Musfiqon, 2011:26). A good learning media is one that meets the assessment of the aspects contained in the validity indicators in accordance with the 2008 Ministry of National Education criteria, namely aspects of the feasibility of content, language, presentation and graphics.Instructional media are prepared to include needs analysis, development of instructional media design, implementation, assessment, evaluation and validation, and quality assurance. With learning media, students can learn more directed and systematic.

IPA thematic learning media discovery learning models based STM (Science, Technology and Society) needs to be developed for the theme of

various occupations, sub-themes of types of work. To create active, creative learning in finding a new concept in science learning, teachers must develop appropriate media and methods in the current curriculum(E. L. S. Lubis, Rajagukguk, & Mustika, 2020: 1-10). This learning media raises problems that occur in the environment around students so that learning becomes contextual. The learning approach involves students in determining learning objectives, implementing learning procedures, finding information on learning materials and evaluating learning.

The purpose of STM-based Discovery Learning is so that students have the knowledge and knowledge to make decisions regarding problems that occur in their surrounding environmentIn the sub-theme Types of work, there are problems regarding the benefits of natural resources that are used by one type of work that causes damage to the surrounding environment. Therefore, it is necessary to explain and appeal to the importance of preserving natural resources in the vicinity to prevent environmental pollution.From the problems that exist in the STM-based science thematic learning media, students will learn to solve problems that occur in the community so that students' skills in solving problems can increase.In this STM-based learning, students are brought to an atmosphere that is close to the real life of students so that it is hoped that students can develop the knowledge they already have to be able to solve problems that are predicted to arise in the surrounding environment.

The results of the preliminary study show that there are several problems in learning, namely (1) the learning media used by teachers in schools is not in accordance with the environment around students, (2) the

content of the learning media has not been adapted to the discovery learning and STM (science, technology and technology) models. community) that are around students, (3) the design of the learning media only contains a few pictures that exist in the environment around students, (4) students do not yet know the uniqueness that exists in the environment around where they live. STM - based discovery learning science thematic learning media is used to develop students' skills in solving problems that exist in the surrounding environment based on daily life.

This study uses a development research design with the ADDIE model. The selection of this model was based on the consideration that this model was developed systematically and based on the theoretical foundation of learning design. This model is arranged programmatically with systematic sequences of activities in an effort to solve learning problems related to learning resources according to the needs and characteristics of the learner. This ADDIE model has five steps or stages that cover aspects of analyze, design, development, implementation, and evaluation.

Based on the formulation of the problem and the research objectives that have been determined, the research to be conducted is categorized into Research and Development. Sugiyono (2012: 407) states that development research is research that aims to produce a particular product and test its effectiveness. The effectiveness test is intended to determine the suitability of the product. In line with Nana Syaodih (2009:165) states that research and development is a process or steps to develop a product or improve an existing product.

METHODS

The research was conducted at MIN 9 Medan in odd semesters. The selected respondents are experts, teachers and students. Small-scale trials were conducted on 7 fourth grade students.This research is included in development research because it produces a product in the form of STM-Based STM (Science, Technology and Society) Thematic Science Thematic Learning Media.

This development uses the ADDIE model development procedure which includes 5 steps, namely: (1) analyze, (2) design, (3) development, (4) implementation, (5) evaluation. This research and development did not reach the stage of field testing and product dissemination due to limited research time and funds. Data analysis technique used is the analysis of qualitative data and quantitative data analysis.Qualitative data analysis was obtained from the validation results of material experts, media experts, learning design experts and teacher. Analysis of quantitative data obtained from questionnaire scores and student learning outcomes tests. According to Sudijono (2011) stated that "before determining the results of the learning evaluation, it is necessary to measure by administering a learning outcome test. The validation of the assessment instrument is determined by the average score given. The criteria for filling out the validation questionnaire are as shown in Table 1 below:

Table 1. Validation Sheet Assessment Category

Rating Score	Criteria
4	Very Good
3	Good
2	Not Good
1	Not Very Good

Source: Modified Mardapi (2013: 122)

The data obtained from the expert validation questionnaire were analyzed using a modified formula from Akbar (2011:147) as follows:

$$Vmt = \frac{Tse}{Tsh}\ x100\% \quad Vd = \frac{Tse}{Tsh}x100\% \qquad Vmd = \frac{Tse}{Tsh}x100\%$$

$$Vt = \frac{Vma + Vd + Vmt}{3} = \cdots \%$$

Desscription: Vmt = Material Expert; Vd = Design Expert; Vmd = Media Expert; Tse = Total Empirical Score achieved (based on expert judgment); Tsh = Expected total score; Vt = Total Validation; 100% = Constant. Source: adapted from Akbar and Sriwiyana With modifications, (2011:147)

Furthermore, it provides interpretation and decision making about the quality of product development using the adjusted validity criteria based on Table 2 below:

Table 2. Criteria for the Validity of Science Thematic Learning Media

No	Score	Validity Level
1	86 %—100%	Very Valid (can be used without revision)
2	70%—85%	Sufficiently Valid (can be used with revisions)
3	60%—69%	Invalid (unusable)
4	0%—59%	Very Invalid

Source : Akbar (2013:158)

The attractiveness data was obtained from a questionnaire given to students in using thematic learning media. To process the attractiveness data from the questionnaire given to students, a modified formula from Hobri (2010:56) was used.

$$M = \frac{\Sigma\, A}{n}$$

Desscription: M = Interests from students; $\sum A$ = Sum of values for all indicators; N = Maximum score

After obtaining attractiveness scores by students, then the average is taken to determine attractiveness in general using the modified formula from Arikunto (2006:272) as follows.

$$\overline{XM} = \frac{\Sigma M_s}{\Sigma X_m} x\ 100\%$$

Desscription: $\overline{XM}$ =Average attractiveness obtained from students; ΣM_s = The number of attractiveness of students in one class; ΣX_m = The number of ideal scores of student attractiveness in one class; 100% = Constant

After obtaining the percentage of attractiveness, then the criteria are applied as data interpretation. Interpretation is the interpretation of the results of the respondent's data analysis. The attractiveness criteria used as interpretation guidelines are listed in Table 3.

Table 3. Criteria for the Attractiveness of Science Thematic Learning Media

No	Score	Attractiveness
1	86 %—100%	Very Interesting, No Revision Needed
2	70%—85%	Quite Interesting, No Need for Revision
3	60%—69%	Less Attractive, Needs Small Revision
4	0%—59%	Not Interesting, Total Revision

(Source: adapted from Akbar Sriwiyana with modifications, 2011:147)

Practicality level data were obtained from questionnaires given to students in using thematic learning media. To process the attractiveness data from the questionnaire given to students, a modified formula from Hamdunah (2015:38) is used as follows.

$$P = \frac{\Sigma \mathrm{f}}{\mathrm{N}} x\ 100\%$$

Information : P = Practicality Percentage; f = Score; N = Maximum expected total score.

After obtaining the percentage of practicality, then the criteria are applied as data interpretation. Interpretation is the interpretation of the results of the respondent's data analysis. The practicality criteria used as interpretation guidelines are listed in Table 4.

Tabel 4. Criteria for Practicality Level of Science Thematic Learning Media

No	Score (%)	Practicality Level
1	81 —100	Very Practical
2	61—80	Practical
3	41—60	Practical Enough
4	21—40	Less Practical
5	P = 20	Not Practical

Source: Modified from Riduwan (in Hamdunah 2015: 38)

DISCUSSION

The learning media developed in this research is the STM-based discovery learning science thematic learning media for 4th grade students of Madrasah Ibtidaiyah. The results of the preliminary study show that there are several problems in learning, namely:(1) the learning media used by teachers in schools are not in accordance with the environment around students, (2) the content of the learning media has not been adapted to the discovery learning and STM (science, technology and society) models that exist around students, (3) design from the learning media only a few contain pictures that exist in the environment around students, (4) students do not yet know the uniqueness that exists in the environment around their residence.

Learning media includes; 1) The intro menu is created as an opening when the media is first run, 2) The main page is a menu that contains the main buttons in the learning media consisting of instructions,

competencies, materials, practicum and competency test buttons, 3) The instructions menu is a page that contains directions in using interactive media, so that students can easily use the media, 5) The competency menu is a menu created to inform users about core competencies, basic competencies, indicators, and learning objectives, 6) The material menu is a menu that contains material to be studied. learned by students, the material menu is the most core menu in this learning media, because the content or learning material is contained in this menu, 7) The practicum menu contains instructions for experimental activities that will be carried out by students, 8) The competency test menu is a menu that made as a student's final project after studying the content or material from the teaching media lessons so that the level of students' understanding of the material that has been studied can be measured. This development uses the ADDIE model development procedure which includes 5 steps, namely: (1) analyze, (2) design, (3) development, (4) implementation, (5) evaluation.

To determine the feasibility of the developed learning media, validation was carried out by material experts, media experts, learning design experts and two classroom teachers. The data obtained from the validator in the form of qualitative data is converted into a quantitative data score that is adjusted to rank using a Likert scale. The analysis is carried out as on the Likert scale, namely by calculating the average answer based on the scoring of each answer from the respondent (Sugiyono 2011:142), then the results are obtained as shown in Table 5.

Table 5. Calculation Results of the Validation of Science Thematic Learning Media

Validation	Percentage Validity (%)			Average (%)	Validity Level
	V1	V2	V3		
Material Expert	81.25%	79.68%	84.73%	81.88%	Quite Valid
Media Expert	78.12%	80.20%	82.41%	80.24%	Quite Valid
Learning Design Expert	79.68%	80.21%	84.25%	81.38%	Quite Valid
Total Average				**81.16%**	**Quite Valid**

Based on the results of the assessments of the three validators in Table 5, for the first meeting up to the sixth meeting, the validity level is quite valid and has gone through the trial validation process three times according to minor revisions.

Table 6. Attractiveness of Science Thematic Learning Media

Validation	Teacher Response Sheet (%)	Student Response Sheet (%)	Average (%)	Attractiveness Level
Response Questionnaire	83.35%	86.24%	84.79%	Quite interesting
Average Attractiveness of Learning Media (%)			84.79%	Quite interesting

Based on Table 6 above, the average practicality of the science thematic learning media developed is 84.79% with quite interesting criteria.

Table 7. Practicality Level of Science Thematic Learning Media

Validation	Teacher Response Sheet (%)	Student Response Sheet (%)	Average (%)	Practical Level
Angket Respon	83.82%	86.23%	85.03%	Very Practical
Average Practicality of Learning Media (%)			85.03%	Very Practical

Based on Table 7 above, the average practicality of the science thematic learning media developed is 85.03% with very practical criteria. Even so, the author continues to make revisions according to the suggestions given by the validator. Suggestions for improvement from the validation and revision results can be seen in Table 8. Based on the validator's assessment and also the classroom teacher's assessment of the learning media developed as well as suggestions and inputs given by material experts, learning design experts, media experts and classroom teachers, the learning media developed are said to be valid and feasible to use in learning.

Table 8. Suggestions from validation and revisions carried out

Validation	Part	Pre Revision	Post Revision
Material Expert	Material	1. Unclear Concept Map	Revised
		2. There is no discussion activity yet	Revised
		3. Adding material with the discovery learning model	Revised
		4. Addition of STM-based materials	Revised
Media Expert	Learning Media	1. Intro and Menu related to STM-based discovery learning model	Revised
		2. Add more animation examples related to the student's surroundings	Revised
		3. Color contrast should not be too flashy and too crowded	Revised
		4. Composer, editor etc added to final menu	Revised

Validation	Part	Pre Revision	Post Revision
Learning Design Expert	Discovery learning	1. Syntax is not compatible with discovery learning	Revised
		2. Add more experiments for discovery	Revised
	STM	1. Pay attention to the syntax and adjust it with animation	Revised
		2. The domain of STM is further clarified	Revised

CONCLUSION

This research has produced a product in the form of discovery learning model science thematic learning media based on STM (science, technology and society) with the theme of various occupations, sub-themes of types of work. Based on the results of the study, it was concluded that the learning media developed in this study were categorized as valid and interesting to use in learning. Validity is illustrated from the results of the validator's assessment that all validators state good results in all three aspects, namely material, media and learning design. Interesting and practical is reflected in the assessments of teachers and students during small group trials.

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