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Development of Learning Media in Mathematics for Students with Special Needs

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Abstract

This study aims to: (1) develop a learning media in the subjects of mathematics for students with special needs, (2) determine students' response to the development of learning media on subjects of mathematics for students with special needs. The design of learning media is using the development method of Research and Development (R & D) and the ADDIE development model consisting of five stages of the design of the development. The stages of the ADDIE model are analysis, design, development, implementation and evaluation. Data analysis was performed by means of summative and formative evaluations. The results showed that the media developed are qualified to be feasible and also qualified for use as learning media for the subject of spatial structures. Based on data obtained can be interpreted that the reviewer of media mentions that by the learning aspect, the media belong into the category of excellent that is 93.33%, and by aspect of the appearance, the media belong into the category of good that is 82%. While the third aspect, namely by the technical quality and the effectiveness of the media expressed belong into the category of excellent that is 82.22%.

Keywords: Learning Media; Mathematics; Student; and Special Need.

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1. Introductionn

Mangunsong states that child with special needs or extraordinary child is a child who deviates from the average normal children in terms of: mental traits, abilities of sensory, physical and neuromuscular, social and emotional behavior, communication skills, as well as combinations of two or more of the above matters, as far as he or she requires modification of school tasks, methods of learning or other related services, aimed to develop him or her fullest potential or capacity [10].

In terms of improvement of the learning achievement of these students, creative teachers who could make learning more attractive and preferred by learners are needed. The classroom atmosphere is indeed need to be planned and constructed in such a way by using appropriate learning models so that students can have the opportunity to interact with each other so that in turn can be obtained an optimum learning achievement [4].

This is in line with the opinions [12] that "Learning is a component of the play, and play is a learning component. Studying and playing are aspects of the epistemology," and they suggested that "a richer understanding of science can be gained through playing. Creating an interesting learning media can make students be conscientious in learning".

Based on an interview with a teacher in Medan obtained information that the limitations of children with special needs to follow the learning in school has repercussions as follows: students are not able to absorb the lesson well, the lack of motivation of the child to learn, as well as reluctance to follow the lesson to completion so more time is used for playing and silence. Each subject using visual media of learning that has been there before like objects with the form of patterns of triangles, rectangles, circles, ruler, puzzle board, books, pictures, as well as markers that have been quite helpful in the process learning, but it is different with the subjects of mathematics. Constraints in the learning process of mathematics are a limited availability of media that make the learning process is not effective, and mastery of concepts and understanding of children are low. He also said that the process of delivery of materials by the animation / cartoon videos are perceived as being more conducive than videos that use the original objects as a model because of students more interested in the varied forms of animation, in terms of coloring and appearance. The use of animation learning media can also increase the child's concentration and focus.

Children with special needs by Heward (in [10]) are a child with special characteristics that are different from children in general that not always manifested in the inability of mental, emotional or physical. Children with special needs, among others, are: children with visual impairment, hearing impairment, mental retardation, physical impairment, disability of sound and tone, learning difficulties, behavioral disorders, gifted children and children with health problems. Another term for children with special needs is extraordinary children and children with disabilities. Due to the characteristics and constraints that they have, children with special needs require some form of special education services that are tailored to their abilities and potential, for visually impaired students, for example, they require a modification of the reading text into Braille and deaf students communicate using sign language. Thus, even if a child has a Certain abnormality/deviation but not significantly so that they do not require special education services, he or she is not included in the children with special needs

[10]. Children with special needs are divided into several categories. The category of disability A (blind) is a child with visual impairment, category of disability B (deaf and dumb) is a child with speech disorders and hearing impairment. Both types of disability were combined into one category because usually speech disorders and hearing impairment occurred in one state. The category of disability C (mental retardation) is child with low intelligence or impaired intellectual development, and the category of disability D (quadriplegic) is a child with impaired bone and muscle which results in impaired motor function. The category of defect in the sound and tone is a child with social behavior deviant category of gifted children is that children with the advantages and capabilities of excess (high IQ), and the category of children with learning difficulties is a child with minimal malfunction of the brain [13] Many terms are used as a variety of special needs, such as disability, impairment and handicap. According to the World Health Organization (WHO), the definition of each term is as follows:

a. Disability: limitation or lack of ability (resulting from impairment) to display the activity in accordance with the rules or still within normal limits, usually used in individual level.
b. Impairment: any loss or abnormality in terms of psychological or anatomical structure or function, usually used in organ level.
c. Handicap: Misfortune of individuals resulting from impairment or disability which restrict or impede the fulfillment of a normal role in individuals.

Students with special needs always have different characteristics from each other. The differences are apparent in academic achievement, intellectual ability in the field of oral expression, listening comprehension, written expression, basic skills in reading, reading comprehension, mathematical calculations, mathematical reasoning, or spelling. Here is a list of some indicators of students with special needs according to [15], among others:

a. Always isolated from their surroundings.
b. Having a hearing is not good.
c. Having a low tolerance level.
d. Having a high level of frustration.
e. Having low self-esteem.
f. Easily distracted.
g. Spontaneous in expression, often cannot control their emotions.
h. Easily confused.
i. Have some difficulties in working with others in a small or large group setting.
j. Having difficulty in following complicated directions or remembering directions for a long time.
k. Have a coordination problem with both large and small muscle groups.
l. Has a pattern of rigid mind.
m. Having poor handwriting skills [15].

Mathematics is the science that underlies the development of modern technologies and plays an important role in other disciplines as well as in the daily life of human beings. The development of mathematics education is dynamic and requires the right attitude in accordance with its development. One of the new innovations in the system of education services is growing and demanding adaptation in mathematics education is inclusive

education [1].

In order for students with special needs can learn math then there needs to be a way of instructions that meet their special needs in learning. While the mathematics educators and special educators often do not agree on how to do math instruction, the dispute is not helpful for the students we serve. Students with special needs are deserved to continue to follow the study of mathematics that integrates "best practices". Mathematics education is usually more advocate the practice of student-centered learning (e.g. learning discovery of a base of inquiry learning). Special educators tend to be more advocating the practice of direct instruction (explicit), which applied for the purpose of learning of mathematics. Students with special needs can benefit from instruction that combines important aspects of the focus on the student and the teacher of mathematics to be directed toward instructional practice [6].

In carrying out the learning of mathematics to children with special needs, the teacher must provide direct instruction and instilling a high level of motivation to students to get the maximum learning outcomes of mathematics for children with special needs. Giving instruction and motivation directly to the students is more effective compared with the learning process that focuses on the students themselves. Monitoring the performance of students, to communicate to the students that performed continuously is expected to be able strengthen the success and improve learning outcomes of students [9].

All the activities that need to be done in everyday life need to use mathematics. For that, the mathematics for students with special needs also sustains for everyday life. Mathematics, among others, is: counting numbers and operations within it, the structures of geometry, measurements, and the use of money and time. In addition to learning math, instruction by tutors (peers and group of learning) can be used as an effective way for students with special needs to improve their understanding of mathematics and skills through practice during the learning activities that have been organized and planned by the teacher. Students with special needs develop learning of mathematics without memorization on one of the subjects of mathematics, but by continuous repetition [5].

Students who experience language barriers also have difficulty understanding the meaning of mathematical symbols. For example, the signs of plus, minus, multiplication, division, equality, greater than, less than, attributive equation, and distributive equation. Teachers should be able to teach in a concrete and simple on the meaning of symbols with real imagery. They are accustomed to read mathematical symbols. According Badrujaman [3] there are some basic principles that need to be considered by teachers in the learning of mathematics for children with special needs, which is as follows:

a. Adapted to the conditions of children with special needs, the implications need to be assessed and a description of their ability in mathematics needs to be elaborated. For example: diagnostic interview techniques to obtain information about specific problems, patterns of error when working with numbers, and strategy of students in problem solving.
b. The use of spiral manner of presentation, which began with a presentation of key concepts and processing of improvements with regular repetition intervals, then applied to the new situation. When proceeding to the next phase of the material is necessary to start from key concepts that have been

mastered by students, only then proceed to the key concepts of the next material. Regular revision is crucial to long-term memory and mastery of key concepts.

c. For the effectiveness of the revision is important to note the recurrence interval, frequency of repetition, and repetition form.
d. Repetition interval can be raised in time-on-task and help students maintain a positive attitude to the learning of mathematics in schools. This was done to help the students fully to experience a sense of competence on the success of the application and practice of creation.
e. The approach that is needed is practical work, teamwork activities and open discussion will always play a major role to develop learners' understanding and positive attitude. Integrated learning is recommended to reduce the "math anxiety '.
f. The most fundamental purpose to study mathematics includes learning about the value of the mathematical, rational, ways of communicating, confidence in mathematical ability, as well as to make mathematics as a basis for solving the problem.
g. Every key concept that has been achieved should be followed in problem solving in real life everyday [3].

The term learning is used to show the educational efforts undertaken deliberately, with the goals set before the process carried out, and its implementation controllable. Learning Media is all that is used to deliver a message and can stimulate the mind, feelings, concerns, and willingness of the students so as to encourage the learning process of deliberate, purposeful, and controlled [11]. Media is an intermediary or a messenger. One of them is applied by the application and use of methods and media, are all things that can be used to deliver a message from the sender to the receiver so that it can stimulate the mind, attention and interest, resulting in the learning process [7].

In the UK, Ofcom (in [8]} defines media literacy as: "The ability to access, understand and make the communications in a variety of contexts". In the United States, the media of education is commonly called the media of literacy education. The media has a close relationship with the technology used in education.

Miarso stated that the media can overcome the limitations of experience possessed by the students. Each student's experience is different. The family and community lives will determine what kind of experience possessed by the students. Media can transcend the classroom, many things are not likely to be experienced directly in the classroom by the students because: (a) the object is too large for example temples, stations, and others; by using the media we can show them to the presence of students; (b) some object, whether it is living beings and inanimate objects, which are too small to be observed with the naked eye, such as bacteria, protozoa, and so on, the magnifying glass as a form of learning tool to enlarge and clarify these objects; (c) movements that are too slow to be observed, for example, the process of blossom, can be followed in a few moments thanks to the medium of photography; (d) movements that are too fast too hard to capture by the naked eye, such as the flapping of the wings of birds, beetles and others, can be observed thanks to the media; (e) sometimes the object to be studied is too complex. The media in the form of a diagram or model can be used to simplify the objects in question to make it more easily understood; (f) sounds so smooth or voice of the teacher lecturing in front of hundreds of students, that cannot be captured clearly by ear can be clearly heard thanks to media; (g) barriers to

study the seasons, climate, and geography in general can be overcome, the life of the fish in the sea, or the life of a lion in the forest can be presented to front of the classroom. Media enables direct interaction between students and their environment, they are not only invited to "read about" or "talked about" physical and social symptoms, but invited to contact directly with them. Media produce the uniformity of observation [11].

From some of the benefits of learning media mentioned above it can be concluded that the benefits of the use of learning media teaching and learning process is that the of learning media can support the learning process that is capable of enhancing the understanding and learning outcomes are achieved, the material more clearly and not be verbalistic, providing motivation (students are motivated to learn), and provide a more meaningful learning experience. Media of education is very important for teachers and learners. This is because any teaching material presented by the teacher definitely use media, at least he or she uses verbal media in the form of words that are uttered in the presence of learners.

Media of education can be divided into four (4) types [2], namely:

a. Visual media: images, photos, sketches, diagrams, graphs, cupboard of posters, maps and globes.
b. Audio media: radio, tape recorders, language laboratories, and CD.
c. Projected still media: slides, OHP.
d. Projected motion media: TV, Video, Computer.

According to Ted, there are some kinds of media that can be used for children with special needs, namely:

a. Audio Loops Audio Loops is another type of amplification system. Previously introduced in an attempt to meet the need to control the sound level of teachers and to provide maximum mobility in the classroom. Audio loops direct the sound from the source directly to the listener's ears through the hearing aid specifically provided. The sound can be transmitted through a cable connection or by using radio waves.
b. Telecommunications device for the deaf (TDD). Some TDD has the printed paper to record a permanent copy of the conversation. To use TDD, the user is typing a message on a keyboard that is automatically converted into tones and transmitted through the telephone line to another TDD, which converts the message back into text form. In this system, both the sender and the recipient must have access to the technology.
c. The text below the TV. The text refers to the addition of text to the visual appearance, in which the words were spoken seen as text.
d. Speech Text. Speech is another variation of the technology that allows people with hearing impairment to access words such as being spoken. This technology works like a stenographic keyboard that is used to record the conversation [9].

2. Research Method

This research was conducted in Yayasan Pembinaan Anak Cacat (YPAC), which is located in Jl. Adinegoro No. 2 Medan, East Medan District. The sample in this study consisted of 20 students with special needs. The present

study was conducted on January 6, 2017.

2.1 Research Design

This type of research carried out is Research and Development (R & D). Research and Development [14] is a research method that is used to produce a particular product or develop the existing product as well as test the effectiveness of the product.

2.2 Development Model

Development model used in this study is a model ADDIE. The stages of development of learning are as follows:

Table 1: The stages of development of learning

No.	Development Stage	Description
a	Analysis	Conduct a needs analysis, identify problems (needs) of the students. In the activity of a needs analysis, an analysis is performed of the syllabus which includes Competence Standard and Basic Competence, characteristics of students, teaching materials / media that have been used to obtain information about media needed by learners in learning the competency have been programmed.
b	Design	This is accomplished by arranging opaque media. Media development initiated by compiling opaque media. The resulting media is expressed as opaque until the completion of the validation and testing. The design phase is the first step in making the learning media and must prepare everything that will be required, among other things: the creation of the design, etc.
c	Development	The results of this phase is a product in the form of learning media that has been structured in accordance with the standards of competence, basic competence and indicator where the three were already contained in any description of the matter. In this development phase, the animation is made according to the needs of the stage of development that has been designed, such as: Modeling, Texturing, Ringging, Skinning, Acting / Animation, Lighting, Rendering, Recording Phase, and Merging Phase.
d	Implementation	A test phase, or the implementation of the learning media to students. This phase was conducted to determine the conformity / validity of the media with the subject matter.
e	Evaluation	To determine the success of learning media developed whether or not in accordance with the original expectations. Evaluation aims to make improvements to the learning media that have been developed.

2.3 Data Analysis Technique

a. Summative Evaluation

This is an evaluation that is used to measure or assess the extent to which the achievement of learners in the subject matter that has been taught and further to determine the increase in the level or graduation of students concerned.

b. Formative Evaluation

Formative evaluation consists of a variety of forms. According to [17] in the dictates of 'theory and practice of evaluation of the counseling and guidance programs' [3], formative evaluation can be carried out as follows:

1) Expert review

Evaluation is implemented where experts review the service program with or without the presence of evaluators. Experts referred to here may be experts of materials, technicians, designers, or instructors. The evaluation was conducted on the program with the contents of the service are still not smooth or in the draft to determine its strengths and weaknesses.

2) One-to-one Evaluation

The evaluation was conducted by interviews with individuals by evaluators to some students where they are required in one by one to comment on the service programs that are being developed. In addition, students are also usually required to complete the pre-test and post-test to measure the effectiveness of the service program.

3. Results

Based on the data on the results of testing of the product of learning media by experts of the material turned out to be the product are valid and can be tested to assess their feasibility in the learning process. This learning media can be considered valid because of the test results, where there is 97.14% with the category of excellent. Through the data obtained can be interpreted that the reviewer of media mentions that according to aspects of the media, the learning fall into the category of very good i.e. 93.33%. Through the data obtained can be interpreted that the reviewer of media mentions that by aspect of the media, 93.33% of the learning is belong to the category of excellent. From the viewpoint of the aspect of media appearance, 82% belong to the category of good. Meanwhile, according to the third aspect with regard to the technical quality and effectiveness, 82.22% belong to the category of excellent. These results are based on the reference ranges of product categories included into the category of good and is said to be sufficient to be able to test its feasibility in the learning process. From some of the descriptions of the above data it can be concluded that the learning media in subject matter of spatial structures said to be very good in terms of quality of media. The aspect of the program appearance and effectiveness can be declared equally well. Thus, the learning media of spatial structures has been declared eligible to be applied to the learning process. The above statement is reinforced by the elaboration

of questionnaire analysis of aspects of the completeness of some media that show a score of 82% with the category of good.

In short, it can be presented in the following diagram:

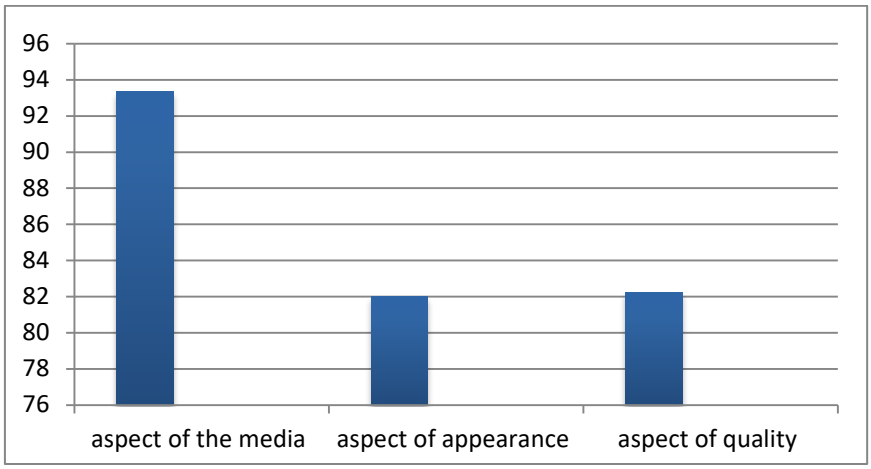

Figure 1: The Learning Media

The test results of students before and after use of learning media showed an average difference of values of pretest and posttest at 13.18 and squared deviation of 6850 with a sample size of 20 students. It is obtained from the calculation = 12.5, while for $\alpha = 5\%$, with a degree of freedom (Df) = 22-1 = 21, t-table = 2.080 is obtained. So it seems clear that the t-counted = 5.15 $\geq$ t table = 2.080. Thus because of the t-counted $\geq$ t-table then the hypothesis (Ho) is accepted. It can be concluded that the average ability of students' understanding of the material of the spatial structures of the lowest is 76. Based on the data and the description given above it can be concluded that the medium of learning in the subject of spatial structures are effective for use in the learning process because after use the new media, student learning outcomes is increased.

4. Discussion

The journal can be discussed is the journal entitled "Development of mathematical learning media in the subject matter of simple fractions for deaf children in the third-grade of Extraordinary School" written by Ramadani Susanto. In a previous study, learning media developed needs to be revised slightly in order to be judged worthy to be used in the field. Based on the analysis of qualitative data in the form of advice, there are some parts that need to be revised. Based on the data provided by the expert of the overall material on multimedia-based learning media for mathematics in the material of fractions for deaf students in the Regional Extraordinary School of Pembina Malang, test score of 75% was obtained with the category of worthy. The revision was carried out in the language, and images on the media.

Learning activities created by teachers in accordance with the demands of "developmental appropriateness" should be based on an understanding of how children with special needs engaged in learning and also how they learn can be reviewed on constructivist learning theory. The constructivist learning process is as described

below. Conceptually, the learning process in the light of the cognitive approach, not as the acquisition of information that takes place in one direction from the outside to the inside of the student, but as an interpretation by the student on his experience through the process of assimilation and accommodation that lead to the updating of the cognitive structure. Purposing for the objects and experiences by individuals is not done individually by students, but through interaction in a unique social network that is formed in the culture of the classroom and outside the classroom. Learning management should give priority to the management of students in acquiring the idea and not solely to the management of students and their learning environment [16].

In addition, the social learning theory developed by Albert Bandura states that the environment is an important factor affecting the behavior, but cognitive processes also not less important. Social learning theory of human beings made them have the ability to control their own behavior [16]. The concept used in this theory is the demonstration. The child will imitate the behavior of others he saw. Therefore, teachers and parents have to demonstrate a good example to the children so that they can develop into a good person.

The considerations that need to be kept in mind in teaching special needs [10] are:

a. Understand that every child with special needs as an individual who has a unique.
b. Learning orientation has a starting point in the child (child-centered learning).
c. The learning which is an active, cooperative, creative, and effective.
d. The provision of a diverse learning experience.

Based on the results of development it can be seen that the product of learning media for the subject matter of spatial structures developed is compatible with the model of Analyze, Design, Development, Implementation, Evaluation (ADDIE). The process of learning media is through several stages of development and validation of experts in order to obtain a product of learning media that fall into the category of worthy. The validation process through which the development takes place, among others, is: validation of learning media program. Based on data obtained in the manufacturing process of learning media, we know that the product of learning media can be subject to the feasibility test in the learning process of mathematics with the subject matter of spatial structures in Yayasan Pembinaan Anak Cacat (YPAC) of Medan. This can be seen from the data obtained during the process of validation of content by materials expert and media expert.

5. Conclusions

a. Development of the learning media using the method of research and development by the ADDIE development model has been studied. Stages of this the model was initiated by wide range of analyzes, namely analysis of market, analysis of users, analysis of materials / curriculum, analysis of the program, the analysis of the means through observation and interviews with teachers and students.
b. After analysis, the material is developed regarding the spatial structures. Through the data obtained can be interpreted that the reviewer of media mentioned that by aspects of media, the learning has a very good category of 93.33%. From the aspect of media appearance is known that 82% belong to the category of good. Whereas by third aspect relating to the technical quality and effectiveness is known

that 82.22% belong to the category of excellent.

6. Suggestions

Classroom teachers should pay more attention to the management of material formulated into a Learning Implementation Plan in more detail. In addition, it is also useful to keep the classroom situation so that the learning is still running conducive, functional and fun. There is also a good idea if the classroom teacher began to learn to understand the various characters of students, especially students with special needs in his classroom, especially if there are students with sounds and tones impairment. This will further help teachers to organize the learning that is more conducive, functional, and fun.

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