



Integrating the Concept of Plane Figure and Baduy Local Wisdom as a Media Alternative of Mathematics Learning In Elementary Schools

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Abstract

This study aims to develop a learning media product that contains the local wisdom of the Baduy tribe. The method used in this research is an ethnographic study to collect data about the Baduy tribe buildings that contain geometric elements. After the data was collected, the researcher used the instructional design research method in the form of the ADDIE model with the aim of making learning media by integrating the local wisdom of the Baduy Tribe in learning geometry based on previous ethnographic studies. The subjects in this study were the Baduy people, teachers, and grade 4 students of one of the elementary schools in Serang City. The results of this study indicate that learning geometry by integrating the local wisdom of the Baduy tribe is very effective in the learning process, so that the learning media product in the form of geomatics cards that are made is ready to be used and implemented in the concept of the plane figure in elementary schools. This research is expected to contribute to education, especially in creating effective learning by integrating culture in mathematics learning in elementary schools.

Abstrak

Penelitian ini bertujuan untuk mengembangkan sebuah produk media pembelajaran yang memuat kearifan lokal suku Baduy. Metode yang digunakan dalam penelitian ini adalah studi etnografi untuk mengumpulkan data-data tentang bangunan suku Baduy yang memuat unsur geometri. Setelah data terkumpul, peneliti menggunakan metode instructional design research berupa model ADDIE dengan tujuan untuk membuat media pembelajaran dengan mengintegrasikan kearifan local Suku Baduy pada pembelajaran geometri berdasarkan kajian etnografi sebelumnya. Subjek dalam penelitian ini adalah masyarakat Suku Baduy, guru dan siswa kelas 4 salah satu sekolah dasar di Kota Serang. Hasil penelitian ini menunjukkan bahwa pembelajaran geometri dengan mengintegrasikan kearifan local Suku Baduy sangat efektif diterapkan dalam proses pembelajaran, sehingga produk media pembelajaran berupa kartu geomatika yang dibuat telah siap digunakan dan diimplementasikan pada konsep bangun datar di sekolah dasar. Penelitian ini diharapkan dapat memberikan kontribusi dalam dunia pendidikan khususnya dalam menciptakan pembelajaran yang efektif dengan mengintegrasikan budaya pada pembelajaran matematika di sekolah dasar.

Keywords: learning media, ADDIE model, ethnography, geomatics cards.

BACKGROUND

Mathematics has been accepted as an important component in formal education from ancient times until now (Raj Acharya, 2017), this is based on the fact that mathematics education has a real contribution to human life. According to Baykul (2009) that mathematics can be used to solve problems in science. Mathematics encourages students to think creatively and critically so that they can understand complex lives, for that reason, it is very natural that mathematics education is a subject that must be taught at all levels of education. The fact is that mathematics is still considered a subject that is very difficult for students to understand (Markovits & Forgasz, 2017) because mathematics is a deductive and abstract science that uses symbolic language and this is difficult for students to understand, especially in elementary schools where the developmental stages of thinking are not formal and relatively concrete (Widodo & Kartikasari, 2017). On this basis, it is imperative for a teacher to be able to encourage students to be interested in learning mathematics because it is one of the keys to success for them in understanding mathematics learning (Rellensmann & Schukajlow, 2017).

Teaching and understanding related to mathematics is an important concern in the education system in various countries (Guinocor et al., 2020), this is the reason practitioners and educators strive to create an effective mathematics learning system. In implementing learning, teachers need various components to achieve learning objectives, and one of them is learning media, this has also been explained in Permendikbud Number 22 of 2016 concerning the standard of elementary and secondary education processes that learning media is an integral

part of learning planning that must be prepared by the teachers. Learning media is a tool or equipment in the learning process, with this media the teacher can be helped in teaching, and students can also understand the subject matter delivered by the teacher (Syafitri et al., 2018). According to Manalu et al (2018) that the most important factor for achieving learning success is the use of learning media as teaching materials. The learning media used must be able to attract attention so that later students are more motivated and active in participating in the learning process. Learning media can help students learn abstract concepts so that it can improve student learning outcomes (Maharani & Dewi, 2015., & Widodo & Wahyudin, 2018).

The use of learning media must be able to be prepared by teachers in various subjects, especially in mathematics lessons in elementary schools, this is because mathematics is seen as a deductive and abstract science so that the role of the media is needed to make concrete abstract things, this principle is in accordance with what has been conveyed by Piaget stated that the development stage of elementary school-age children is still at a concrete operational stage, so that learning must be directed at things that are real and can also be imagined by students.

One of the most important materials studied in mathematics is related to geometry and measurement. Geometry is a branch of mathematics and is one of the learning materials in mathematics in elementary schools (Fauzi & Arisetyawan, 2020), students need geometric concepts to understand the nature and environment in which they live because it will help students to understand various situations in everyday life (Aktaş & Ünlü, 2017., & Iskrenovic-Momcilovic, 2020). Meanwhile, NCTM (2000) also states that

the goal of geometry taught in schools is so that students can use visualization, have spatial skills, and model geometry to solve problems. In the 2013 curriculum, the portion of geometry and measurement material is very large compared to other materials based on basic math competencies in elementary schools compiled by the Ministry of Education and Culture in Permendikbud number 37 of 2018 that the percentage of geometry material in elementary schools ranges from 40-50%. However, the fact is that teachers find it difficult to teach geometric concepts to students, not only that, even students also have difficulty understanding geometry material (Mainali, 2019), This is also explained by Hwang et al (2020) that students often fail to understand geometric concepts and problem-solving due to a lack of experience of applying geometric concepts in everyday life, so for that reason that improving students' ability to solve geometric problems has become an important problem that must be solved in mathematics education recently (Lin & Lin, 2018). In studying geometry, students should need a mature concept so that students are able to apply their geometric skills such as visualizing, recognizing various shapes and spaces, describing images, sketching shapes, labeling certain points, and the ability to recognize the differences and similarities between geometric shapes (Muhassanah et al., 2014).

Learning geometry should be taught using a context that is recognized by students in their daily lives, in this case, the context of learning mathematics, especially important geometry material is related to local wisdom, as for the local wisdom associated with the Baduy tribe so that learning does not only act as a transfer of knowledge but also as a transfer of value. According to Ascher (1994) that the study of mathematical

ideas in a group of traditional societies is part of a new venture called ethno mathematics. According to Powell & Frankenstein (1997), ethno mathematics invites us to see how mathematical knowledge is built throughout history in different cultural environments.

Various researches has explained learning media to teach the concept of geometry either using pictures or using technology, but there is still very little research that discusses local wisdom and mathematics learning especially on the concept of geometry to be taught. The research relevant to this research is that submitted by Fredy et al (2020) which discusses the Kandara (Papua) musical instrument as a learning medium for geometric concepts in elementary schools, the concepts presented are related to local wisdom in Papua. However, in this study, local wisdom which is used as the basis for making learning media is the Baduy tribe in Banten Province. So that the purpose of this research is how to make creative and innovative learning media based on the local wisdom of the Baduy tribe on plane figure material using the ADDIE model. The ADDIE model is included in instructional design research whose purpose is to help teachers ensure that they teach the appropriate material optimally (Cheung, 2016). The ADDIE model is a systematic learning design model that can be applied across various disciplines. So that the learning media developed is based on the steps in the ADDIE model and can be tested properly. This study can facilitate students to understand the concept of geometry in-depth because the context it teaches is very close and recognized by students in their environment, besides that the context of Baduy local wisdom is also a means of introducing culture to students. This study also provides an overview for teachers in developing

mathematics learning media by integrating the context of local wisdom on the concept of geometry, especially plane figure material in elementary schools.

METHODOLOGY

This research uses a qualitative approach, qualitative research was used to categorize a Baduy traditional house building concept so that it could be integrated into a mathematics learning medium, especially on geometry (plane figure) in elementary schools. qualitative research is interactive research in which the researcher is involved in continuous and participatory experiences, this involvement will lead to a series of strategic, ethical, and personal issues in the qualitative research process (Creswell, 2015).

This study uses 2 stages of research. The first stage uses the ethnographic method in order to collect data about the Baduy tribe. At this stage, the researcher explores the elements of Baduy culture that can be integrated into mathematics learning in elementary schools. At this stage, the ethnographic method that will be used includes interviews, observation, documentation, and field notes. The second stage, after exploring ethnographic studies related to Baduy house buildings, then continued with the design development method using the ADDIE model to develop plane figure learning media by integrating local wisdom of the Baduy tribe. According to Bell & Shank (2007) ADDIE is an instructional design model that has become the root of many other forms of instructional design models. According to Aldoobie (2015) the ADDIE model consists of five stages, namely analysis, design, development, implementation, and evaluation.

The ADDIE model stages can be seen in the image below.

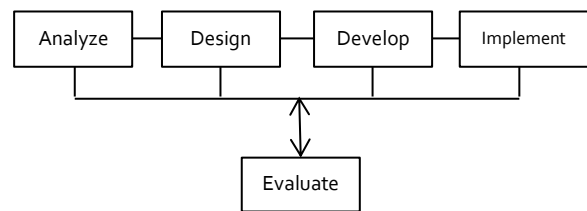


Figure 1. ADDIE Model Stages (Taylor, 2004)

The development of plane figure learning media by integrating the local wisdom of the Baduy Tribe, of course, has experienced 5 stages in the ADDIE model above so that the validity of the resulting product can be tested. The five stages that are undertaken are as follows, 1) analysis, the researchers conducted an analysis of the learning materials used in the learning process, the aim was to see how the conditions of the activities in the learning materials could form the image of students' concepts in understanding plane figure, 2) design, the researcher designs the learning media that will be used in the learning process, of course, the design stages are carried out based on the results of the analysis that has been done before, and at this stage, the concept of local wisdom of the Baduy tribe is integrated into a mathematics, 3) development, after doing the design, the researcher conducts a learning media development, at this stage, the researcher has also made learning media and a set of learning planning, 4) implementation, the researcher conducted trials on designs that had been made in the learning process, this was done to see a real picture of the influence of the media on students, so that various possible student responses could be seen at this stage, and finally the researcher got a real picture of the learning process that could be used as a evaluation, and 5) evaluation, the researcher evaluates the learning process that has been carried out and revises the learning media that may be deemed ineffective.

The subjects in this study were to explore in detail and obtain a description of the Baduy traditional house, furthermore the researcher also involved grade 4 elementary school teachers to ask questions related to the media used in the learning process that has been carried out, and ask for responses to the Learning media that are local wisdom to teach plane figure in grade 4, the two subjects are the source of data for researchers in developing initial products in the form of learning media for plane figure by integrating local wisdom of the Baduy Tribe.

The limitations in the preparation method are at the ADDIE model stage, to get a comprehensive and in-depth picture, the implementation should also be carried out in large-scale classes so that various responses can be seen in the learning process. These various responses will later become the basis for evaluation and revision of learning media.

RESULT AND DISCUSSION

Result

To get an initial picture in developing learning media that integrates the local wisdom of the Baduy Tribe, it is necessary to examine in detail how the traditional house of the Baduy tribe, the concept of this building which will later become the basis for the development of learning media to teach materials related to geometry, this is based on the building of traditional houses. The Baduy tribe has several plane figure constructions so it is very suitable for being a learning media. Linking the concept of learning with what is in the student environment is a must for teachers so that students can construct initial knowledge into the knowledge they will learn, this is of course in accordance with the principles of assimilation, accommodation, and

schemes described in Piaget's theoretical framework (Müller et al., 2015).

After the initial data was collected, the researcher conducted interviews with the teacher to see a real picture related to the implementation of mathematics learning, especially in plane figure material in schools, the topics asked were related to the use of media in teaching plane figure in grade 4 elementary schools and teachers' perceptions of media use by integrating local wisdom.

The results of the interview show that the teacher realizes that interesting learning media really helps students in understanding the subject matter, besides that by using local wisdom that is integrated with games, students will be enthusiastic about participating in the learning process, especially on plane figure materials, learning is also included in contextual. According to Hutagaol (2013) that contextual learning is rooted in constructivism, where students must construct the knowledge learned and give meaning through real experiences

The last stage, the researcher developed the learning method by integrating the local wisdom of the Baduy Tribe using the ADDIE model which consists of five stages, namely 1) analysis, the researcher analyses teaching materials in the form of student worksheets as a description of the learning process that occurs, so that researchers can find out what the things that are not yet contained in the teaching materials used in the plane figure material, the analysis used is based on the pedagogical philosophical theory of mathematics, which is related to psychical acts and mental acts that can form ways of thinking and ways of understanding. The formation of knowledge needs to be studied in a traditional relationship, namely mental acts-ways of understanding-way of thinking. This traditional model is the basis for the

emergence of new ideas and breakthroughs regarding the pedagogical definition of mathematics (Harel, 2008); 2) In design, the researcher arranges the learning media format which contains all the things that must be in the learning media, besides that the researcher also adds interesting and innovative material so that the learning media that the researcher creates can foster student interest in learning; 3) development, the learning media that researchers make are adjusted to the curriculum and what things must be in the learning media that will be developed by integrating them in the geo card game. The results of integrating the geo card game are validated by experts to determine whether the learning media that the researcher has made are appropriate and contain the values of local wisdom or not; 4) Implementation, at this stage the results of the development are applied in the learning process to determine their effect on the quality of learning including effectiveness, attractiveness, and efficiency. Implementation is applied to small groups to get a real picture of students and get input from the teacher as a revision in the last step, the findings obtained explain that learning by integrating the local wisdom of the Baduy tribe has a significant impact on the learning process, students who are usually bored and feel uninterested in learning mathematics turns into enthusiasm during learning, then students also show good results and understand the concepts taught, this is also in accordance with the opinion of Fredy et al (2020) that ethnomathematics helps students understand mathematical concepts well; and 5) evaluation, the researcher evaluates based on the results of the implementation that has been done before, the revision becomes the result of the development that can be applied in the learning process in the

classroom.

Discussion

Ethnographic Study of the Baduy Traditional House

Based on the results of observations, interviews, and documentation/literature studies and field notes, researchers obtained data about the Baduy traditional house as follows.

The traditional Baduy house or known as *Sulah Nyanda* is the residence of the Baduy community which is made of natural materials such as wood, rattan, and bamboo, and the roof is made of dried *Nipah* leaves. The manufacturing process is carried out mutually by the surrounding community without any compensation. To replace nails, the Baduy community uses ropes made of rattan to tie and wooden pegs to strengthen the building.

Along with the times, the Outer Baduy people who were already familiar with modern culture began to use nails. According to Mr. Iping, one of the residents of the village of Gajeboh stated that "*di dieu mah tos loba nu make paku jang nguatkeun pondasi na*", which means that there are already many who use nails to strengthen their foundations.

The traditional house of the Baduy tribe is in the form of a house on stilts. The bottom frame (pedestal) of the house uses stones so that the wooden supports are not easily rotten because it is directly in contact with the ground. The Baduy tribe uses stilt houses to avoid animals that can enter the house and so that the air inside the house feels cool. Inside there are three rooms which are partitioned using woven bamboo or the local community calls it a *bilik*. The three rooms are the living room (*tepas*), the kitchen (*imah*), and the room. The front of the house is usually called *sosoro*, while

the terrace at the front of the house is usually called *palupuh*.



Figure 2. *Suluh Nyanda, Baduy Traditional House* (Arisetyawan & Permana, 2020)

Learning Media Development Using the ADDIE Model

Based on the data that has been collected, the researchers developed a plane figure learning media by integrating the local wisdom of the Baduy Tribe through the ADDIE model stages, the results are as follows.

Analysis Phase

In the analysis stage, the researcher conducted an analysis of the student worksheets (LKS) used in the learning process, while the analysed theory referred to the philosophical-pedagogical theory of mathematics.

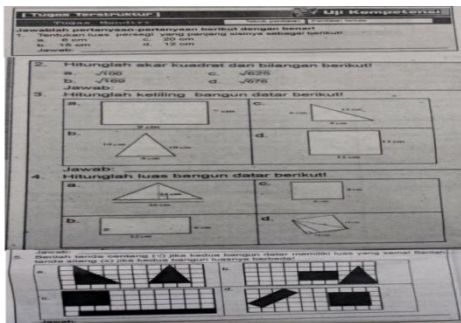


Figure 3. Student Worksheets

Physical acts are activities that are carried out using the physical to help form students' knowledge during the learning process, these activities can be in the form of throwing, lifting, and oth-

ers (Suryadi, 2018), however, in the student worksheets, there are no learning instructions that allow students to take action through physical, physical activities that are seen only as limited to doing questions or what students usually do in the learning process which does not actually form understanding to students.

Furthermore, the mental actions presented above do not affect the way of thinking (WoT) with certain mental characteristics, which then does not affect the way students' understanding (WoU) is formed in understanding axioms, definitions, theorems, proofs, problems, and solutions. the problem with what he is studying is related to the plane figure material. The mental activities presented above are only limited to memorizing formulas that they don't actually understand correctly so that their memories are only temporary, or according to Turmudi (2008) the degree of attachment can also be said to be low.

Design Phase

The design of mathematics learning media on plane figure material by integrating geo card games is based on the results of preliminary observations and needs analysis that has been compiled. This stage includes compiling a lesson plan implementation, drafting the geo card modification concept, and making evaluation tools.

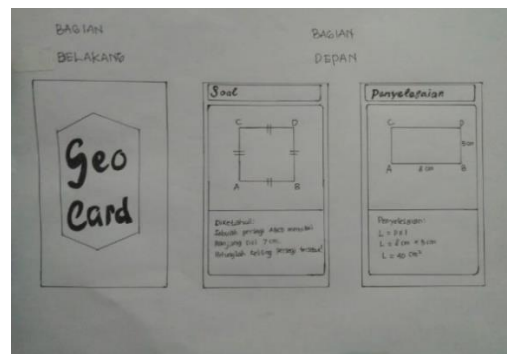


Figure 4. Learning Media Design

In addition, researchers also conducted an analysis of the basic competencies in the 2013 curriculum, the results of this analysis became materials in designing learning that was in accordance with the expected goals. The media development design has met educational requirements which include the accuracy or suitability of learning media with the goals or competencies that have been set and must be achieved by students according to the applicable curriculum (Asyhari & Silvia, 2016). The material in the basic competencies developed in grade 4 is about the properties of regular and irregular polygons and determining the perimeter and area of a plane figure.

Development Phase

In this stage, everything that has been designed is then developed by the

researcher as material for trials in schools. This stage is to integrate local wisdom objects that have been obtained in the first stage using ethnographic principles into learning media using the AD-DIE model.

In the picture above, the development of learning media allows students to convert their knowledge into knowledge that is in accordance with scientific conception, this learning media involves iconic-symbolic stages so that abstract elements that are initially difficult for students to understand can be explained with media in the form of geo cards which is equipped with a picture. This certainly minimizes the form of mathematics learning materials and media that students usually find in the form of symbols that sometimes students do not understand. The concept built in this

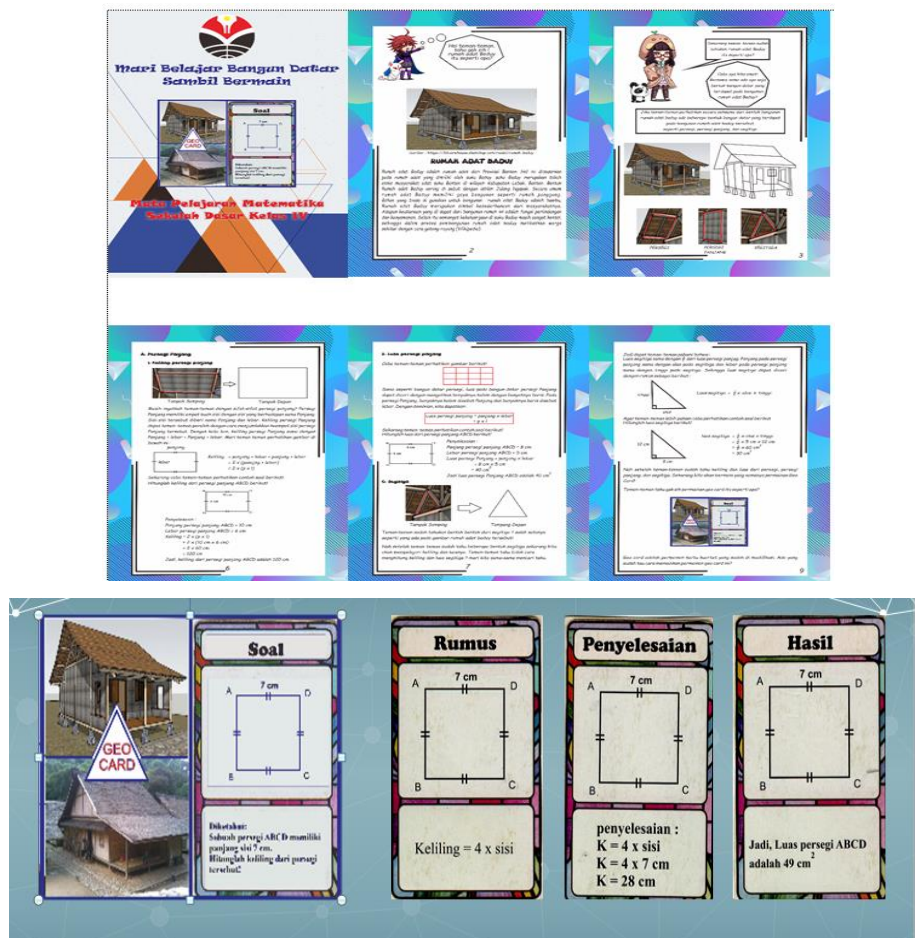


Figure 5. Learning Media Development

learning is how to build knowledge that is actively acquired by students, and this is in accordance with the opinion expressed by Bruner (Buto, 2010) that learning is about maintaining and transforming information actively.

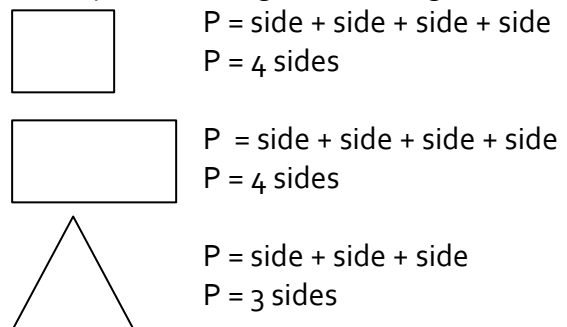
Implementation Phase

At this stage, the researcher conducted a learning media trial in one of the elementary schools in Serang City. In this activity, the researcher instructed students to observe the media of the Baduy traditional house image. After that the researcher asked "*anak-anak siapa yang tau gambar apakah ini? (kids, who knows what picture this is?)*" and the children answered with the spirit of "*Rumah Adat Baduy Pak (Baduy traditional house, sir)*". Then the researcher informed that the media used on that day were pictures of Baduy traditional houses and geo card games. The researcher asked the students about the meaning of the Baduy traditional house, and the children simultaneously did not know the answers to the questions that the researchers asked. The researcher instructed the students to read the teaching materials for 5 minutes. After that, the researchers began to provide material about the perimeter and area of a plane figure. Students respond by focusing on paying attention to the front of the class, the researcher invites students to identify the parts that are in the Baduy traditional house building, then relates them to the concept of plane figure.



Figure 6. The Integration of Traditional Baduy Houses in Geometric Concepts

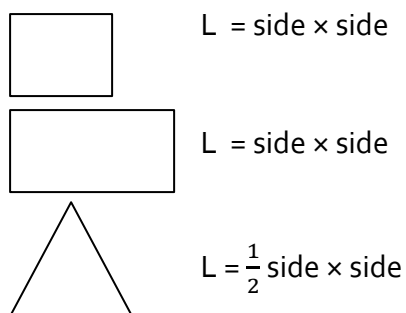
The first, students are stimulated to analyse related to the perimeter, some students are mistaken and even confused with the concept of area, this error was also found in research (Fauzi & Arisetyawan, 2020) that students sometimes confuse the formula for the perimeter of a plane figure, this is because the concept of the material is not fully understood by them, but after being given a stimulus that the perimeter is the length of the outer side of the shape, the students can understand the concept of the perimeter in a square, rectangular or triangle.



In this concept, students are usually more directed to the concept of memorizing rather than building their own knowledge. In fact, many students think that how to find the perimeter of a square and a rectangle has a different concept because they only memorize that the formula for finding the perimeter is 4 sides ($K = 4s$), while finding the perimeter of a rectangle is 2 length plus 2 width ($K = 2p + 2l$), even though both have the same concept.

Likewise, when students determine the formula for the area of a plane figure,

students also experience difficulties, this is where the role of scaffolding is given. According to Baxter & Williams (2010) Scaffolding is giving a number of assistance to students during learning, then reducing the assistance and giving students the opportunity to take over the responsibility to be able to do it independently. The researcher stimulates students that area is part of the shape, so that they find the concept of how to find area is as follows.



Because the rectangle has different side lengths, the researcher explains that the longest side is called the length, and the shortest side is called the width. So they realized that the area of a rectangle is the length multiplied the width ($L = p \times l$). Whereas in the triangle concept, students find that the triangle is half of a square. The two things that are contained in a triangle are the base and the height, so the area is half the base multiplied the height ($L = \frac{1}{2} a \times t$).

After the concept was built, the learning process is continued with group learning. Each group consists of 5 people. After that the researchers explained how to play the geo card game.



Figure 7. Students Playing Geo Card

In the initial process of playing the geo card game students still have difficulty playing it because it is the first time students play this game, after several times, students begin to feel used to playing the geo card game.

Student response to the learning process was very enthusiastic. When learning uses media that can attract students' interest in learning, students will respond well to learning and be active in class. So that learning becomes fun and not boring.

In game activities involving social interaction with the environment, and the interaction process runs well, in this game it also involves a didactic contract, according to Brousseau in Suratno (2016) that this didactic contract regulates social responsibility that underlies the devolution process, namely transferring problem solving from teachers to students, of course the teacher acts as a supervisor who sees how the didactic contract works properly, if the didactic contract does not work well then the teacher can take over to rectify this.

The use of media in learning has an impact on the learning process, and it is also widely explained in various studies that there is a positive influence on the use of media in learning with student learning outcomes (Batubara, 2015; Elpira & Ghufon, 2015), this is because the learning media acts as an attractive

learning tool to convey information (Capuno et al., 2019). In addition, the application of a culture-based learning model is considered very important to be able to develop the positive character of students that reflect the cultural values of the nation while improving the cognitive aspects of students (Arisetyawan et al., 2014).

Evaluation Phase

In this stage, the researcher carried out 2 main activities including reflecting on the implementation and revision of learning media. Reflections on the implementation of researchers describe the obstacles faced in the trial process.

In the implementation reflection stage, the researcher described the obstacles faced when testing learning media in one of the elementary schools in Serang City. The obstacles faced include the finding of the wrong formula in the learning media, students tend to scramble and want to play how to use cards, the learning time is lacking. However, on the positive side, with the new learning media introduced to students in the form of the use of geo math cards, students also tend to be more enthusiastic about learning plane figure materials compared to using the lecture method in general. This is because, in addition to learning, they also feel that they are playing so they don't get bored. Student responses are also very positive towards learning, this can be seen from the picture below.

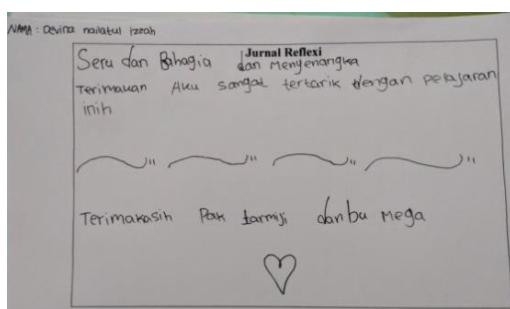


Figure 8. Student Reflection

Furthermore, the Learning media that have been implemented are then revised again, while the part that is revised is the wrong formula, the editorial of sentences in questions that are deemed too long and difficult for students to understand, and the card design to make it more interesting in the future.

CLOSING

Conclusion

From the research that has been carried out, the learning media tools that are interesting in the learning process are very helpful for students in understanding the concepts taught by the teacher on the plane figure material. Teaching tools that are integrated with the content of local wisdom in general or the Baduy community in particular, also remind students of the importance of preserving the values of local wisdom which are very diverse in Indonesia. The learning media that have been developed in this study are of course ready to be applied in the learning process.

Suggestion

This research is expected to make a real contribution to education, especially in creating the right formula in teaching the concept of geometry (plane figure) in elementary schools, the results of this study are also a reference for various parties in developing plane figure learning media by integrating local wisdom in the mathematics learning process in elementary school. So it does not rule out this media can be perfected for the better.

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