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# Didactic Design of Sundanese Ethnomathematics Learning for Primary School Students

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**Abstract.** This paper aims to optimize Sundanese ethnomathematics learning by improving the creative thinking ability of mathematics, geometry thinking, and algebra of primary school students. Teaching materials prepared by qualitative research, the didactical design research method. The research subject which used in the learning obstacle test is the fifth-grade primary school students with a total of 71 students. The Initial design didactic and revised design didactic, four-grade primary students with a total of 32 students. The resulting research Sundanese ethnomathematics learning by using a Sundanese cultural board and engklek games can optimize the creative thinking ability of mathematics, geometry thinking, and algebra of primary school.The results achieved in the initial didactic design used the design of Sundanese ethnomathematics learning in refining geometric thinking, creative thinking, and algebra thinking and almost all of which relate to predictions. The revision of didactic design was organized in accord with the initial didactic design which is not optimal. The research of the revision of didactic design was also constant to use Sundanese ethnomathematics learning and modified to indicators of thinking ability of mathematical geometry of creative thinking and algebra thinking. The outcome achieved on the revision of didactic design uses ethnomathematics learning in refining the ability to geometric, creatively and mathematical algebra thinking of students has already been in accord with predictions.

**Keywords:** Sundanese; Ethnomathematics Learning, Didactic Design.

## 1. Introduction

Mathematics learning is usually less putting students to be more active than teachers. Based on the research of Supriadi (2017) on the analysis the mathematical thinking process of primary school pre-service teachers, primary teaching education students, and primary school students have similarity, that is they like the routine mathematical thinking process and vertical thinking process or the traditional logical thinking process and mathematical by collecting and using relevant information. Other findings regarding the ability to think accordingly (Bulut& Bulut , 2012), the results of this study reveal the need for an assessment about development pre-service elementary mathematics teachers through their geometric thinking levels.

So that there is a change in the direction of high-level mathematical thinking it is necessary to improve the creativity of teachers, students, and teaching materials in learning mathematics. Mathematical creativity can be viewed as a necessary vehicle to foster an equitable learning environment for all students (Kozlowski & Si, 2019).

The creativity of mathematics learning in primary school can be done by using culture-based learning, one of them is Sundanese ethnomathematics learning. Mathematical concepts based on cultural perspectives allow students to not only reflect and appreciate their own culture, but also the culture and traditions of others. The involvement of members of the community is an essential part of the integration of cultural components into mathematical activities. (d'Entremont, 2015).

The concept of Sundanese ethnomathematics according to Supriadi (Supriadi, 2018) is all activities of one's ideas based on a view of Sundanese culture which developed through the mathematical thinking process, by viewing that mathematics is a cultural product.

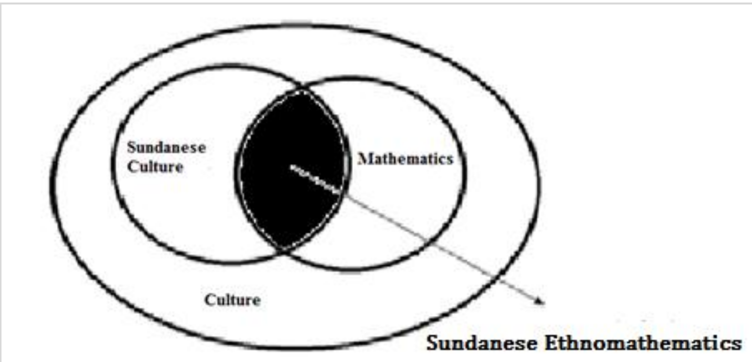



**Figure 1. Sundanese Ethnomathematics Concept**

Sundanese ethnomathematics learning can be used in improving the mathematical thinking process of primary school because this learning prioritizes the mathematical thinking process of students. The ability of mathematical thinking of primary school, which will be developed through this learning is relatively new to be studied by using the Sundanese cultural context as students' thinking idea. Thinking skills to be studied is the ability to think creatively in mathematics, geometry thinking, and algebra. The reliability of learning ethnomathematics by using culture, according to the findings of Achor, Imoko, & Uloko (2009) that learning the geometry of students who learn with ethnomathematics is superior.

Creative thinking contains the aspect of cognitive, affective, and metacognitive skills. The cognitive skills include the ability to: identify problems and opportunities, make good and different questions, identify relevant and irrelevant data, productive problems and opportunities, generate many ideas (fluency), different ideas (flexibility), and new products or ideas (originality), examine and assess the relationship between choices and alternatives, change old mindset and old habits, develop new relationship, expand and update plan or idea. (Puccio, Mance & Murdock, 2010).

In the field of geometry required the ability to think geometry based on Van Hiele theory. Van Hiele reveals five levels of geometry thinking that is 1) visualization; 2) analysis; 3) informal deduction; 4) deduction; 5) rigor (Mason, 2009).

The geometry thinking model proposed by van Hiele can be used as a guide for identifying the ability of primary school students in geometric material. To overcome barriers in learning mathematics concepts, then a teacher who has functioned as a facilitator in the learning process should be able to design instructional materials in accordance with the student's condition and student's environmental situation. The teacher must choose a proper way or learning approach to apply in overcoming learning obstacles. Algebraic thinking ability according to Kriegler (Kriegler, Gamelin, Goldstein, & Chan, 2007) has two primary components in algebraic thinking, which deal with the development of mathematical thinking devices, and the study of basic algebra ideas. Mathematical thinking devices are analytical thinking habits, problem-solving skills, reasoning skills, and representational skills. The idea of basic algebra is a domain where mathematical thinking devices can be developed, which is a subject matter related to algebra.

The purpose of this study is to optimize teaching materials in accordance with the characteristics of learning Sundanese ethnomathematics. Teaching materials are designed in accordance with indicators of creative thinking ability of mathematics, geometry thinking, and algebraic thinking which will be developed. Teaching materials that will be composed, contain the Sundanese cultural context which developments in learning.

## 2. Theoretical Framework

To understand creativity, (Woodman, Sawyer, & Griffin, 1993), (Mumford, Watego, & Baturo, 2005). **First**, creativity as a person illustrates the individual with his/her unique thoughts or expressions. **Second**, creativity as a product is original, new, and meaningful creation. **Third**, creativity as a process of reflecting skills in thinking includes fluency, flexibility, originality, and elaboration. **Fourth**, creativity as a press is an internal or external condition that encourages the emergence of creative thinking.

Guiford (1967) explains that there are five characteristics of creative thinking ability as follows:

1. Fluency, the ability to produce many ideas.
2. Flexibility, the ability to express a variety of solutions or approaches to problems.

3. Originality, the ability to trigger ideas in genuine and not cliché ways.
4. Elaboration, the ability to describe something in detail.
5. Redefinition is the ability to review a problem based on a different perspective of what has been there before.

The ability to think geometry in learning mathematics is developed from Van Hiele's thought. There are three main elements in the teaching of geometry namely time, teaching materials, and teaching methods that applied. According to Van Hiele, there are five steps for students in learning geometry, that is the introduction, analysis, sorting, deduction, and accuracy stages. Stage 1. Introduction. Students start learning to recognize an overall geometry building. Stage 2. Analysis. Students have familiar with the features of the observed geometry buildings. Stage 3. Sorting. Students can sort geometry buildings, the one with the other which interconnected. Stage 4. Deduction. Students are able to draw an inference deductively, that is, from general to specific. Stage 5. Accuracy. Students have begun to realize how important the precision of the basic principles that underlie proof (Wilson, 1990), (Mason, 2009).

According to (Kriegler, Gamelin, Goldstein, & Chan, 2007), Carpenter, Franke, and Levi (2003) there are two main components in algebraic thinking that are related to 1) the development of thinking devices and 2) the study of basic algebra ideas. Mathematical thinking devices are analytical thinking habits, problem-solving skills, and representational skills. The idea of basic algebra is a domain where mathematical thinking devices can be developed, such as subject matter which related to algebra. Algebraic thinking is a particular way of thinking, including analyzing the relationship between quantity, paying attention to structure, studying change, generalizing the problem solving, modeling, justifying, proving, and predicting.

Ethnomathematics was conceived for the first time by D'Ambrosio in 1985 and Nunes in 1992 (d'Ambrósio, 1985, 2006).The definition of ethnomathematics derives from the word ethno, which refers to a social-cultural context that consists of language, jargon, codes of behavior, myths, and symbols. Mathema means explaining, knowing, understanding activities such as encoding, measuring, classifying, summarizing, and modeling. Tics mean technique, in other words, ethno refers to group members within a cultural environment which identified by their cultural traditions, symbol codes, myths, and specific ways that used to think and to infer (Rosa & Orey, 2007)

Based on the study of Supriadi (2017) a study of mathematics used the Sundanese culture as an idea of thinking and by viewing mathematics as a cultural product, it can be composed of a concept of ethnomathematics learning. The concept of Sundanese ethnomathematics according to Supriadi can be defined as all activities a person's ideas based on the Sundanese cultural view (Sundanese cultural values) which developed through mathematical thought processes, by seeing that mathematics is a cultural product. The concept becomes a reference in learning of Sundanese ethnomathematics, this learning develops the concept of contextual learning so that in the process many use the main component of contextual learning. Learning ethnomathematics can be begun by (constructivism on Sundanese culture which will be studied, (2) asking about Sundanese culture, (3) finding a Sundanese cultural link with mathematical ideas, (4) learning community of Sundanese, (5) mathematical modelling featuring Sundanese culture, (6) reflection in studying Sundanese culture, (7) authentic assessment.

a. Constructivism: Students construct knowledge and feed through real experience. The lecturer or teacher chose cultural aspects which one to choose so that it can help students more quickly and easily understand the concepts described.
b. Asked: Digging information, inform what is already known, and led to the aspect of the unknown.Students who do not have a culture referenced trouble to ask, precise and purposeful. Lecturer or teachers must explain why he took certain cultural aspects or elements, to debunk, in a culture of equality issues.
c. Search: Knowledge and skills are the result of finding themselves, not the result of the fact, lecturers/teacher should be able to design learning experiences that refer to events find themselves Lecturers/Teachers should be able to choose the relevant culturally so that learners cannot find itself the substance of learning materials. Lecturers/Teachers should be able to integrate elements of the culture so that learning becomes meaningful.
d. Learning Together: There are groups studying heterogeneous (plural). How to empower learners who are smarter to guide the less able, pushes the sluggish, which had bold ideas.Lecturers/teachers and students strive to develop campus culture, equality, and justice pedagogy, as well as unity in diversity and how to create unity, without losing its identity in diversity
e. Modeling: Learning the skills or knowledge of the particular model. Students are able to solve the problem can be presented as a model of learning. Lecturers/Teachers find examples of local culture to be displayed as a problem-solving model in learning. Students can find examples of participation in society (civil society).
f. Reflection: How to think that reveals something of a learning experience to respond to things that are new. Ability to preview and predict, and integrating them with new ones. Students can reflect ethnomathematics learning experiences related to the topic or theme of learning who introduced the lecturer/teacher. Lecturers provide a stimulus to a reflection that occurs inthe culture of students. Lecturers/teachers can instill the concept of a new culture so that it integrates with the concept of culture that has been owned by the learners (enrichment, renovation, and integration).
g. Authentic Assessment: An overview of student learning progress drawn from real activities, both inside and outside the classroom.Lecturers or teachers can explore the development of students to show the conditions that have been integrated with their cultural treasures are still separated from each other, or even against each other. Lecturers or teacher takes an individual approach inside or outside the classroom with various forms of assessment of students.

Learning steps Sundanese ethnomathematics learning (Supriadi, 2018) is as follows:

a. Activities Introduction, lecturers deliver ethnomathematics Sunda learning, rules, tasks that will be given, and assessment. Lecturer/Teacher gives apperception by asking oral questions to the student/teacher to explore starting capabilities related to mathematical concepts to be learned.

b. Core activities
   1. Teachers from groups of 4-5 students
   2. The teacher gives each student worksheet on the contextual issues that will be discussed Sundanese culture.
   3. One of the students reads a cultural issue in worksheets and other students noticed.
   4. A teacher asks students the things that have not understood related problems on worksheets that will be done.
   5. Students understand the materials on the worksheet before discussing them with other group members.
   6. Students then resolve the issue independently. The results were then discussed together in the group.
   7. Teachers provide assistance to groups who have difficulties when students solve problems on worksheets.
   8. The results of the work of students in the group were then interpreted in front of the class. Each group presents their work (mathematical models) in rotation.
   9. When a student writes his work on the board, members of the group and other groups to observe and compare the results of each work.
   10. The teacher asks the other groups to write answers on the board if different from the answers that have been presented, then a lecturer lead the class discussion
   11. Another group (in addition to presenting) to respond to what is being presented, helpful answer if necessary, and add to the answers. Renderer groups respond and answer questions from students or from other groups.
   12. During the discussion, the teacher acts as a facilitator and moderator of the discussion so that students can discover and construct related knowledge considered a problem.
   13. Teachers with students to reflect, analyze and re-examine the process of mathematical learning activities that have been presented.
   14. If the process is a correct understanding of mathematical concepts, the teacher then asks questions to students, for example: "What if? Is there another way? Of the three answers, which is more efficient? Why? "
   15. The end result is a discussion of students' perception of the concepts contained in the issues discussed can be applied in order to complete the practice questions.

c. Closing activities

1. The teacher reviews the mathematical concept that has been studied, then directs the student to make a summary of learning materials that are considered important.
2. Teachers remind students about the importance of maintaining and preserving the values of the Sundanese culture in everyday life and the importance of learning math by Sundanese culture.
3. The teacher provides information about the next learning material information and said that the next meeting will always be given problems to work in groups and one member of the group will come forward to class. Each student must prepare.
4. Teachers provide practice questions to do at home individually. Results collected homework, graded and returned to students.

This learning was made with the aim to preserve the Sundanese culture from extinction. Elements of culture that can be used as media in this learning are the language, knowledge, equipment technology, art, livelihood, religion, kinship, social organization.

The purpose of this study is to optimize teaching materials in accordance with the characteristics of learning Sundanese ethnomathematics. Teaching materials are designed in accordance with indicators of creative thinking ability of mathematics, geometry thinking, and algebraic thinking which will be developed. Teaching materials that will be composed, contain the Sundanese cultural context which developments in learning.

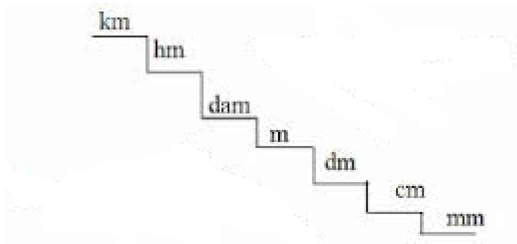
## 3. Method

This research used qualitative research, the didactical design research (DDR) method in the making of learning materials of Sundanese ethnomathematics learning by improving the ability to think mathematically creatively, geometrical thinking, and algebra of primary school students. DDR is a method developed by Suryadi (2010, 2013) that consists of three stages, that is: 1) Didactic Situation Analysis (DSA); 2) Metapedadidactis Analysis (MA); and 3) Retrospective Analysis (RA). Data collection techniques in this study, first learning obstacle test, initial didactic test, revision of the didactic design, interview, and observation. The learning obstacle test was given to make didactic design after data are obtained and conducted an analysis of student answers that is before the tested, the researchers make predictions of answers that are divided into three kinds: in accordance with the prediction, some appropriate to predictions, not appropriate to predictions. The research subjects used in the learning obstacle stage are the fifth-grade primary school students from two schools in Serang City, Banten with a total of 71 students. After obtaining Learning obstacle data, then continued on the initial didactic design stage of compiling a student worksheet which adapted to Sundanese ethnomathematics learning, the design stage of initial didactic (IDD) of the fourth-grade students in a primary school A in the Serang City with a total of 16 students. After the initial didactic design obtained a revised learning obstacle by reconstructing a students' worksheet and revision of didactic design (RDD)using the fourth-grade students in primary school B in Serang city with a total of 16 students. The total number of all IDD and RDD is 32 students.

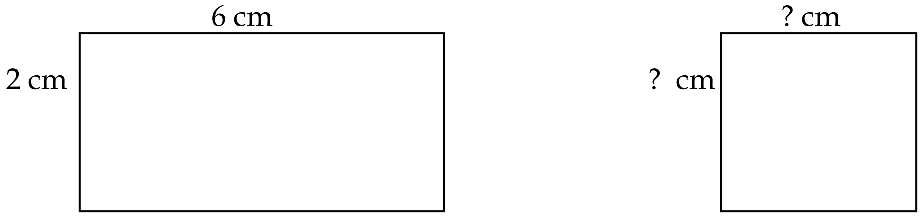
**3.1 The obstacle learning test instrument:**

**3.1.1 Creative Thinking Ability Test**

1. How to determine the measurement results of 1 km in hm, dm, m, dm, cm, and mm?



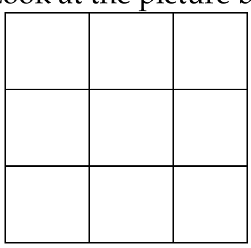

2. Azka made a rectangle with a length of 6 cm and a width of 2 cm, try to make a rectangle that has the same area as the rectangle made by Azka?




**3.1.2 Geometry Thinking Ability Test**

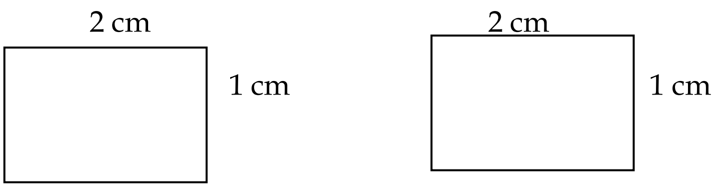
1. How many sides and lines are there in the flat shape below?

2. Look at the picture below!



Tasya has a square picture. Each side of a square is 4 cm. Rina wants to count the number of squares in the picture. What is the sum of all the squares in the picture above?

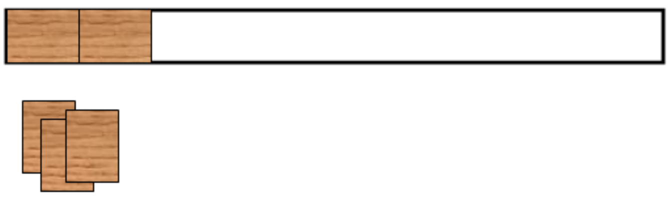
3. Azka has two rectangles with a length of 2 cm and a width of 1 cm, how do you arrange the two rectangles to make a square and new rectangle?




**3.1.3 Algebra Thinking Ability Test**

1.Tasya calculates the measurement result of 21 hm + 100 dam = 3000 m, Is Tasya's answer correct?

2. There is a track with a length of 4 meters. How many boards with a size of 20 cm can be arranged along the path?



## 4. Results and Discussion

### 4.1 Learning Obstacle Data

After doing research, the first step is to identify the learning obstacle on the concept of length units and flat building. It is done by giving learning obstacle questions to the fifth grade students  from the results of learning obstacle tests that have been done in some primary school, it is obtained the learning obstacle on the concept of length units and flat building that then can be divided into three, namely learning obstacle related to the concept image in length units and how to calculate it; learning obstacle related to rectangle and square; learning obstacle solves problems related to rectangle and square.

Learning obstacle that appears on the concept of the image on length units and how to calculate it is caused by the ontogeny factor as well as learning obstacles related to rectangle and square by ontogeny factor. Meanwhile, learning obstaclesto solve the problem related to the rectangle and square are caused by ontogeny and epistemology factors (Jatmiko, Herman, and Dahlan, 2017).

Student responses after being given a problem at the learning obstacle stage.

**Table 4.1 Student Responses to Obstacle Learning Questions on Creative Thinking Abilities**

| Subject | Problem Number | All according to predictions | Partly as Predicted | Not according to predictions |
|---|---|---|---|---|
| Primary School A | 1<br>2 | 0<br>0 | 1<br>11 | 15<br>5 |
| Primary School B | 1<br>2 | 29<br>10 | 4<br>0 | 22<br>17 |

**Table 4.2 Student Responses to Obstacle Learning Questions on Geometry Thinking Abilities**

| Subject | Problem Number | All according to predictions | Partly as Predicted | Not according to predictions |
|---|---|---|---|---|
| Primary School A | 1<br>2<br>3 | 0<br>0<br>0 | 8<br>12<br>5 | 8<br>4<br>11 |
| Primary School B | 1<br>2<br>3 | 0<br>4<br>4 | 25<br>9<br>16 | 30<br>42<br>35 |

**Table 4.3 Student Responses to Obstacle Learning Questions on Algebra Thinking Ability**

| Subject | Problem Number | All according to predictions | Partly as Predicted | Not according to predictions |
|---|---|---|---|---|
| Primary School A | 1<br>2 | 0<br>0 | 5<br>0 | 11<br>16 |
| Primary School B | 1<br>2 | 10<br>6 | 32<br>14 | 13<br>35 |

**Table 4.4 Findings of Types of Learning Obstacle**

| No | Difficulties identified | Types of learning obstacle |
|---|---|---|
| 1 | Obstacle learning related to the concept image of length units and how to calculate them | Ontogeny |
| 2 | Obstacle learning related to the shape of square and rectangular shapes | Ontogeny |
| 3 | Obstacle learning solves problems related to square and square rectangular shapes | Ontogeny and epistemology |

Learning obstacle on creative thinking Ability:

a. Learning obstacles related to the concept image of length units and how to calculate them.

The questions are given to determine the measurement results of the unit of length to measure the ability to think creatively on fluency indicators (many ideas). According to Gagne's theory (Erlinda, & Surya, 2017), there are 8 types of learning, ranging from simple to complex, namely: sign learning, response stimulation, movement sequence, verbal sequence, learning to differentiate, learning concepts, learning rules, and problem-solving. One of the types of learning according to Gagne: is to learn concepts, in this problem, students must understand how to determine the measurement results in long units with creative thinking. A learning obstacle derived from the ontogeny factor is the barrier of learning that caused by a lack of mental readiness of students in facing the learning process. Here is one of the examples:

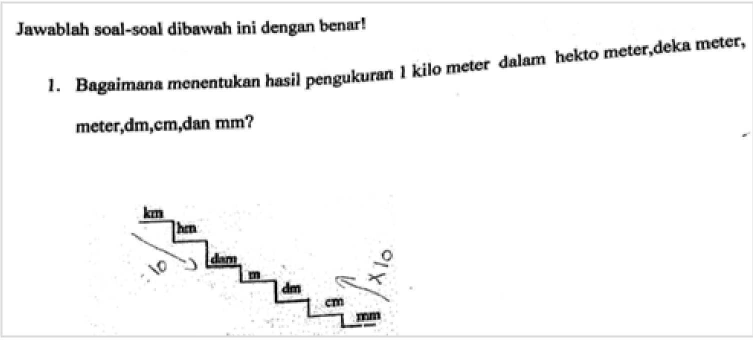



**Figure 2. Learning obstacle 1**

From the learning obstacle question above students experience a concept error on the length unit. And from the learning obstacle can be seen from the student's answer, there is a reversed concept to rise multiply 10 and down divided by 10, but it must be rise divided by 10 and down multiply 10. There are also some students who do not answer the question. This is due to a lack of mental readiness of students learning or called ontogeny factor, students have not fully understood how to determine the result of the long unit. Students' difficulties in studying unit lengths are similar to the findings of Clements, Battista, Sarama, Swaminathan, & McMillen, 1997).

A Learning obstacle caused by the epistemology factor is the time when students have limitations on a concept of knowledge. Here is one example of a learning obstacle caused by epistemology factor:

a. Learning obstacle solves problems related to building square and square rectangles

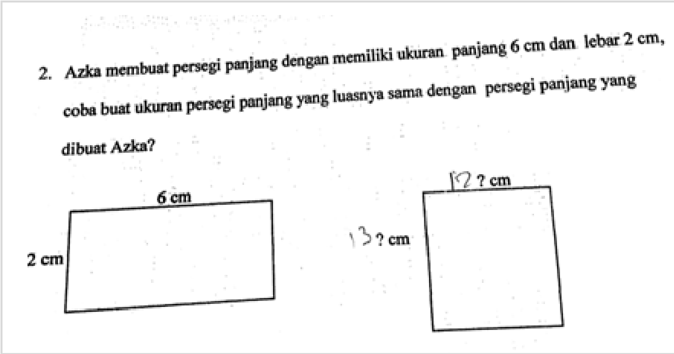



**Figure 3. Learning obstacle 2**

From the learning obstacle example above students have difficulty in understanding the intent of the given question. The intention of this question is in order students think creatively by trying to make a rectangle that is the same width as the given example. Students are not accustomed to questions that are different from what they see. And it means that they are disabling to apply a concept to the problems which presented or in learning obstacle analysis, it can occur due to factors derived from epistemological factors such as where the students have concept limitation of knowledge.

Learning an obstacle to Geometry thinking ability:

Learning Obstacle related to the square and rectangular shape. The questions given to determine the level of geometry thinking about level 0 are visualization or recognition. According to Brunner's theory (Takaya, 2008), there are stages of children learning mathematics, namely successive, iconic, and symbolic stages. At this stage students are at the iconic stage, namely understanding the concept of a shadow image. Students are still having difficulty recognizing the shape of a simple flat figure as shown below:

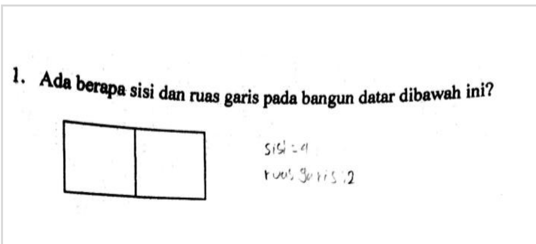



**Figure 4. Learning obstacle 3**

Student responses to this problem can be seen when answering the number of sides and line segments in the drawing provided. Students have difficulty distinguishing sides and line segments. This happens because students do not yet understand about the line segments and their normal sides only know the sides only. From the results of this learning obstacle, it can be seen that students experience difficulties due to ontogenic factors (mental readiness of student learning), which means that learning constraints are caused by the lack of students' mental readiness in facing the learning process.

2) Learning obstacle solves problems related to building data square and square length

The learning obstacle that appears on the concept of this flat figure is related to the properties of the simple flat figure. Questions are given to determine the level of geometry thinking at the analysis stage. At this level, students recognize geometric shapes based on the characteristics of each of these shapes. In other words, at this stage students analyze the parts that exist in a form and observe the properties they have by calculating the number of flat shapes from the images provided. According to Brunner's theory (Takaya, 2008), there are stages of children learning mathematics, namely successive, iconic, and symbolic stages. At this stage students are at the iconic stage, namely understanding the concept of a shadow image. Students are still having trouble solving problems related to square and rectangular shapes like the picture below:

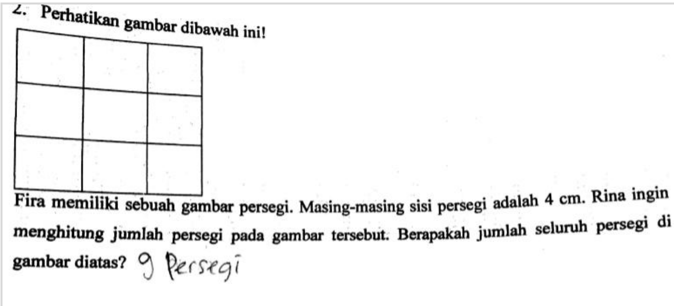



**Figure 5. Learning obstacle 4**

In this problem, students are asked to count the number of square flat shapes in the drawing. Many students answered because they only counted small squares did not see the whole number of squares. Based on the picture students only know that the same shape does not see the whole. Because of the limitations of this concept students answer the number of square shapes built there are 9. Students are not familiar with the questions that are different from what they see. And it means that they have not been able to apply a concept to the problem presented or in the analysis of learning obstacles it can occur because of factors derived from epistemological factors such as where students have limited concepts to knowledge. Furthermore, it is still about learning obstacle solving problems related to geometrical and rectangular data building on geometrical thinking but on different indicators, namely the deduction stage in this problem students are asked to understand the relationship between one character with another in a building. Students are still having trouble solving problems related to square and rectangular shapes like the image below:

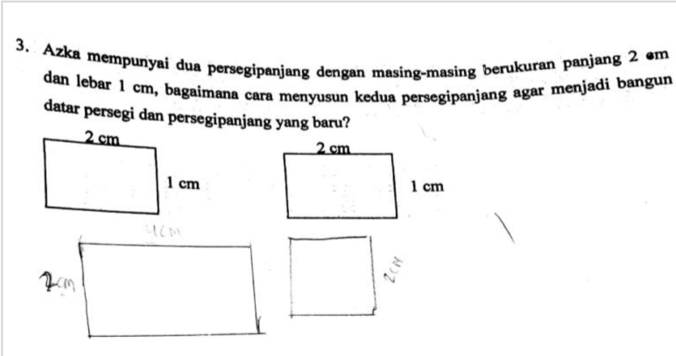



**Figure 6. Learning obstacle 5**

In this problem, students are asked to arrange the two rectangles into square shapes and rectangular shapes, to find out the relationship between square shapes and rectangular shapes. In these questions, students do not understand the purpose of the questions given. They already know the concept of shapes from rectangles and rectangles but when given different problems they still have difficulty. And it means that they have not been able to apply a concept to the problem presented or in the analysis of learning obstacle it can occur because of factors derived from epistemological factors such as where students have limited concepts to knowledge.
Learning Obstacle on Algebra Thinking Ability

a. Learning obstacles related to the concept image of length units and how to calculate them.

1. Tasya menghitung hasil pengukuran 21 hm + 100 dam = 3000 m, Apakah jawaban Tasya benar? Tidak

**Figure 7. Learning obstacle 6**

In these questions, the average student only answers yes or no without including the reason for answering like that. This happens because students still do not understand how to calculate length units. They only answer with logic with the usual sum of 21 + 100 not possible 3000, not counting first by changing the units of length. From the results of this obstacle learning, it can be seen that students experience difficulties due to ontogenic factors (mental readiness of student learning), meaning that learning obstacles are caused by the lack of students' mental readiness in facing the learning process.

b. Learning obstacle solves problems related to building square and square rectangles

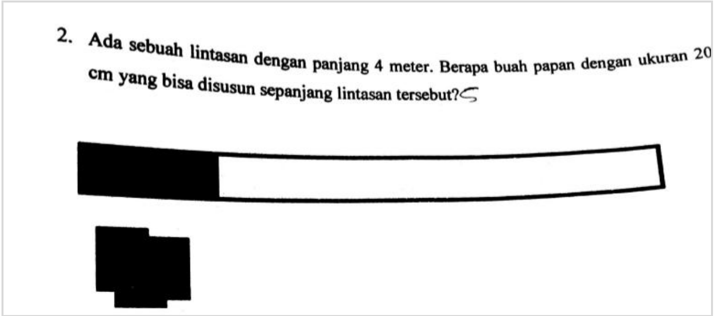



**Figure 8. Learning obstacle 7**

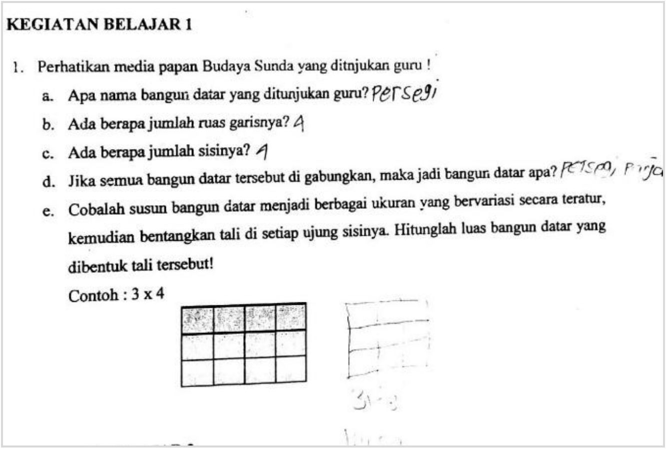
In these questions, students are still having trouble understanding questions to solve problems with problems. The average student divides 20 by 4, the result of which is 5. Students do not convert 4 meters to centimeters first. Because of the limitations of this concept students answer like that. Students are not familiar with questions that are different from what they see. And it means that they have not been able to apply a concept to the problem presented or in the analysis of learning obstacles it can occur because of factors derived from epistemological factors such as where students have limited concepts to knowledge.

### 4.2 Initial Didactic Design (IDD)

An understanding of the shape of square and rectangular flat shapes of the Sundanese culture board media. The positive influence of learning mathematics using cultural media has been proven by Matthews, Watego, Cooper, & Baturo, (2005). In this learning activity to improve the ability to think geometry by using the Sundanese board media situation when working on the first worksheets in a didactic situation familiar with flat builds is quite conducive, the teacher guides students if they have difficulty. The following is the form of media for Sundanese culture boards.


**Figure 9. Early Didactic Design Phase Activity**

The teacher shows a Sundanese culture board that is square in the shape of a square and in it there are numbers in Sundanese language. Students are asked to observe the Sundanese board media that is shown by the teacher and answer questions from the worksheet from the observations made. Here are the results of the students' answers.


**KEGIATAN BELAJAR 1**

1. Perhatikan media papan Budaya Sunda yang ditnjukan guru !
   a. Apa nama bangun datar yang ditunjukan guru? Persegi
   b. Ada berapa jumlah ruas garisnya? 4
   c. Ada berapa jumlah sisinya? 4
   d. Jika semua bangun datar tersebut di gabungkan, maka jadi bangun datar apa?
   e. Cobalah susun bangun datar menjadi berbagai ukuran yang bervariasi secara teratur, kemudian bentangkan tali di setiap ujung sisinya. Hitunglah luas bangun datar yang dibentuk tali tersebut!
   Contoh : 3 x 4

**Figure 10. Students Response Early Didactic Design Stage**

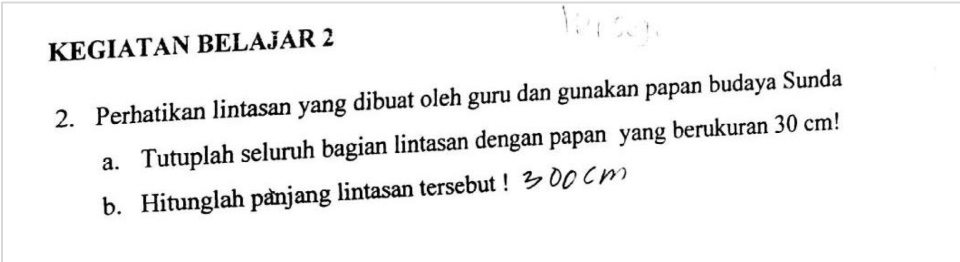
In this didactic design, students can already understand the shape of a square flat figure, 12 people answer correctly that is a square figure. But there were 4 students who answered that the board was rectangular. This didactic situation is to know the ability to think geometry at the level of visualization or recognition. At this stage, students recognize geometric shapes based on the display characteristics of their shapes and recognize the names of shapes, but students have not observed the characteristics of these shapes.

The next situation is for segments and sides in a square student who can already understand both of them visible from the answers of all students who are correct. This didactic situation is to find out the analytical level geometry thinking ability. In addition, students have also understood that the square structure of Sundanese culture boards put together will form a rectangular flat shape.

Solve problems related to building flat squares and rectangles. In this second activity students are still using Sundanese culture boards, students are asked to form a flat structure from rapid ropes and boards. This didactic situation is done to find out the students' creative thinking abilities. Students solve the problem by making a path and calculating the length of the path as shown below:

**Figure 11. Early Didactic Design Phase Activity**

Here is one of the results of student answers:



KEGIATAN BELAJAR 2

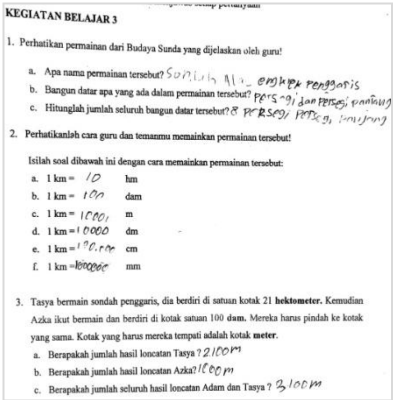
2. Perhatikan lintasan yang dibuat oleh guru dan gunakan papan budaya Sunda
   a. Tutuplah seluruh bagian lintasan dengan papan yang berukuran 30 cm!
   b. Hitunglah panjang lintasan tersebut ! 300 cm

**Figure 12. Students Response Early Didactic Design Stage**

Understanding of length units and how to calculate them

This didactic situation is for knowing students' algebra thinking skills. The media used is a typical Sundanese game that is *engklek*. This game is almost rarely played by kids nowadays. *Engklek* game-used has been modified for learning purposes. This didactic situation includes learning with culture. The following is the game that is used:


**Figure 13. Early Didactic Design Phase Activities**



KEGIATAN BELAJAR 3

1. Perhatikan permainan dari Budaya Sunda yang dijelaskan oleh guru!
   a. Apa nama permainan tersebut? engklek penggaris
   b. Bangun datar apa yang ada dalam permainan tersebut? persegi dan persegi panjang
   c. Hitunglah jumlah seluruh bangun datar tersebut? 8 persegi persegi panjang
2. Perhatikanlah cara guru dan temanmu memainkan permainan tersebut!

   Isilah soal dibawah ini dengan cara memainkan permainan tersebut:
   a. 1 km = 10 hm
   b. 1 km = 100 dam
   c. 1 km = 1000 m
   d. 1 km = 10000 dm
   e. 1 km = 100.000 cm
   f. 1 km = 1000000 mm
3. Tasya bermain sondah penggaris, dia berdiri di satuan kotak 21 **hektometer.** Kemudian Azka ikut bermain dan berdiri di kotak satuan 100 **dam.** Mereka harus pindah ke kotak yang sama. Kotak yang harus mereka tempati adalah kotak **meter**.
   a. Berapakah jumlah hasil loncatan Tasya ? 2.100 m
   b. Berapakah jumlah hasil loncatan Azka? 1000 m
   c. Berapakah jumlah seluruh hasil loncatan Adam dan Tasya ? 3.100 m

**Figure 14. Student Response**

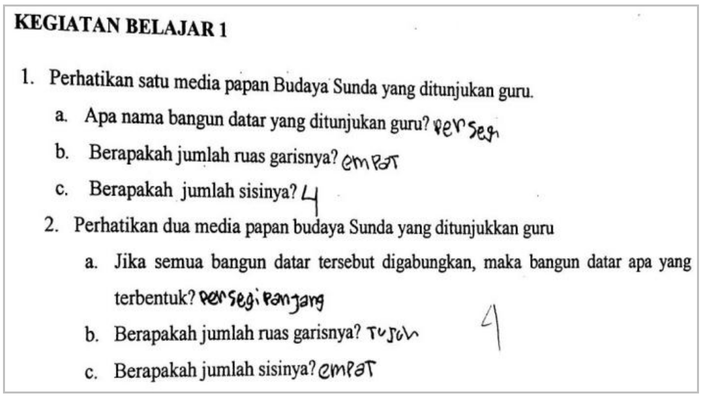
All students' answers match predictions, students play *engklek* and calculate the unit of length with the correct answer. Besides learning students also play it makes students feel happy. When learning is fun, it will always be remembered by the child the material presented. Besides, students can also get to know the Sundanese culture from the *engklek* game. In problem number 2 in this third learning activity, students see the teacher and some of his friends when playing engklek to fill 1 km to hm, km to the dam and others. In question number 3 it is more complicated with the question story in it. Students must understand the question of the story first and then apply it to the *engklek* game. All students' answers in this didactic situation are all correct. Learning mathematics with culture is very helpful in understanding elementary school student concepts (Supriadi, Susilawati, & Tristyanto, 2019)

### Revision of Didactic Design (RDD)

An understanding of the shape of square and rectangular flat shapes of the Sundanese culture board media

The following design is the result of the analysis of the implementation of the didactic design revision in the previous didactic design. In the revised design, the didactics still use Sundanese culture boards, which are only editors of the questions and steps of their activities. That is when IDD learning activity 1 consists of only one number of questions but in RDD it consists of two number of questions. In this RDD, the focus is more on segments and edges on rectangular and rectangular shapes.

**Figure 15. Revision Didactic Design Phase Activity**



**KEGIATAN BELAJAR 1**

1. Perhatikan satu media papan Budaya Sunda yang ditunjukan guru.
   a. Apa nama bangun datar yang ditunjukan guru? perseg
   b. Berapakah jumlah ruas garisnya? empat
   c. Berapakah jumlah sisinya? 4
2. Perhatikan dua media papan budaya Sunda yang ditunjukkan guru
   a. Jika semua bangun datar tersebut digabungkan, maka bangun datar apa yang terbentuk? persegi panjang
   b. Berapakah jumlah ruas garisnya? tujuh 4
   c. Berapakah jumlah sisinya? empat

**Figure 16. Student Response**

All the answers to the learning activities of the board media are all correct, students can already understand the difference between a square and a rectangle, the line along the side of it happens because students see directly or see real objects on the Sundanese culture board media. This is in accordance with Bruner's theory (Takaya, 2008) stated that in the learning process the child goes through 3 stages, one of which is the enactive stage. In this learning stage, the child is directly seen in manipulating (fiddling with) objects. In learning activities, 2 in RDD is different from when IDD. When IDD only calculates the length of the track on the board. When RDD students are asked to calculate the length, width of the string of raffia pattern and the number of square shapes on the board path. This didactic situation is done to find out the students' creative thinking abilities. Students solve problems by making trajectories and calculating the length, width of the string of raffia pattern and the number of square shapes on the board trajectory. When RDD the didactic situation in learning activities 3 which is different from IDD is only editorial. In RDD the numbers on the questions are more varied. The learning activities carried out are still the same, namely using the *engklek* game to calculate long units as shown below:

**Figure 17. Engklek Sundanese Game**

All students' answers match predictions, students play the *engklek* and calculate the length unit with the correct answer. The ability to think algebra on the indicator of thinking in the analysis of the number one problem at a time and solving problems in the number two problem students are able to answer it. Because students do direct or direct practice using this *engklek* game.

## 5. Conclusions

The conclusions from this study are as follows: first, the initial didactic designs were prepared by adjusting the needs of students based on the learning obstacle that appears and compiled by using Sundanese ethnomathematics learning. The results obtained in the initial didactic design uses the design of Sundanese ethnomathematics learning in improving geometric thinking, creative thinking, and algebra thinking and almost all of which correspond to predictions.

The second, the revision of didactic design was prepared in accordance with the initial didactic design which is not optimal. The preparation of the revision of didactic design also continued to use Sundanese ethnomathematics learning and adapted to indicators of thinking ability of mathematical geometry of creative thinking and algebra thinking. The results obtained on the revision of didactic design uses ethnomathematics learning in improving the ability to geometric, creatively and mathematical algebra thinking of students has already been in accordance with predictions.

The use of local cultural contexts in mathematics learning can make it easier for students to understand the concepts taught by students because the culture is already close to students' daily lives. The abstract nature of mathematics is reduced when learning mathematics in elementary schools is close to the culture.

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