Mathematical concepts using *Kain Cepuk* Nusa Penida

N M Dwijayani*

1Information System, Institut Teknologi dan Bisnis STIKOM Bali, Indonesia

*Corresponding author: nimade_dwijayani@stikom-bali.ac.id

**Abstract.** This research aims to investigate mathematical concepts using Kain Cepuk. The design of this research is exploration. This research involved grade VI students and class teachers at SDN 4 Daun Puri. The data used in this study were collected by means of interviews, observations and questionnaires. Data about mathematical concepts on Kain Cepuk were analyzed descriptively. Students have been asked how to make repeating red, blue and white motifs like the one on the Kain Cepuk. Based on student’s responses, it can be said that the red Kain Cepuk motif has shifted three to the right by passing through the blue and white colors. Regarding the concept of reflection, students responded that there are several ways to make red, blue and white kite motifs on Kain Cepuk. The first way is to fold the Cepuk fabric upwards so that a horizontal line of symmetry is formed. The second way is to fold the Cepuk fabric to the right or left so that a vertical line of symmetry is formed. Learning using Kain Cepuk can provide benefits for students including 1) students discovering the concept of shifting and reflection by themselves, 2) reducing students’ perceptions that mathematics is only an abstract formula, and 3) fostering student confidence that mathematics is close to their lives.

1. **Introduction**

Elementary school is the initial level to instill basic concepts for children, so that the concepts that are accepted by children are the opening of their thoughts in facing the next level. But, as students’ grade levels increase, their mathematics self-concept levels decrease [1]. Starting from childhood, there are several factors affecting self-concept development such as achievement in mathematics, attitude in mathematics, motivation, parent education level, family socio-economic level, educational quantity and quality, classroom environment. For quite a long time, the significant accentuation in school was on procedural information, presently alluded to as procedural familiarity. Repetition learning was the model, with little consideration paid to the comprehension of mathematical concepts. [2] In fact, many researchers who tried to create educational mathematics learning games have shown that their games could facilitate the performance, enjoyment, and self-efficacy of mathematics.[3] Most studies could not effectively exclude the novelty effect of games because of the limitations of either experimental time or sample sizes, unless they were conducted for a long time in a natural setting. [4] At the elementary level, learning experience includes work with young children and their future teachers on interactive mini-projects [5]. Action learning brings “reality” to the abstractions of mathematics [5]. Even when teachers try to give problems with applications, students will not know the meaning of concepts until they put it to use.

Mathematics has historically been known to be a topic learned in school to learn and perform procedures using algorithm-written numbers and symbols [6]. Mathematics is too often viewed as a collection of static, unchanging rules created by ancient people without any connection to modern problem solving. Mathematics education around the world has underscored mathematical mechanisms.
that can help solve real world problems outside of school [7]. Mathematics is near to lifestyle. In any case, mathematical information is continuously used. Habits or every day exercises are loaded with mathematics. Cultural resources may be used as mathematical objects for learning [8]. Culture is a progression of exercises and perspectives that furnish people with the reason for seeing themselves as "person[s] of worth inside the universe of importance"— raising themselves over the only actual parts of presence, to deny the creature inconsequentiality and demise that Homo sapiens got mindful of when they obtained a bigger cerebrum [9].

One of the existing cultures in Bali, especially Nusa Penida, is the Kain Cepuk which is a traditional cloth. Kain Cepuk has a certain pattern. The patterns on Cepuk fabrics include triangular, rhombic, and kite patterns. In addition, when making Kain Cepuk, it also uses mathematical concepts, namely translation and reflection. Elementary school students are certainly not aware of the concept that exists in the Kain Cepuk because it is not introduced in the school environment. Even though the introduction of concepts like this will increase students' curiosity in learning mathematics. The introduction of the concept by relating this culture is called Ethnomathematics. There are many benefits that can be obtained by students when studying mathematics with Ethnomathematics concepts [10]. Ethnomathematics fits well inside the constructivist hypothesis of having understudies assemble comprehension and information through what they have just realized and been presented to already. Ethnomathematics can possibly help understudies feel acknowledged, become additionally tolerating of others, and even assistance in the battle against prejudice [11]. Other studies by Unodiaku [12] found that the usage of Ethnomathematics can progress student accomplishment in learning cylinder volume. Subsequently, the most reason of this research is to investigate mathematical concepts using Kain Cepuk.

2. Methods
This study focuses on obtaining information related to the mathematical concept of Kain Cepuk. So that the design of this research is exploration. This study involved 26 grade VI students and 4 teachers at SDN 4 Dauh Puri. Selection of grade VI based on the reason that the learning material is in accordance with the research material so it does not interfere with the learning process. The data used in this study were collected by means of interviews, observations and questionnaires. Data about mathematical concepts on Kain Cepuk were analyzed descriptively.

3. Results and Discussion
The results of interviews and questionnaire with students have shown that they have felt that learning mathematics is only calculating and memorizing formulas. It is shown in Table 1. Based on the data above we can say that students have been unable to demonstrate the use of mathematics in everyday life. Students have tended to give answers that mathematics can only be used in calculations such as when buying and selling transactions, calculating weight and length, and other things related to measurement. This is inline with [13] contends that perhaps the most serious issue in mathematics educating is the regular perspective towards the idea of science; subsequently understudies consider mathematics as a field involving conceptual and incoherent standards, conditions and equations that have no worry with the necessities of day by day life, rather than review it as an apparatus ready to be utilized in different everyday issues. A student with such factor of view who is now not conscious of the relation of mathematics to actual life will no longer supply due significance to it, will discover math-related activities meaningless and needless and will have bad tutorial overall performance in mathematics [14].

However, from the results of the observations that have been made, it was found that students were able to show the differences in the kite and rhombus shapes in the kain Cepuk. These results indicate that students have not been able to relate mathematical concepts to the real things around them. This is also reinforced by the results of interviews which stated that students were only trying to "memorize" mathematical concepts to get good grades, not to understand them. Most students think that its hard to comprehend and apply the idea of mathematics in a real life setting. [15] Accordingly, the significance of mathematics, a control interwoven with the existence this much, is expanding increasingly more for
all nations and the biggest guidance time is allotted for mathematics in the educational programs. Subsequently, people need to comprehend the idea of mathematics and its connection to life to utilize it in their regular daily existence. In this research we use Kain Cepuk that close to students life because they wear it for some activities in their life.

The nonexclusive term Kain Cepuk comprises of two components: kamben (Indonesian, long material) assigns a long, unprinted fabric worn in Bali as a cover skirt throughout the second inward material, tapih; Cepuk signifies "carried eye to eye with somebody" (detached structure, cepukang), particularly by the intensity of God. The etymologist Herman Neubronner Van der Tuuk (1824-1894), in the Kawi-Balinees-Nederlands Dictionary says about the word Cepuk: "material of four tones".

In the vast majority of the short Cepuk textures from Nusa Penida, the essential example is one in which four rhombuses are consolidated to frame a cross-like shape, which is rehashed in lines (Figure 1). A big part of the columns of dull focus bars are rehashed on one or the other side of the middle along the white barong of the Barong, bringing about a vertical line of dim three-sided shapes normal for Nusa Penida even today.

![Figure 1. The basic structure of Cepuk fabric.](image)

**Table 1.** The result of questionnaire.

| No | Agreement | Strongly Disagree | Disagree | Neither Agree nor Disagree | Agree | Strongly Agree |
|----|-----------|-------------------|----------|----------------------------|-------|----------------|
| 1  | Mathematics trains us to be more careful, conscientious and less careless | -       | -      | 3.85%                      | 3.85 % | 92.30%         |
| 2  | Mathematics trains a systematic way of thinking | -       | -      | 11.54%                     | 76.92% | 11.54%         |
| 3  | Mathematics trains us to be patient | -       | 19.23% | 57.69%                     | 23.08% | -              |
| 4  | Mathematics helps us think rationally and logically | -       | -      | -                          | 100%  | -              |
| 5  | Mathematics help with daily activities | 3.85%   | 14.20% | 7.70%                      | 46.15% | 28.10%         |
| 6  | Math is found in many aspects of daily life | 38.46% | 23.08% | -                          | 26.92% | 11.54%         |
According to the NCTM [16], "The teaching program began kindergarten to high school should make students capable of using transformations and symmetry to analyse mathematical situations". This claims that by studying geometry transformation, students can understand geometry's concepts both visually and spatially [17]. Geometry abilities such as visualizing, recognizing kinds of two dimensional figures and geometries, describing and portraying geometrical images, labeling points, identifying the geometrical similarities and differences needs a thinking skill in applying concept and way to solve a geometry problem [18]. So that students need media in real life to understand the concept of geometry, in this study are translation and reflection. Learning geometric transformation with kain Cepuk shows the following results.

The first mathematical concept, which is about translation, can be seen more clearly in the picture of the Kain Cepuk below that given to students as material for observation. Students have been asked how to make repeating red, blue and white motifs like the one on the Kain Cepuk, as shown in Figure 2.

Based on student's responses, it can be said that the red Kain Cepuk motif has shifted three to the right by passing through the blue and white colors. Likewise, the blue and white motifs have shifted three to the right. Or if students see a shift from the right to the left then the student has found the concept that the red Cepuk fabric has shifted three to the left by passing white then blue. If a student's response is drawn it will look like Figure 3 and Figure 4.

Student's responses about translation show that they were understood what is the concept of translation that is a movement or replacement. But, they still confuse about the direction of movement, they were asking which one is the right, shifting to the left or right. Since the question was a non routine problems whis is there is no explicit solving approach such that it is difficult to predict [16], students have difficulty in determining the “right” direction of translation. However, this can be overcome by direct experience by students to shift an object and determine an appropriate position.

Regarding the concept of reflection, students responded that there are several ways to make red, blue and white kite motifs on Kain Cepuk. The first way is to fold the Cepuk fabric upwards so that a horizontal line of symmetry is formed. The second way is to fold the Cepuk fabric to the right or left so that a vertical line of symmetry is formed. Visually, Figure 5 and Figure 6 show the student's response.
Based on previous reviews, the Kain Cepuk is one of the cultural elements of Balinese society, including Balinese people in the Nusa Penida area. Meanwhile, the process of making Kain Cepuk patterns includes mathematical thinking activities, namely predictive patterns, using the concept of transformation geometry, and producing flat geometric shapes. Thus it can be said that Kain Cepuk contains Ethnomathematic values. Ethnomathematics that has been successfully explored can be used in mathematics learning for primary, secondary, or higher education. Muara is a meaningful as well as mathematics learning real manifestation of the act of preserving culture.
4. Conclusion
Mathematics is closely related to culture. Cepuk has a mathematical concept in it, namely the concept of translation and reflection. By introducing Kain Cepuk to students, it is not only able to provide new experiences for students but also to preserve Balinese culture. Learning using Kain Cepuk can provide benefits for students including 1) students discovering the concept of shifting and reflection by themselves, 2) reducing students' perceptions that mathematics is only an abstract formula, and 3) fostering student confidence that mathematics is close to their lives.

This research is expected to be further deepened by other researchers, especially related to ethnomathematics. In addition, teachers are also expected to use ethno-mathematical concepts more often in learning, provided that the cultural linkages and concepts being studied are not too far away.

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