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LEARNING SETS THEORY USING GAPLE CARDS: A STUDY OF EAST JAVA ETHNOMATHEMATICS

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ABSTRACT

Students' interest in learning mathematics in Indonesia still needs to be improved. Efforts can be made by providing creative learning in the classroom, one of which is by linking mathematics and culture, known as ethnomathematics. Ethnomathematics can be used as a learning innovation to motivate students to learn mathematics. Therefore, this study aims to explore the concept of mathematics in one of the traditional game cultures still developing in Malang, East Java, namely *Gaple*. *Gaple* cards can be used as a media for learning mathematics in set material linked through the Realistic Mathematics Education (RME) approach. This study used a descriptive qualitative method with an ethnographic approach, which describes the results of the ethnomathematics exploration of the *Gaple* card game. Data collection uses observation, interviews, literature review, and photo documentation to explore ethnomathematics elements on *gaple* game cards. Exploration results were obtained by observing the number of points on each *gaple* card, namely the concept of universal sets, intersections, unions, and complements. These results are then packaged in a table of learning activities by implementing the three stages of the RME approach.
Keywords: ethnomathematics, *Gaple* cards, learning, sets, RME

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INTRODUCTION

Students' interest in learning mathematics is still relatively low. On the other hand, it is known that mathematics is basic knowledge and is considered the mother of all branches of science. Therefore, mathematics is essential to learning at every level of education (Yusuf Aditya, 2016). The preliminary study shows that students' interest in studying mathematics has yet to reach half the number of students in the class (Friantini & Winata, 2019; Sucipto & Firmansyah, 2021). The common factors that cause these problems are teacher is too monotonous in giving material during the learning process in class. This situation affects in students' interest of mathematics and gives rise to the perception that mathematics is difficult to learn (Putri et al., 2019; Firdaus, 2019; Sarah et al., 2021). Thus, it is necessary to make an effort to attract students' interest in learning mathematics.

One of the efforts that can be made in order to students are interested in learning mathematics when in class is that the teacher must be able to deliver material creatively. This can be done using the right approach or engaging learning media so that learning in the classroom is more meaningful, fun, and not monotonous. Learning mathematics using a cultural approach will be more meaningful and help students become more active in class and explore their culture (Shahbari & Daher, 2020; Supriyadi et al., 2020). Learning linking mathematics and culture is called ethnomathematics (Cimen, 2014). Further, ethnomathematics can be used as a learning innovation that makes students love mathematics more, motivated to learn, and more creative through culture.

D'Ambrosio coined ethnomathematics to express mathematics in cultures that can be identified and perceived as the study of mathematical ideas in every culture (Sarwoedi, 2018). Ethnomathematics is a study of mathematics that connects mathematical objects with the actual cultural environment (Kurniawan et al., 2019; Sulistyani et al., 2019). According to Delviana et al. (2022), ethnomathematics is considered as a media to see and understand mathematics as a cultural product. Therefore, students will more easily understand the material if they depart from contextual and cultural issues (Zaenuri & Dwidayati, 2018; Rahayu et al., 2019). From these various opinions, ethnomathematics is one of the right strategies to be used in classroom learning so that students can easily understand mathematical material.

Ethnomathematics can be integrated into various cultures in Indonesia. Many cultures contain mathematical concepts, one of which is in the traditional *Gaple* game. *Gaple* is a traditional game that is still developing in the community, to be precise, in Malang, East Java. However, this *Gaple* game is played in Malang and all regions of Indonesia. It is just that each region has different rules. In playing *Gaple* cards, there are general and special rules. There is something that makes each region different, namely the special rules.

The mathematical studies on the *Gaple* card can be used as learning media for *material sets*. The *sets* is one of the mathematical materials that are still problematic for students, and the factor is due to differences in the ability of each student (Fauza et al., 2017; Listiana & Sutriyono, 2018). Besides, there is a teacher factor that is still relatively monotonous in delivering material (Dwidarti et al., 2019; Falah et al., 2021). Therefore, creating a more meaningful learning atmosphere through creative learning media is necessary to achieve the learning objectives in the *set material*.

There have been several studies on the use of traditional games as learning media that have been carried out with a focus on studying the concept of plane geometry, relationships between angles, and the concept of transformation geometry in the Deqklak game (Fauzi & Lu'luilmaknun, 2019), studying the concept of geometric shapes on the Pikachu game card (Fitria et al., 2019), the study of the concepts of addition and multiplication in the mangosteen fruit guessing card game (Hariastuti R, 2017). However, there are still needs to be a study of the *Gaple* cards because *Gaple* is a local culture that is easy to find in every region. In addition, if learning is introduced from its own culture, it will attain students' interest in learning mathematics. Therefore, researchers are interested in conducting a study on the *Gaple* cards. The findings obtained on this *Gaple* card are the concept of *sets*, including universal *sets*, intersections, unions, sub*sets*, and complements.

The results of this finding can be used as one of the mathematics learning media in the classroom, especially in set material linked to the Realistic Mathematics Education approach. RME is an approach that involves students practicing natural objects in the learning process to attract students to learn mathematics (Dewimarni et al., 2022). Therefore, in this study, using the RME approach is associated with the findings obtained because students can practice directly with natural objects, namely *Gaple* cards in classroom learning activities.

METHODS

This study used a descriptive qualitative method with an ethnographic approach, which describes the results of ethnomathematics exploration of the *Gaple* card game in the form of a set material concept. Data collection techniques used observation, interviews, literature review, and photo documentation to explore ethnomathematics elements on *Gaple* cards.

Observations and interviews were conducted to find out the rules for playing *Gaple* in the city of Malang, which took place in a coffee shop with most visitors still playing *Gaple*. Furthermore, to find the mathematical side, it is only focused on the number of *Gaple* card points to document each card, conduct a literature review, and obtain information from *Gaple* cards and set material.

RESULT AND DISCUSSION

After conducting observations and interviews with visitors playing *Gaple* cards, the results obtained are the rules of the *Gaple* game, while the set concept consists of the number of dots on the *Gaple* cards.

Gaple Game Rules in Malang

Gaple game must be played with four people. The *Gaple* card contains 28 cards, which are then distributed seven cards each to each player. The game rules in this area are for those with a "blank" card as the first player (put down the first card after being shuffled). More details can be seen in Figure 1.

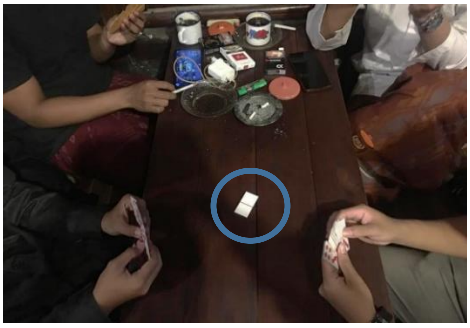

Figure 1. First Player with Blank Card

Furthermore, if players still need to get the type of card to lower, they will be skipped. After that, it repeats until the end of the game. The game ends when one of the players has *Gaple*. The following is the condition of the game after *Gaple*, which can be seen in Figure 2.

Figure 2. End Game Conditions

Determine who loses and wins. It can be seen from the remaining number of dots on each player's card at the end of the game. The loser is the player who has the most remaining number of card points. Figure 2 shows that the third player loses.

***Sets* Concept in *Gaple* Cards**

In each *Gaple* game card, there are two sides. There are many dots on each side of the card; more details can be seen in Figure 3.

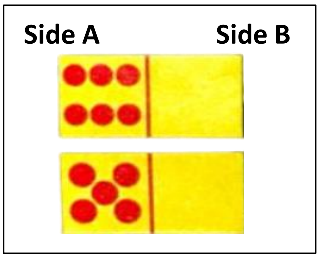

Figure 3. Two sides of *Gaple Card*

In Figure 3. the two cards have many points, which can be written as (6,0) and (5,0). Regardless of the order, this means (6,0) equals (0,6) and (5,0) equals (0,5). Then, after being observed, there are dots on the side of each card that are sequential to each other. For example, for points that add up to 6 from side A, this means that there are cards that have consecutive points, namely (6,0), (6,1), (6,2), (6,3), (6, 4), (6,5), and (6,6). More details can be seen in Figure 4.

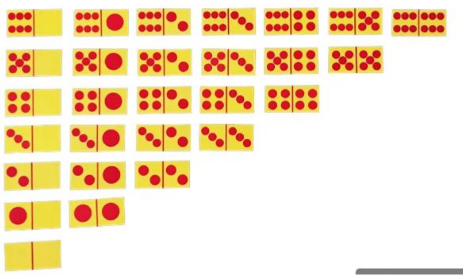

Figure 4 . Sequence of *Gaple* Cards Based on Side A

In Figure 4, the order of all *Gaple* cards can be easily defined in a set. The *sets* that contain all defined objects are called the universal *sets* (Sholikhah & Masriyah, 2022). Thus, indirectly, if we are going to group all *Gaple* cards using the concept of a universal set, expressed mathematically as follows.

Gaple Card *Sets* = {(6,0), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6), (5, 0), (5,1), (5,2), (5,3), (5,4), (5,5) , (4,0), (4,1), (4,2) , (4,3), (4,4), (3,0), (3,1), (3,2), (3,3), (2,0), (2,1), (2,2), (1,0), (1,1), (0,0)}

In addition, the *sets* of all *Gaple* cards can be defined by set notation. Suppose S is denoting the *sets* of all *Gaple* card sequences, so to express these sets using *sets* notation is as follows.

S = {is the sequence of all x|x *Gaple* cards}

Furthermore, each card member can be written in *a set* notation (see Figure 4). For card 6, members are (6,0), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6), for more details; pay attention to Figure 5.

Figure 5. Card members 6

Based on Figure 5, card 6 members can be expressed in mathematical form as follows.

Card 6 = { (6,0), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6) }

For example, K6 is a member of card 6, it can be denoted as follows.

$K6$ = { $x \in S$ | x is a member of card 6}

Likewise, card 5 members are (5,0), (5,1), (5,2), (5,3), (5,4), (5,5). For more details, see Figure 6.

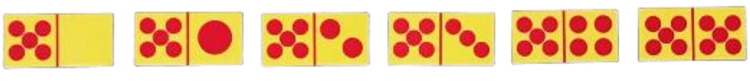

Figure 6. Card Members 5

Based on Figure 6, card 5 members can be expressed in mathematical form as follows.

Card 5 = { (5,0), (5,1), (5,2), (5,3), (5,4), (5,5) }

For example, K5 is a member of card 5, it can be denoted as follows.

$K5$ = { $x \in S$ | x is a member of card 5}

This also applies to other card members, namely card members 4, 3, 2, 1, and card 0, which are also analogous to K6 or K5.

Next, look at the *sets* of all *Gaple* cards and the *sets* of card 6, which states that all members of card 6 are members of all *Gaple* cards. In the basic concept of sets, there is the term sub*sets*, which is a condition when all members of sets are members of other sets (Arfiyanti & Irawan, 2017). So, in this case, it is concluded that card 6 is a subset of all *Gaple* cards. In mathematics, it can be written as follows.

6 cards are all ⊂ *Gaple* cards

Let K6 be the *sets* of 6 cards, and S be the *sets* of all *Gaple* cards. So, it can be denoted as follows.

K6 ⊂ S

It is also possible to determine *set* operations using the properties of sets described previously, such as intersection, union, and complement, first, for the *set* intersection operation. If observed from the number of points of each card are interconnected (see Figure 4). For example, cards 6 and 5. For card 6, there are (6,0), (6,1), (6,2), (6,3), (6,4), (6,5), and (6,6), while for card 5, there are (5,0), (5,1), (5,2), (5,3), (5,4), (5,5), (5,6). But in this case, the cards with the most points (6,5) or (5,6) are on the same card, so there is only 1 card. For more details, consider Figure 7 below.

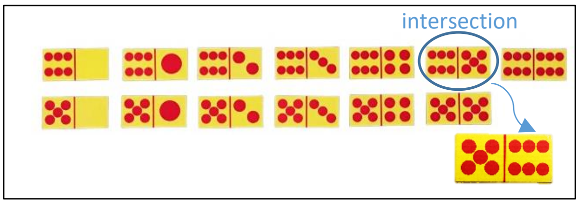

Figure 7. Concept of *Sets* Intersection on *Gaple Cards*

Based on Figure 7, cards in member 6 with many dots (6,5) can be included in member 5, namely (5,6), because they are on the same card. Likewise, cards in member 5 with many dots (5,4) can enter card member 4, that is (4,5), because they are in the same card, and so on. So, in mathematics, this is included in the concept of intersection. A set with members in *sets* A and B is called an intersection (Prahmana & Istiandaru, 2021). The intersection of two sets is denoted as "∩". More specifically, suppose two examples of cards 6 and 5 are taken to be written mathematically as follows.

For example, K6 is a *set* of 6 cards, and K5 is a *set* of 5 cards. The concept of the intersection of cards 6 and 5 can be written mathematically**.**

K6 = {(6,0), (6,1), (6,2), (6,3), (6,4), **(6,5),** (6,6)}

K5 = {(5,0), (5,1), (5,2), (5,3), (5,4), (5,5), **(5,6)}**

K5 ∩ K6 = {(6,5)}

If illustrated through a Venn diagram, as follows.

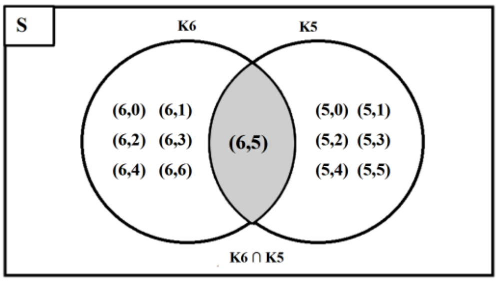

Figure 8. Illustration The Intersection of *Sets* on *Gaple* Cards in a Venn Diagram

Furthermore, if two cards are taken, namely cards 6 and 5 (see Figure 7). So, card 6 is a combination of the *sets* of card 5. The sets whose members come from Member A, Member B, or both are called a union of sets (Umardiyah & Anggraini, 2022). Thus, because card 6 consists of (6,0), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6), and card 5 members consist of (5,0), (5,1), (5,2), (5,3), (5,4), (5,5), (5,6), where one member of the two cards is in both, namely (6,5) which is also the same as (5,6), then it is called a union of *sets* denoted as "∪".

For example, K6 is a *set* of 6 cards, and K5 is a *set* of 5 cards. The cards six and five sets' union concept can be written mathematically.

$$K6 = \{(6,0), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6)\}$$
$$K5 = \{(5,0), (5,1), (5,2), (5,3), (5,4), (5,5), (5,6)\}$$
$$K6 \cup K5 = \{(6,0), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6), (5,0), (5,1), (5,2), (5,3), (5,4), (5,5)\}$$

If illustrated through a Venn diagram, as follows.

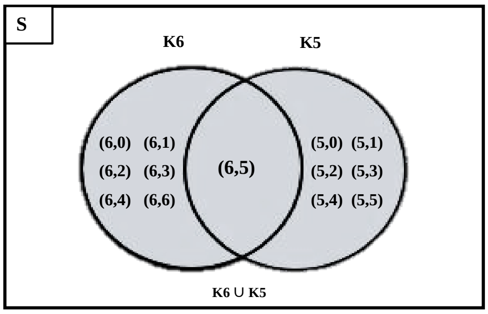

Figure 9. Illustration The Union of *Sets* on *Gaple* Cards in a Venn Diagram

Furthermore, suppose S is the *set* of all members on a *Gaple* card (see Figure 4). Thus, the complement of one of the members on a *Gaple* card can be determined, for example, for the complement of a card with six members. So, it can be written mathematically as follows.

$$S = \{(6,0), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6), (5,0), (5,1), (5,2), (5,3), (5,4), (5,5), (4,0), (4,1), (4,2), (4,3), (4,4), (3,0), (3,1), (3,2), (3,3), (2,0), (2,1), (2,2), (1,0), (1,1), (0,0)\}$$
$$K6 = \{(6,0), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6)\}$$

So,

$$K6^c = \{(5,0), (5,1), (5,2), (5,3), (5,4), (5,5), (4,0), (4,1), (4,2), (4,3), (4,4), (3,0), (3,1), (3,2), (3,3), (2,0), (2,1), (2,2), (1,0), (1,1), (0,0)\}$$

Utilization of *Gaple* Cards as *Sets* Learning Media

Gaple is a game that is often found in every region, but sometimes what is still being debated is that playing *Gaple* cards is known as social behavior that is not good and may not have more benefits, even though this is not always the case when examined from a certain point of view (Alghadari & Son, 2018). Therefore, this study shows the other side of the *Gaple* card, which benefits education. Namely, it can be used as a learning media for mathematics in schools.

Explorations that have been carried out on *Gaple* cards found mathematical concepts, especially in set material. As discussed previously, *Gaple* cards can be helpful in learning sets in class, namely learning based on natural objects. In this case, learning that involves natural objects is the Realistic Mathematics Education (RME) approach. RME is a mathematics learning approach that emphasizes understanding concepts through natural objects and experiences that are relevant to students (Ningsih, 2014; Rudyanto, 2019) .

RME is an approach that can support students' success in learning mathematics. This can be seen in the process of students becoming actively involved in learning because it shows directly the relationship between mathematics and everyday life, which can increase students' motivation and interest in learning mathematics (Wijayanti, 2016; Rahmayanti & Maryati, 2021; Dewimarni et al., 2022). It can also encourage students to think mathematically actively, find patterns, ask questions, and discuss with classmates (Chisara et al., 2018).

Based on the statement submitted, using the RME approach is appropriate to be associated with the exploration results on the *Gaple* card. The suitability of *Gaple* cards and the RME approach can emerge when students understand the pattern of the number of dots on each card from one side and when students can group cards sequentially based on the card pattern so that the *Gaple* card associated with the RME approach can be used as a learning media for mathematics in the classroom to support students' understanding of the primary set concept material in seventh-grade junior high school.

The implementation of RME in the classroom includes three stages, namely (1) the introduction stage, (2) the exploration stage, and (3) the summarizing stage (Van den Heuvel-Panhuizen & Drijvers, 2014). Based on the three RME stages, the researcher describes them according to the needs of this research related to the use of *Gaple* card learning media using the RME approach to the basic concept of *sets*. This is packaged in a learning activity shown in Table 1.

Table 1. Learning activities using *Gaple Card media*

RME Stages	Learning Path	Learning Activities
Introduction	**Activity 1** *Gaple* cards to be introduced that *Gaple* is a traditional game related to the concept of *sets*.	Students observe *Gaple* cards, which show that each card has dots from two sides of the card.
Exploration	**Activity 2** Students begin to explore to find problems by grouping *Gaple* cards.	• Students understand the pattern of card dots from one side. • Students begin to group cards in sequence based on the pattern of the number of dots understood from one side of the card. • Students discover the concepts of universal sets, subsets, intersections, and complements on *Gaple* cards.
Summarize	**Activity 3** Write down the *sets* of *Gaple* cards	Students define the *sets* of cards that have been sorted and write sub*sets*, unions, intersections, and complements.

CONCLUSION

Gaple card game found basic concepts of sets, including universal sets, subsets, unions, intersections, and complements. The results of this exploration can be seen from the pattern of the number of dots on the *Gaple* cards. Thus, the results can be used as a learning media for mathematics in the classroom because linking mathematics with real contexts is essential to make learning more meaningful.

The results of this study can also be followed up by other researchers in exploring the mathematical concepts of the *Gaple* card. However, other researchers can add a different focus on the material. In addition, further research can also be applied and tested directly in schools.

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