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SUTEN GAME: EXPLORATION OF EMPIRICAL AND THEORETICAL PROBABILITY FOR JUNIOR HIGH SCHOOL MATHEMATICS LEARNING

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Abstract: *Suten* is one of the local games often played for determining a purpose fairly. The game is played in pairs by choosing Elephant, Ant, or Man by each player. The choosing is one of the applications of the probability concept learned by students of the junior-high school. The use of the game in the instructional process can aid students in relating the probability concept they learn to real events. The objective of the present study is to explore the concepts of empirical and theoretical probabilities in the *Suten* game. The study is descriptive qualitative with an ethnographic approach to present detailed description and analysis concerning the *Suten* game in relation to probability material. Research results show the finding of the concepts of empirical and theoretical probabilities in the *Suten* game, especially in showing whether or not that *Suten* is a fair game. The game can be used in mathematics learning to introduce to students the concepts empirical probability, sample space, sample point, and theoretical probability. In addition, positive aspects can be obtained when the *Suten* game is integrated in learning such as, among others, inter-appraisal of decisions, training intuition, and using the abilities of creative thinking in searchimg for strategies.

Keywords: Suten games, probability, concept, Middle School students

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INTRODUCTION

Every person needs to have skill competences to ensure that his life goes well. One of the competency that underlines those competences is mathematics (Freudenthal, 2006). The application of mathematics in daily life is, for example cooking. When cooking, one needs to have mathematical knowledge to measure the amount of materials, consider the time needed, and even estimate the temperature that is needed so that the food be cooked properly. These simple calculations show that mathematics influences man's life (Patton *et al*, 1997).

Seeing the relation of mathematics with daily life, the goal of education is to prepare individuals to learn life long through the problems of the real world with the core competences of literacy and numeracy (OECD, 2003). In mathematics learning, literacy and numeracy refer to two competencies that have the same concepts, i.e. mathematics literacy and numeracy (Pusmenjar, 2021). Mathematics literacy—numeracy is defined as one's competence to use the knowledge that he has to describe a phenomenon, solve a problem, or make a decision in daily life. These two competences in mathematics are realized in the minimum competency assessment program (MCAP) that is divided into three contexts, one of which is socio-cultural.

Culture is one of the aspects of life which also contains mathematical concepts since these include the concepts of numbers, space, chance, and time (D'Ambrosio, 2001). Indonesia is known as a country with rich cultures. Meanwhile, culture is the entire system of ideas, actions, products of creation, inspiration and emotion to satisfy man's life needs by way of learning, all of which can be found in the society's life (Inrevolzon, 2013). Indonesian cultural inheritence is then divided into two, i.e. physical cultures and cultural values (Karmadi, 2007). Cultural values come from the local cultures that are present in the Nusantara islands, consisting of traditions, folklores and legends, mother tounges, oral histories, creativities (dances, songs, drama shows), capabilities to adapt, and uniqueness of the local community. Meanwhile, physical cultures are in the forms of buildings or cultural objects such as temples, daggers, puppets, and so on and others.

Richness of cultures, and then the presence of relation with mathematics, cab be used by the teacher in the learning processes (d'Entremont, 2015). Knowing mathematics from cultures is a good activity that can be used to help students have the habits to make use of mathematics-numeracy literacy (Lubis *et al*., 2021). Mathematics literacy can be taught through the connection of mathematics and socisl life (Wedege, 2010). This way, students can learn to use their knowledge in describing the activities they have, solving problems they really are in needs, or making decisions they really are facing. Introduction of mathematical concepts through cultures can be done by using one of the games members of the local community commonly play, i.e. *Suten*.

Suten is a game to determine the winner fairly. It is also used to determine the order of the players. The game is play properly by two players. In mathematics, the fair determination can be connected to the concept of chances. A game can be called fair if all players have the same chance to win, i.e. equal probibility to win the game (Aldous & Diaconis, 1986). Because it is possible in *Suten* to get a draw, this game is fair since each player has the same chance to win, the same chance to lose, and the same chance to draw.

The material of probability is given to junior-high students Year VIII, one of which is concerned with empirical and theoretical chances. Empirical probability is related to the number of events and number of experiments conducted while theoretical probability the number of clusters and the number of the members in a cluster of a event. The two concepts have a connection, i.e. the more experiments are done, the closer it is for the empirical probility to the theoretical probability. The cocepts of empirical and theoretical probibilities can be introduced to students by the activities where students are asked to prove whether or not the game *Suten* is fair. The inclusion of real contexts such as the one in the game of probability learning can solve students' difficulty in understanding the concept and aid them in understanding the relation between empirical probability and theoretical probability (Prihartini *et al*., 2020; Sari *et al*., 2022).

The present study will play the role in exploring the probability concepts by breaking out and explaining every chance that appears in the game *Suten*. The expectation is for the results of the exploration can be used by the teacher to introduce the empirical and theoretical probabilities to students of the junior-high school. In addition, an explanation will be given of the Pancasila student profile values that are contained in the game *Suten*.

METHOD

The study used the descriptive qualitative research method in which the collected qualitative data were analyzed descriptively. The study also involved at ethnographic approach since cultural aspects were involed. The study was conducted in Pati, Middle Java, involving local society members to give information about the game *Suten*, two students of Year IX to give empirical data, and one graduate student of the Mathematics Education Department to get verification on the concepts of probility. The study was completed with data triangulations through observation, interviews, and docomentations in the forms of photo shots and results of the playing of the game *Suten*. After data triangulations were completed, research data were analyzed and the results were displayed in tables, and descriptions were given verbly. Research findings were verified by the graduate student and the reesrch conclusion was drawn.

RESULTS AND DISCUSSION

Suten is one of the local games often played by the children. This game is carried out in an intention to determine something (such as lottery, order, winner) in a fair way. It is called 'fair' since nothing burdens any player and the winning or not winning is determined by each player's "luck". *Suten* is also known by the name *Gamsit*, *Sut*, or *Ant-Elephant-Man*. The existence of *Suten* has begun to be abandoned and replaced with *Rock-Scisors-Paper* (Ghiffary, Prasetyo, & Muslihah, 2019). Suten has similar concepts with those of *Rock-Scisors-Paper*. The difference lies in the use of the hand symbols. In *Rock-Scisors-Paper*, the children fold their fingers to form a fist symbolizing Rock; stand the fore and middle fingers to symbolize Scisors; and open the hand up for Paper. In *Suten* (Figure 1), the little finger is used as Ant, the thumb as Elelephant, and the fore finger as Man. Different from the *Hompimpa*, the *Suten* is played in pairs, or only by two opposing persons.

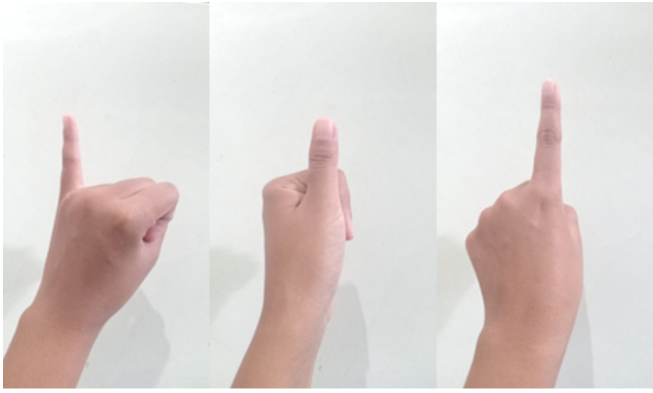

Figure 1. Gestures for *Suten*

In the beginning, the two children position themselves face to face, hands are closed and and put beside the shoulders. When this position is achieved, they are ready to play. One of the players counts "one, two, three", and on the mention of "three", the two players throw out their hand and show their choice, at the same time, at once. The rules to turn up as winner are as follows:

1. Ant (little finger) loses to Man (fore finger) but wins against Elephant (thumb);
2. Elephant (thumb) loses to Ant (little finger) and wins over Man (fore finger);
3. Man (fore finger) loses to Elephant (thumb) and wins over Ant (little finger).

According to the results of the interviews, there are reasons for the rule; as follows. Elephant (thumb) wins over Man (fore finger) because Elephant has a bigger and stronger body than Man. If Man tries to fight Elephant, he will be crushed to death. Elephant (thumb), however, will lose to Ant (little finger) because Ant can crawl into Elephant's ear hole and kill Elephant. On the contrary, Man (fore finger) wins over Ant (little finger) because Man can easily crush Ant. On a draw, the toss is repeated.

In the following discussion, 30 tosses will be explored to look at the empirical probability and each of the probability of the Suten tosses to find the empirical probibility.

Empirical Probability in *Suten*

Empirical probability is defined as the chance of every event from the entire experiments that happen. To introduce the concept of empirical probability, a number of tosses of *Suten* can be conducted.

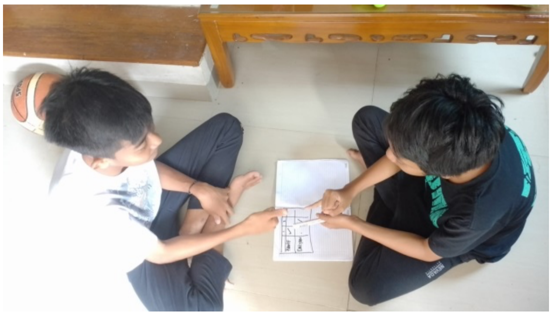

Figure 2. Playing *Suten*

An example is the *Sutan* played by two students of Year 9 in 30 tosses (Figure 2). Results are obtained as shown in Table 1 follows.

Table 1. Results of Experiment of the Game *Suten*

Experiment	Player 1	Player 2	Winner	Winner's Choice
1	Man	Ant	Player 1	Man
2	Elephant	Elephant	Draw	-
3	Man	Man	Draw	-
4	Elephant	Man	Player 1	Elephant
5	Man	Elephant	Player 2	Elephant
6	Elephant	Ant	Player 2	Ant
7	Man	Elephant	Player 2	Elephant
8	Man	Man	Draw	-
9	Ant	Ant	Draw	-
10	Man	Elephant	Player 2	Elephant
11	Elephant	Man	Player 1	Elephant
12	Ant	Elephant	Player 1	Ant
13	Elephant	Man	Player 1	Elephant
14	Ant	Elephant	Player 1	Ant
15	Man	Man	Draw	-
16	Elephant	Ant	Player 2	Ant
17	Ant	Elephant	Player 1	Ant
18	Man	Man	Draw	-
19	Elephant	Man	Player 1	Elephant
20	Ant	Man	Player 2	Man
21	Elephant	Elephant	Draw	-
22	Man	Man	Draw	-
23	Man	Elephant	Player 2	Elephant
24	Ant	Man	Player 2	Man
25	Elephant	Elephant	Draw	-
26	Man	Man	Draw	-
27	Man	Man	Draw	-
28	Elephant	Ant	Player 2	Ant
29	Man	Ant	Player 1	Man
30	Elephant	Elephant	Draw	-

After the tosses, the empirical probability of every toss that may come out can be identified. In this exploration, two empiral probabilities can be counted: one related to the result, the other to the winner's choice. First, from the table, the 30 tosses of Suten will be grouped into result. (Player 1, Result) shows the number of Player 1 with the choice taken. So (Player 1, Win) shows the number of Player 1 receives result win, (Player 1, lose) shows the number of Player 1 loses, (Player 1, draw) shows the number of Player 1 draws and also applies to (Player 2, result). After being categorized according to result, the Table 2 describes the results.

Table 2. Empirical Experiment According to The Playing Result

(Player 1, Result)	Number	(Player 2, Result)	Number
(Player 1, win)	9	(Player 2, win)	9
(Player 1, lose)	9	(Player 2, lose)	9
(Player 1, draw)	12	(Player 2, draw)	12
Number	30	Number	30

From Table 2, the empirical probability of every toss can be counted, as follows. The empirical probability Player 1 obtains result of winning. Supposed A is event Player 1 wins and S is event *Suten* experiment, and supposed too $n(A)$= number of events Player 1 wins and $n(S)$= number of experiment tried, then the empirical probability (PE) of A is

$$PE(A) = \frac{n(A)}{n(S)} = \frac{9}{30}$$

a. Empirical probability Player 1 obtains result lose

Supposed B is event Player 1 lose and S is event experiment *Suten*, then too supposed $n(B)$= number of event Player 1 lose and $n(S)$ = number of experiment tried, then empirical probability (PE) of B is

$$PE(B) = \frac{n(B)}{n(S)} = \frac{9}{30}$$

b. Empirical probability Player 1 obtains result draw

Supposed C is event Player 1 draws and S is event experiment *Suten*, then too supposed $n(C)$ = number of events Player 1 obtains result draw and $n(S)$= number of experiments tried, then empiriccal probability (PE) of C is

$$PE(C) = \frac{n(C)}{n(S)} = \frac{12}{30}$$

c. Empirical probability Player 2 obtains result win

Supposed D is event Player 2 wins and S is event experiment *Suten*, then too supposed $n(D)$ = number of events Player 2 obtains result win and $n(S)$= number of experiments tried, then empirical probability (PE) of D is

$$PE(D) = \frac{n(D)}{n(S)} = \frac{9}{30}$$

d. Empirical probability Player 2 obtains result lose

Supposed E is event Player 2 loses and S is event experiment *Suten*, supposed too $n(E)$ = number of events Player 2 obtains result lose and $n(S)$= number of experiment tried, then empirical probability (PE) of E is

$$PE(E) = \frac{n(E)}{n(S)} = \frac{9}{30}$$

e. Empirical probability Player 2 obtains result draw

Supposed F is event Player 2 draws and S is event experiment *Suten*, then too supposed $n(F)$ = number of events Player 1 obtains result draw and $n(S)$= bumber of experiments tried, then empirical probability (PE) of F is

$$PE(F) = \frac{n(F)}{n(S)} = \frac{12}{30}$$

Second, exploration of empirical probability can be seen from the winner's choice. From the data table result of *Suten* in 30 experiments, winner's choices and events that maybe probable are summed up in the following Table 3.

Table 3. Result of Empirical Experiment Seen from Winner's Choices

Winning Choice	Event	Number
Elephant	(Elephant, Man) (Man, Elephant)	8
Ant	(Elephant, Ant) (Ant, Elephant)	6
Man	(Man, Ant) (Ant, Man)	4

From the table, empirical probability can be obtained on the winner's choices in the 30 tosses of *Suten* as follows:

1) Empirical Probability Elephant Wins

Supposed G is event where Elephant wins and S experiment *Suten*. Then too supposed $n(G)$ is number of events G and $n(S)$ is number of events S, then

$$PE(G) = \frac{n(G)}{n(S)} = \frac{8}{30} = \frac{4}{15}$$

2) Empirical Probability Ant Wins

Supposed H is event where Ant wins and S is experiment *Suten*. Then too supposed $n(H)$ is number of events H and $n(S)$ is number of events S, then

$$PE(H) = \frac{n(H)}{n(S)} = \frac{6}{30} = \frac{3}{15}$$

3) Empirical Probability Man Wins

Supposed I is event where Man wins and S is experiment *Suten*. Then too supposed $n(I)$ is number of event I and $n(S)$ is number of event S, then

$$PE(I) = \frac{n(I)}{n(S)} = \frac{4}{30} = \frac{2}{15}$$

Theoretical Probability in *Suten*

Before exploring the theoretical probability in the game *Suten*, the sample space will be explained. A sample space is defined as the cluster of all the results that may appear of an event; while the cluster member of a sample space is called sample point. According to this definition, when a person plays the *Suten* one time, the sample space that occurs is the cluster of all all the results that may appear from the the event of playing *Suten* one round. To determine the sample space of an experiment, there are three ways that are usually used; namely listing, tree diagraming, and tabling. In this study, listing and tabling will be used. The choice on listing and tabling is done so that the results can be easier to understand.

When the *Suten* begins, two persons will face each other (Player 1 and player 2). Each player can choose the three fingers that represent Elephant, Ant or Man. Supposed S is sample space cluster of the event choice of Man/Ant/Elephant in the game Suten, then S= {(Elephant, Ant), (Elephant, Man), (Elephant, Elephant), (Ant, Ant), (Ant, Man), (Ant, Elephant), (Man, Ant), (Man, Man), (Man, Elephant)}. To obtain the sanple space, listing the probability that can occur can be done, such as

a) Player 1: Elephant, Player 2: Ant
b) Player 1: Elephant, Player 2: Man
c) Player 1: Elephant, Player 2: Elephant
d) Player 1: Ant, Player 2: Ant
e) Player 1: Ant, Player 2: Man
f) Player 1: Ant, Player 2: Elephant
g) Player 1: Man, Player 2: Ant
h) Player 1: Man, Player 2: Man
i) Player 1: Man, Player 2: Elephant

Besides listing the probability that may occur, space sample can be made by using tables. In the following Table 4 diagram, the first row refers to the first player and thevfirst column the second player. The combination of the first player and second player is shown in (Player 1, Player 2).

Table 4. Sample Space of the Game *Suten*

	Ant	Elephant	Man
Ant	(Ant, Ant)	(Elephant, Ant)	(Man, Ant)
Elephant	(Ant, Elephant)	(Elephant, Gajah)	(Man, Elephant)
Man	(Ant, Man)	(Elephant, Man)	(Man, Man

Just as the exploration of the empirical probability, exploration of the theoretical probability is done by looking at the result and winner's choice. Supposed S is sample space of an experiment with each member having the same chance to appear, and A is an event where $A \subset S$, then thw probabilityfor A to occur is

$$P(A) = \frac{n(A)}{n(S)}$$

Notes

P(A) : Probabilityof an event A to occur

n(A) : Number of members in cluster of event A

n(S) : Number of members in cluster S

The first is the exploration of theoretical propability seen from the obtained result. Outcome of game is grouped into three, i.e. win, lose, and draw. In the following table diagram, the first row shows the first player and the first column the second. By looking at all the chances that occur, the result of the winning of the game can be presented in the following Table 5.

Table 5. Results of Winning by Listing All the Chances

	Ant	Elephant	Man
Ant	Draw	P2	P1
Elephant	P1	Draw	P2
Man	P2	P1	Draw

Notes

Draw : No winner no loser

P1 : Winner is Player 1

P2 : Winner is Player 2

In the game of *Suten*, when Player 1 wins, Player 2 must lose. The opposite is true; when Player 1 loses, player 2 must lose. So, as in the table above, the number that Player 1 (P1) may win is 3 and the number that Player 2 (P2) may lose is 3. In the same manner, the number of chances that Player 1(P1) may lose is 3 and the number of chances that Player 2 (P2) may win is 3. The rest is draw (no winner, no loser). The probability of P1 wins , P1 loses, P2 wins, P2 loses. And Draw is explained as follows.

(1) Probablity that Player 1 Wins

Supposed J is the event where Player 1 wins, then n(J) = {(Ant, Elephant), (Elephant, Man), (Man, Ant)} = 3 and n(S) = {(Elephant, Ant), (Elephant, Man), (Elephant, Elephant), (Ant, Ant), (Ant, Man), (Ant, Elephant), (Man, Ant), (Man, Man), (Man, Elephant)} = 9. And so, the theorical probability of the event J is

$$P(J) = \frac{n(J)}{n(S)} = \frac{3}{9} = \frac{1}{3}$$

(2) Probbility that Player 1 Loses

Supposed K is the event Player 1 loses, then n(K) = {(Elephant, Ant), (Man, Elephant), (Ant, Man)} = 3 and n(S) = {(Elephant, Ant), (Elephant, Man), (Elephant, Elephant), (Ant, Ant), (Ant, Man), (Ant, Elephant), (Man, Ant), (Man, Man), (Man, Elephant)} = 9. So, the theoretical peobability of event K is

$$P(K) = \frac{n(K)}{n(S)} = \frac{3}{9} = \frac{1}{3}$$

(3) Probability that Player 2 Wins

Supposed L is the event where Player 2 wins, then n(L) = {{(Elephant, Ant), (Man, Elephant), (Ant, Man)} = 3 and n(S) = {(Elephant, Ant), (Elephant, Man), (Elephant, Elephant), (Ant, Ant), (Ant, Man), (Ant, Elephant), (Man, Ant), (Man, Man), (Man, Elephant)} = 9. So, the theoretical probability of event L to occur is

$$P(L) = \frac{n(L)}{n(S)} = \frac{3}{9} = \frac{1}{3}$$

(4) Probibility that Player 2 Loses

Supposed M is the event where Player 2 loses, so n(M) = {(Ant, Elephant), (Elephant, Man), (Man, Ant)} = 3 and n(S) = {(Elephant, Ant), (Elephant, Man), (Elephant, Elephant), (Ant, Ant), (Ant, Man), (Ant, Elephant), (Man, Ant), (Man, Man), (Man, Elephant)} = 9. And so, the theoretical probability for event M to happen is

$$P(M) = \frac{n(M)}{n(S)} = \frac{3}{9} = \frac{1}{3}$$

(5) Probability for a Draw Game

Supposed N is the event when the game is a draw, so n(N) = {(Ant, Elephant), (Elephant, Man), (Man, Ant)} = 3 and n(S) = {(Elephant, Ant), (Elephant, Man), (Elephant, Elephant), (Ant, Ant), (Ant, Man), (Ant, Elephant), (Man, Ant), (Man, Man), (Man, Elephant)} = 9. So, the theoretical probability for the event N to occur is

$$P(N) = \frac{n(N)}{n(S)} = \frac{3}{9} = \frac{1}{3}$$

Other than the exploration of the concept theoretical probability ftom the angle of view of the winner, theoretical probability will be explored from the angle of view of the winner's choice. The cluster of the sequential pair (Choice 1, Choice 2) shows the event of the choosing of Man/Elephant/Ant by Player 1, and the choosing of Man/Elephant/Ant by Player 2 sequentially. For example, $(Man, Elephant)$ indicates that Player 1 chooses Man and Player 2 chooses Elephant, and so on. Table 6 shows all the probabilities (Choice 1, Choice 2) that is possible to occur in the *Suten* game.

Table 6. Outcome of Winner's Choice in every Propability of the *Suten* Game

	Ant	Elephant	Man
Ant	-	Ant	Man
Elephant	Ant	-	Elephant
Man	Man	Elephant	-

It has been mentioned that S is the global cluster of the experiment in *Suten*, so that $n(S) = 9$. In the following, the theoretical probability will be explored on the winning choice in accordance with the probibility that will happen.

(a) Probibility for Elephant to Win

Supposed O is the event where Elephant wins, then O = {(Elephant, Man), (Man, Elephant)} where $n(O) = 2$. The Probibility of O is

$$P(O) = \frac{n(O)}{n(S)} = \frac{2}{9}$$

(b) Probibility for Ant to Win

Supposed P is the event where Ant wins, then P = {(Ant, Elephant), (Elephant, Ant)} where $n(P) = 2$. The Probibility of P is

$$P(P) = \frac{n(P)}{n(S)} = \frac{2}{9}$$

(c) Probibility for Man to Win

Supposed Q is the event where Man wins, then Q = {(Man, Ant), (Ant, Man)} where $n(Q) = 2$. The probability of Q is

$$P(Q) = \frac{n(Q)}{n(S)} = \frac{2}{9}$$

In the exploration above, calculation of empirical and theoretical probabilities has been presented that are concerned with two different aspects, namely outcomes (win, lose, draw) and choices players who win. In the section of the theoretical probability, from the view of the outcome, it is found that the chance for Player 1 to win is $\frac{1}{3}$ and that of Player 2 $\frac{1}{3}$. The chance of each player to win the game is the same. Such that *Suten* is a fair game.

Besides, the game is said to be fair because each player has the same chance to choose Man, Elephant, or Ant. This is obtained from the finding the theoretical probability when Ant wins, Elephant wins, and Man wins. Findings are obtained that the chances for the three choices (Ant, Elephant, and Man) are the same; or it can be said that when a player decides on Ant, his probability to win is the same as Elephant and Man, which is $\frac{2}{9}$. From the simulation of the two students of Year IX in playing the *Suten* in 30 rounds, it is found that the chance for Player 1 to win is $\frac{10}{30}$ and so is the same for Player 2, $\frac{10}{30}$. The simulation also shows that the probability for Elephant to win is $\frac{4}{15}$, that for Ant is $\frac{1}{15}$ and for Man is $\frac{2}{15}$.

The results above are also cross-compared, and it is found that the probability of Player 1 is almost the same as Player 2. And when comparison is done on the scores of the two players, the theoretical values of the two players are also almost the same.

In the mathematics learning, the empirical and theoretical probabilities can be taught to students through playing the *Suten* game with one objective to find whether or not the a game is fair. Students can conduct observations and measurements on data through experimentations and repetitions guided by the teacher to know the concepts of empirical probability. Observations from two different angles such as determining probability based on outcomes and choices can enrich students' experiences in determining empirical probabilities and assessing whether a game is fair or not. After finishing with empirical probability, students can go on with theoretical probability in which they can list all the events that can happen in the *Suten* game.

The game will make it possible for students to learn the concepts of samples and sample spaces. A sample space is defined as the cluster of that may emerge in an experiment. In this phase, students will learn to determine sample cases by table diagramming or by listing. A sample point, meanwhile, is the possibility that may happen. It can be introduced to students by, for example, asking the question, if the game is a draw, what possible choices can the two players throw?" The answer to the question will be pointed to the students as sample points.

In addition to finding the relation between the concepts of empirical and theoretical probabilities, the study also uncovers some of the high values that are in harmony with the implementation of the profiles of Pancasila students. In the *Suten* game, three different characters are found; they are Man, Ant, and Elephant. These three characters are creatures created by God the Almighty with different characteristics. Although they are created in different forms and characteristics, eventually they are the same.

They are the same in their opportunities in achieving what they desire (winning) and they are the same in the possibility of failing what they want to reach (losing). In such conditions, as creatures of God the Almighty, they must remain appreciating wht God gives to them and working to reach what they want to reach. As it has been stated earlier, the game *Suten* is played to toss or determine order fairly and impartially. In the common interest of the society, everyone has his own role and responsibility in achieving a common purpose. The process of fair tossing teaches that common work will run well, easy, and light if everybody receives the same and fair part and is able to be responsible of what is being decided on. Similarly, when making a decision, it must be fair and impartial to everybody so that the outcome is satisfactory for all and does not disappoint anybody.

In relation to the *Suten* game, each player will look at the pattern by which the opposant selects the finger to throw. This can be seen as finding a strategy. In the process of playing the game, one is going to show his strategy in battling (Rahnang *et al*., 2023). In this activity, one will need the capacity to think critically and creatively in order to get the most effective strategy. Up to this very phase, one will be aware that, in order to achieve an objective, one needs to go over a series of conscious thinking and hard working in spite of the fact that there remains another factor, which is luck.

The game of *Suten* has characteristics that are the same as those of the game Rock-Scisors-Paper. The *Suten* is also categorized as a formative game (*embodied games*) since it involves movement of the parts of the body (Wilson, 2002) to transfer information visually (Sharma *et al*., 2021) by using the gestures of the hand; the thumb to represent Elephant, fore finger to represent Man, and little finger to represent Ant. The game also has psychological aspects that operate in it. This psychology emerges in the situation when players decide to determine their choice of Ant/Man/Elephant to toss (Reiser, 2021). Johnston (2014), in his study, shows the habits of people to do the same thing, especially when, earlier, they get positive effects. Similar to Rock-Scicors-Paper, the *Suten* game offers rich contexts to explore in relation to the concepts of experimental and theoretical probabilities in a fair game (Nelson & Williams, 2020). In the contexts of probability, being “fair” means that every player has the same theoretical probibility to win the game (Sharma, 2019). On another side, the theory of playing games (*Game theory)* stresses that a game like Rock-Scisors-Paper played by two players is said to be a fair game because every player receives the same chances to choose among Rock, Scisors, and Paper (Eyler *et al*., 2009). Meanwhile, similarly, the *Suten* is said to be a fair game since every player receives the same chances to select Man, Elephant, or Ant.

Before theoretical probability, students learn empirical probability by playing the *Suten* game. Knowledge of the empirical probability becomes the basis for understanding theoretical probability (Koparan, 2019). Activities to conduct experiments or simulations can help students to improve intuition, build good understanding of the concepts of probability, and heighten motivation (Manfred & Ramesh, 2009). Meanwhile, comparing the results of empirical and theoretical probabilities aids students in directing their intuition; if larger numbers of experimentations are done than before, empirical probability will be closer to its theoretical probability (Prihartini, Puspita Sari, & Ibnu Hadi, 2020). This is shown by the study by Koparan (2019) on an experiment simulation of the game Rock-Scisors-Paper of 900 tosses on the computer. Results of the computer-aided experiment show that the probability for Rock (T), Scisors (M), and Paper (K) to win is almost identical.

CONCLUSION

Suten is a local game that is commonly used to determine some outcome fairly. The principles of the *Suten* game is closely the same as those of the Rock-Scisors-Paper game; it is only that the bodily gestures that are used are different. Suten uses three characters, namely Ant, Man and Elephant. Ant wins over Elevant and loses to Man; Elephant wins over but loses to Ant; Man loses to Elephant and wins over Ant. The *Suten* game combines bodily movements, involves visual abilities, and contains psychological aspects. To show whether or not *Suten* is a fair game, exploration is needed concerning empirical and theoretical probabilities. By using these two probibility concepts, it can be shown that *Suten* is a fair game as it is with Rock-Scisors-Paper. The *Suten* game can be intergrated into the mathematics learning for Year IX of the junior-high school since it has the concepts of empirical probability, theoretical probability, sample spaces, and sample points. In addition, the game teaches positive things to the players such as the meanings of co-operation, appreciating decisions, and sharpening intuition and creative thinking in looking for strategies.

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