Preface: 2nd International Conference on Mathematics – Pure, Applied and Computation

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Preface: 2nd International Conference on Mathematics – Pure, Applied and Computation

As a follow up on the first edition of International Conference on Mathematics: Pure, Applied and Computation (ICoMPAC) which was held in 2015, the second edition of ICoMPAC was jointly organized by the Department of Mathematics in Faculty of Mathematics and Natural Sciences, Institut Teknologi Sepuluh Nopember (Indonesia) and by the Science Program (Mathematics) in Faculty of Industrial Science and Technology, Universiti Malaysia Pahang (Malaysia). The aim of this conference is to provide a forum for researchers, educators, students and practitioners to exchange ideas, to communicate and discuss research findings and new advancement in mathematics, and to explore possible avenues to foster academic and student exchange, as well as scientific activities. The conference will be a venue to communicate and discuss on mathematical problems faced by the industries. The topics of the conference comprise: Pure, Applied, Computation, Education and related fields. This conference was held on November 23rd, 2016 in Pullman Hotel, Surabaya. The scientific program consisted of plenary and regular presentations. Preceding the conference, we organized two one-day workshops on applied mathematics and computer science. This year's Conference is themed, "Empowering Engineering using Mathematics".

There were 90 papers presented at the conference. The authors were from Indonesia, Malaysia, Japan, Saudi Arabia, Ethiopia, Germany, United Arab Emirates, Hungary, Pakistan, Taiwan and United Kingdom. It is a unique opportunity for all of us to meet and reunite with colleagues from some areas of Mathematics and its applications. There were 1 keynote speaker and 3 invited speakers covering the different areas of the conference. The keynote speaker was Prof. Dr. Ir. Heru Setiawan, M.Eng (Institut Teknologi Sepuluh Nopember, Indonesia). The invited speakers were Endah Rokhmati Merdika Putri, Ph.D (Institut Teknologi Sepuluh Nopember, Indonesia), Prof. Hsing-Kuo Kenneth Pao (National Taiwan University of Science and Technology, Taiwan) and Dr. Frits Van Beckum (University of Twente, The Netherlands).

We know that the success of the conference depends ultimately on the many people who have worked with us in planning and organizing this conference, in particular for the review process and preparing the technical programs. Recognition should belong to the Local Organizing Committee members who have all worked extremely hard for the details of important aspects of the conference programs. Last but not least, we would like to thank American Institute of Physics (AIP), for the cooperation for publishing papers in this conference to their proceedings.

Dieky Adzkiya
Chairman of ICoMPAC 2016

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Probabilistic thinking of elementary school students in solving probability tasks based on math ability

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Probabilistic Thinking of Elementary School Students in Solving Probability Tasks Based on Math Ability

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Abstract. Probabilistic thinking is very important in human life especially in responding to situation which possibly occured or situation containing uncertainty elements. It is necessary to develop students' probabilistic thinking since in elementary school by teaching probability. Based on mathematics curriculum in Indonesia, probability is firstly introduced to ninth grade students. Though, some research showed that low-grade students were successful in solving probability tasks, even in pre school. This study is aimed to explore students' probabilistic thinking of elementary school; high and low math ability in solving probability tasks. Qualitative approach was chosen to describe in depth related to students' probabilistic thinking. The results showed that high and low math ability students were difference in responding to 1 and 2 dimensional sample space tasks, and probability comparison tasks of drawing marker and contextual. Representation used by high and low math ability students were also difference in responding to contextual probability of an event task and probability comparison task of rotating spinner. This study is as reference to mathematics curriculum developers of elementary school in Indonesia. In this case to introduce probability material and teach probability through spinner, as media in learning.

INTRODUCTION

Humans are usually faced with three different situations; past, current and future situation. In related to the future situation, human, perhaps, could predict uncertainty event. They will be ready to face the event. Mental activity related to predicting an event which may occur is called probabilistic thinking. Since, probabilistic thinking is a mental activity related to context containing uncertainty elements [1], [2], [3].

Probabilistic thinking is also very important, especially in the development of science and technology. For example, an expert knowledge of thinking in making inferences and testing hypotheses based on empirically uncertainty data. These activities is called probabilistic thinking. Since, one does mental activity related to situation containing uncertainty elements. Another example, we often hear a doctor said that 80% his patients can be cured totally, after doing repeated therapy and the result showed an increasing improvement. Doctor's statement is the result of his probabilistic thinking, because doctor studied some therapeutic result performed by his patient and predicted the cured patients after doing therapy.

Based on the above statement, one's probabilistic thinking ability should be developed. One way is through education, because education is an appropriate means. It means that there are sources, methods and media which can support the development of students' probabilistic thinking. One of mathematics materials is probability. [4] define probability as a mathematical rule to link uncertainty problems. This probability is also as a tool to measure likelihood event. It is also supported by [2] defined probability is as old mathematical discipline dealing with calculating events chance. According to [5] and [6], probability is defined as trial quantification and mathematics component of probability is randomness.

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Based on the mathematics curriculum in Indonesia, probability is firstly introduced to ninth grade students. At elementary level, probability is not introduced. Though, some research resulted low-grade students were successful in solving probability tasks, even in pre-school. [7] in their resulted that kindergarten students who were not educated formally about probability, were successfull in solving problems related to probability concepts. Even 6-year-old student were not only able to use subjective knowledge in solving problems, but he/she also realized appropriate quantitative reasoning in comparing probabilities and calculating probability of an event, without getting formal education on fractions. This result in line with [8] that kindergarten students have showed some improvement in their probabilistic thinking as result of experimental teaching. They developed quantitative thinking in responding to probability tasks and they got second level (transition level) based on cognitive model developed by Jones, et al (1997). In addition, the result of[2] to 623 students from six elementary schools and kindergartens in Slovenia showed that early third-grade students could differ between certainty, possible and impossible event. They also compared probability of various events. Even a half of 4-5 years student could do it. Moreover, [2] said that probability needs to be taught at concrete operations level. Unless, it was taught in transition level from concrete operation level to formal operation level. This showed that it was necessary to introduce probability in developing students' probabilistic thinking of elementary school. It is in order to prepare students with a stronger foundation for further learning about probability in high class [9].

Students' probabilistic thinking can be seen from several aspects; responses, strategies and representation. [10] in his study related to probabilistic situation consisted theoretical probability tasks based on sample space analysis and numerical measurement or simple geometrical measurement to determine probability of an event and probability comparison tasks. [10] creates a rubric with four response categories of probabilistic thinking; non-response, non-statistical response, partial response and statistical response. Meanwhile, [11] in their two studies; 1 study, subjects were first, third and fifth grades. 2 study, subjects were first grade until fifth grade, resulted that all age groups were present variation in denominator, numerator, and they attend to interact between these two variables. Meanwhile, [12] in his study of subjects 6-14 year old showed that children (6-7 year old) were not able to build the same probability to generate proportionality (PRO).Their strategy seemed to be unsystematic, although they showed some tendency to rely on one-dimensional (OD), the number of win items (W) or the number of lost items (L) depending on given tasks. Highly development in achieving equal probability by means of proportionality were also occurred at the age of 13 years. There were consistent indications in middle level (9-10 year old) in integrating two variables with difference strategy (DIF). The result of Falk's study indicated that there were three strategies used by students to solve probability tasks; one-dimensional strategy (OD), difference strategy (DIF) and proportional strategy (PRO). While one-dimensional strategy (OD) was divided two, namely the number of win items (W) and the number of lost items (L). Furthermore, the results of [1] stated that students used part-part and part-whole relationships in comparing and describing probabilities, and they used invention language or conventional to describe their probabilistic thinking, as one of three. In sample space tasks, [13] stated that there were five strategies used by students; trial and error strategy, emerging strategy, a cyclic pattern strategy, odometer with errors strategy, odometer strategy.

One's probabilistic thinking in solving probability tasks is different and depends on the extent to which he/she understands probability task at hand, the extent to how he/she gives response and uses strategies and representation. Strategies and representation are used varies depending on the math skills of each. Based on the above statement, this study is aimed to explore probabilistic thinking of elementary school students; high and low math ability in solving probability tasks.

METHOD

Subject

Subjects in this study were two male students of fifth grade who have high and low math ability and able to communicate. The subjects were chosen based on gender under consideration the research result of [14] and [15] showed that male students scored higher than female students on probabilistic reasoning.

Instrument

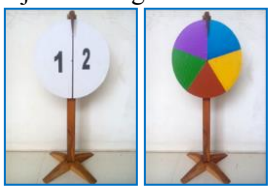
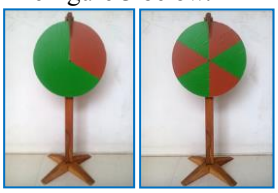
Instruments in this study consisted of:

- Math skill test items was used to select subjects who have high and low math ability.

- Probability task sheet, containing (a) sample space which related to list or identify complete set of possible outcomes of one- and two-dimensional problems, (b) probability of an event which related to identify and provide the reason for which one is most likely or least likely to occur, (c) probability comparison which related to define and justify: (1) a situation where most probability to generate target events; or (2) whether a two-probability situations offer the same chance for target event.

Problems in probability task sheet can be seen in table 1 below.

TABLE 1. Problems on Probability Tasks.

Sample Space	Probability of an Event	Probability Comparison
1. There is a box contains balls with same type and size. The balls are 4 red balls, 3 blue balls, and 2 green balls. If you are told to close your eyes and take one ball from the box, what color of the ball will you get? What is your reason? 2. There are 2 *spinners* each of them is completed with an arrow in the above just like figure 1 below.  **Figure 1**. Number and colour spinners If both spinners are rolled together and when they stop, you are told to observe the number and color pointed by both arrows in each spinner, so what pair of number and color will be pointed by both arrows? Give me your reason! 3. There is a dice. If the dice thrown up, and then when it fall to the floor, you are told to observe the dots on the dice which is showed up, so what will the dots show us? Give me your reason! 4. One day Dinda and her family went to "Maduratna" restaurant. This restaurant offers 3 types of beverages, namely ice tea, coconut ice and lemon ice, as well as offers 4 types of food, namely soup, meat balls, chicken noodle and fried rice. Dinda was asked by her father to order one food and one beverage. How many options can be Dinda ordered? Mention all the options and give your reason!	1. There is a box contains balls with same type and size. The balls are 4 red balls, 3 blue balls, and 2 green balls. If you are told to close your eyes and take one ball from the box, what color of the ball will most likely to occur? Give me your reason! 2. There is a dice. If the dice is thrown up, and then when it fall to the ground, you are told to observe the dots on the dice which is showed up, so what will the dots most likely to occur, dice with more than 3 dots or less than 3? Give me your reason! 3. There is a spinner completed with an arrow in the above just like figure 2 below.  **Figure 2**. Spinner for playing game Spinner above is used to playing game points. In this game there are 3 players. Each player chooses a color of blue, green or yellow. Players alternately rotated spinner. Players will earn point, if the arrow indicate a color which has been chosen. The winner of the game is the players who earn the most points. If you want to play this game, then which color would you choose? Give your reasons!	1. There are 2 boxes contain markers with same type and size. Box I contains 3 blue markers and 2 black markers. Box II contains 4 blue markers and 3 black markers. You are told to close your eyes and take one marker. If you want to get a black marker, so which box you will choose? Give your explanation with using a number! 2. There are 2 spinners each of them is completed with an arrow just like figure 3 below.  **Figure 3**. Colour spinner If the spinners are rolled and when they stop, you are told to observe the color which is pointed by the arrow, which spinner give the same opportunity to the red and green color to be pointed by the arrow? Give your explanation with using number! 3. There are two students play the game. The first student throw 500 rupiah coin and will get point, if the coin falls to the floor and the above of the coin appears the image number 500. The second student throw dice and get point, if the dice falls to the floor and the above of the dice appears mostly 3 and 5 dots. If you are one of the two students and you want to be a winner in that game, then you select 500 rupiah coin or the dice? Give your reasons using numbers!

Procedure

The research design of this study was descriptive exploratory study by using a qualitative approach. Data collection and data analysis were conducted by the researcher [16]. The data collection procedure to explore students' probabilistic thinking in solving probability tasks, started by giving probability task sheet to the subject, subject solved probability tasks based on his ability and wrote down his answer. Next, the researcher interviewed subject related to aspects of probabilistic thinking. Time triangulation of data was used to have a credible data. This procedure was applied to high and low math ability students in respectively. The data was analyzed, categorized, reduced and interpreted to make a conclusion related to students' probabilistic thinking.

RESULT

Probabilistic Thinking of High Math Ability Student

Sample Space

Student could list all balls which can be drawn (red ball, blue ball and green ball), if he was given problem to take one ball from box which contains 4 red balls, 3 blue balls and 2 green balls by closed eyes. Furthermore, he could list all many dots of dice which appear (1, 2, 3, 4, 5 and 6), if the dice was thrown upward and observed many dots of dice would be appeared. He gave statistical response, because he could list all members of sample space. Strategy used by student did not indicate trial and error strategy, because he gave reason that he took balls by closing his eyes. So, he did not know, what a color ball will be drawn. Similarly, in throwing dice task, he gave reason that dice was thrown up and rotated. So, he did not know, how many dots of dice will appear because many dots of dice consist 1, 2, 3, 4, 5, and 6. Representation used by student was list all the possible outcomes.

Student gave response that number 1 and 2in first spinner could be appointed by arrow, as well as all colors in second spinner. However, he failed to pair numbers and colors could be appointed by arrow. He thought that all numbers and colors had same possibility to be appointed by arrows, because he noticed the same size of each part on spinners. The following is the interview between researcher and student.

Researcher : What is your answer?
Subject : Number 1 and 2, because all numbers could be appointed, and we will not know what number will be appointed. Then all colors in spinner, because all colors could be appointed, and we will not know and the possibility has the same chance.
Researcher : What do you mean by "the possibility has the same chance"?
Subject : Large colors. And this is same, that one is same (*appointed any parts of spinner B*)

However, in contextual sample space task, he could pair foods and beverages. Thus, he gave statistical response, he could list all the possible matching. Strategy used by student was odometer strategy, because he chose a beverage and paired with all foods, then pick one another beverage and paired with all foods, etc. Thus, there were 12 pairs. Representation used by student was list all pairs of beverage and food.

Probability of an Event

Student responded that red ball was most likely drawn, under consideration that the number of red balls were most of all. In this task, he gave partial statistical response, because his response referred to proportional misunderstanding; he compared the number of red balls to the number of blue and green balls. Strategy used by student was numerator strategy, because he examined part of set corresponding to target event. Representation used by student was numbers wich showing thenumber of red, blue and green balls.

However, in throwing dice task, student gave response that the number of dots which less than 3 has least chance to appear. Because he thought that the number of dots in dice were fewer, the luck was also little. The following is the interview between researcher and student.

Researcher : What is your answer?
Students : Less than 3.
Researcher : Why is less than 3?
Student : Because the luck is least than 3, because the number of dots in dice were fewer, the luck was also little, this is my opinion.

Researcher : Why did you mention that "the luck is least than 3, because the number of dots in dice were fewer, the luck was also little", what does it mean?
Student : If the number is 6, so there will be a great luck. It is just like playing snakes and ladders or monopoly. If I get 1,,, (*while moving the pen like stepping*) jump first, then if I get 6, jump sixth, 1, 2, 3, 4, 5, 6 (*while moving the pen like stepping*). If the luck is only 3, then we jump 1, 2, 3 only. So it will be 1, 2 or 1 only.
Researcher : Why do you say like that?
Student : From playing.
Researcher : What games do you often play?
Students : Monopoly, snakes and ladders. But I often play monopoly.
Researcher : Do you like 6?
Student : Uh, uh.
Researcher : Why do you like 6?
Student : I can play again.
Researcher : If you get 5?
Student : Yeah, I cannot, but I can jump so far. If I get 6, I can play again.

In throwing dice task, student's response referred to his experience in daily life while playing snakes and ladders or monopoly. He thought that many dots of dice more than 3 was a great luck. There will be a great chance. Instead, many dots of dice which less than 3 was a little luck, so there will be a little chance also. He thought that possibility was the same as luck. This suggest that he gave non statistical response.

In contextual probability of an event task, he answered a blue color, because it has a large opportunity to win, i.e 2/4, while the other colors; yellow was 1/4 and green was 1/4. It showed that he gave statistical response, because he was able to justify his reason by using classical interpretation and used probability with numbers. Strategies used by student was combination strategy to connect the number of target elements to total number of elements in the set. The following is the interview between researcher and student.

Researcher : Okey, why is the chance is 2/4?
Students : Because the number is 2 and the total number is 4. If all numbers was 5, for example there are 2 blue, 2 yellow, 1 green, so I will choose a blue or yellow, because they have many chances.

Representation used by student was a fraction which showing numerator; the number of target event, denominator, the total number of whole.

Probability Comparison

Student gave response that if he took a red marker from the first box (containing 2 black markers and 6 red markers) than the second box (containing 4 black markers and 8 red markers). His reason was because the number of black marker in the first box less than the number of black marker in the second box, so that the possibility to get red marker in second box was a little. He gave partial statistical response, because his response referred to proportional misunderstanding. Strategy used by student was less than non-target event. Representation used by student was a fraction which showing numerator; the number of red markers and black markers, denominator; the total number of markers in the first box or the second box. The following is the interview between researcher and student.

Researcher : What is your answer?
Student : First box.
Researcher : Why do you choose the first box?
Student : First box, the possibility of false is little. In first box, black markers is 2/8 and red markers is 6/8 and second box, black markers is 4/12 and red markers is 8/12. So, the number of black markers in first box is less than the number of black markers in second box. That's why I choose the first box.

In rotating spinner task, student gave response that spinner B provided equal opportunity for red and green to be appointed by the arrow. The reason was because spinner B has the same number and size than spinner A. The following is the interview between researcher and student.

Researcher : Which spinner?
Student : Spinner B.
Researcher : Why is B?
Student : Spinner B has the same number and size than spinner A. In a number, green 3/6 and red 3/6. So both of them has the same opportunity to be appointed by the arrow. Spinner A has different size. The green

size is large than red size. So, the opportunity is different to be appointed by the arrow. That's why I chose spinner B.

Researcher : What does 3/6 mean?

Student : There are six. They are 1, 2, 3,4, 5, 6 (*counting and pointing to parts of spinner B*). While, red is 3/6, so they are 1, 2, 3 (*counting and pointing to red color on spinner B*). So, three (*pointing 3 parts of red*) per six (*pointing 6 parts of red and green*). If the number of green is 3 (*pointing 3 parts of green*) per 6 (*pointing 6 parts of red and green*).

Researcher : How about this one? (*Pointing spinner A*)

Student : It's different. Green is large.

Researcher : So, why?

Student : (*Smiling*) if it is a small size, like 20%, while green 80%. So what is it,,, that red was not often to be appointed by arrow. Eee,,, So, definitely go on the green one. The red one was only occasionally.

Student gave statistical response because his response due to the ability to justify his reason by using classical interpretation and used probability with numbers. Strategy used by student was checking the set of more target event. This was demonstrated when he examined two spinner which provided equal opportunity for red and green to be appointed by the arrow. Representation used by student was common fraction or percent that showing the numerator; the number of part, the denominator; the total number of a single circle.

In contextual probability comparison task, student answered that he used a 500 coin to play. His reason was because in a 500 coin, there was only 2, so the opportunity to get eagle was ½ and to get figure of 500 was also ½. While in dice, if he got 1, 2, 4 and 6, then he did not get points. If he would get points, just there was 2, so the opportunity to get points was 2/6 and to get no points was 4/6. The following is the interview between researcher and student.

Researcher : Why?

Student : Because there are only two, so if the number of 6, like 1, 2, 4, 6 get no points. If I get point, so there will be 2/6.

Researcher : What is 2/6?

Student : Eee,,, in dice, I do not get points 4/6. And I get points 2/6, I better choose 500, because ½ to ½.

Researcher : What does 2/6 to 4/6 and ½ to ½ mean?

Student : Yah,,, 4/6 is get no points. It is mean 1, 2, 4 and 6, get no points. So, the opportunity to get no points is greater than the opportunity to get points. If a 500 coin, there will be equally chances.

Student gave statistical response because his response due to the ability to justify his reason by using classical interpretation and used probability with numbers. Strategy used by student was checking set of target and non-target events. This means that he examined opportunity to get points and no points. Representation used by student was fraction, showing numerator; the number of target or non-target events, denominator; the total number of possible outcomes on the dice or a 500 coin.

Probabilistic Thinking of Low Math Ability Student

Sample Space

Student gave response that a red ball can be drawn, if he was given problem to take one ball from box which contain 4 red balls, 3 blue balls and 2 green balls by closed eyes. His reason was because in the box, the number of red balls were the most of all. It showed that student failed to list all color balls can be drawn. Furthermore, he could list all many dots of dice which appear (4, 5 and 6), if a dice was thrown upward and observed many dots of dice which appear. His reason was because every he played monopoly, he often got 5 and 6 (or got many dots of dice more than 4). The following is the interview between researcher and student.

Researcher : What is your answer to 3a?

Student : Many dots of dice more than 4, the number are 4, 5 and 6.

Researcher : Why?

Student : (*Smiling*) If I play monopoly, I often got number 5 and 6, the numbers more than 4.

Researcher : Oh, I see. Are you happy if you get number5 and 6?

Student : Not really.

Researcher : Why is not really?

Student : If it is monopoly, I will be happy. I can moving around. But if it is snakes and ladders, will be difficult. For example I must get number 1 to reach finish, but I got 6, so that I returned back.

He gave non-statistical response because his response referred to his experience in daily life while playing monopoly or snakes and ladders.

Student gave response that the pairs which could be appointed by arrow was number 1 with purple, green and red, while number 2 with blue, yellow and red. He gave reason that red was difficult to determine because it was in middle of the arrow spinner. His reason because when spinner has not rotated yet, number 1 was on the left, as well as purple and green. While, number 2 was on the right, as well as blue and yellow. While, red could be said to be on the left and right. He thought that after rotating spinner will be the same situation as before.

In contextual sample space task, student answered that a food and a beverage which can be selected Dinda based on subjective thinking. It means that student chose fried rice and coconut ice, because this was his favorite. The following is the interview between researcher and student.

Researcher : What is your answer?
Student : There are two, namely one food is fried rice (*smiling*) and one beverage is coconut ice.
Researcher : What is your reason, why are there two, fried rice and coconut ice?
Student : I think may be, because this food and beverage are my favorite. I like fried rice.
Researcher : Oh, I see. Do you like fried rice and coconut ice?
Student :Yes. Close to my house, there is people selling fried rice, and I always buy it.

Student gave non-statistical response, because his response referred to his experience in daily life.

Probability of an Event

Student gave response that red ball was most likely drawn, his reason was because in the box, the number of red balls were the most of all. In this task, he gave partial statistical response, because student's response referred to proportional misconceptions by comparing the number of red balls with the number of blue and green balls. Strategy used by student was numerator strategy, because he examined part of the set corresponding to target event.

However, in throwing dice task, student gave response that many of dots less than 3 which least chance to appear. His reason was because when he played snakes and ladders, he was hard to get many of dots less than 3 on a dice. The following is the interview between researcher and student.

Researcher : What is your answer?
Student : Eeemmm,,, less than 3.
Researcher : Why is less than 3?
Student : Well, because I,,, due to the number less than 3,,, for me it was hard to get, when I play snakes and ladders. When I will have finish, I have to get the number of many dots less than 3. And it is difficult to obtain.

His response related to experience in daily life. So that, he gave non statistical response because his response referred to experience in daily life, like playing.

In contextual probability of an event task, student answered a blue color in spinner. His reason because there were 50% blue, while the others like yellow and green respectively 25%. It showed that student gave statistical response because student due to the ability to justify his reason by using classical interpretation and used probability with numbers. Strategy used by student was a combination strategy, because student connected many of target elements with the total number of elements in the set. The following is the interview between researcher and student.

Researcher : If you want to play this game, what color will you choose?
Student : Blue.
Researcher : Why is blue?
Students : Because there are two possible, blue is 50%, while others are respectively 25%.

Representation used by student was percentage of every part of colors on spinner.

Probability Comparison

Student gave response that took a red marker from second box containing 4 black markers and 8 red markers than first box containing 2 black markers and 6 red markers. His reason because the number of red marker in second box more than the number of red marker in first box, that was 8 more than 6. So it was easier to take a red marker in second box rather than in first box. Student gave partial statistical response because his response referred to

proportional misunderstanding. Strategy used by student was the set of more target event. Representation used by student was a number which indicated the number of red markers.

In rotating spinner task, student gave response that spinner B provided equal opportunity for red and green colors to be appointed by arrow. His reason because the number of red and green colors in spinner B was equal, while spinner A was different, it was more green. The following is the interview between researcher and student.

Researcher : What spinner which provided equal opportunity for red and green to be appointed by arrow?
Student : I choose spinner B.
Researcher : Why do you choose spinner B?
Student : Because in spinner B, green and red is same as 50% green and 50% red. While spinner A, it was more green, may be 60% green and 40% red. Well, here provided equal opportunities for red and green so, for me maybe, I choose B because the number of green and red are the same.

Student gave statistical response because his response due to the ability to justify his reason by using classical interpretation and used probability with numbers. Strategy used by student was checking a set of more target event. This was demonstrated when student examined two spinner which provided equal opportunity for red and green to be appointed by the arrow. Representation used by student was percentage of size of each color in spinner.

In contextual probability comparison task, student answered 500 coin to play. His reason referred to experience in daily life when played coins. The following is the interview between researcher and student.

Researcher : What is your answer, will you choose 500 coin or dice?
Student : 500 coin.
Researcher : Why do you choose a coin?
Student : Because I really, I also play coin with my brothers here. But my brother and I often named the game was guess image. So, if I always chose images 500 and I often won. While my brother often lost, he chose eagle.

Student gave non-statistical response, because his response referred to experience in daily life while playing coin with his brother.

DISCUSSION

In both 1 and 2 dimensional sample space tasks, there were difference responses between high and low math ability students. High math ability student could list all possible outcomes in solving 1 dimensional and contextual 2 dimensional sample space tasks by odometer strategy. In rotating spinner task, he answered all possible outcomes, but he did not list pairs of number and color. While low math ability student failed to list all possible outcomes in solving 1 and 2 dimensional sample space tasks. Meanwhile, in contextual 2 dimentional sample space task, low math ability student gave non statistical response, because his reason based on his experience in daily life.

In probability of an event tasks, high and low math ability students gave responses depend on the type of a task. In drawing ball task, students gave partial statistical response, by checking the number of part of set corresponding to target event. In throwing dice task, students gave non statistical response, referred to experience in daily life, that was playing snakes and ladders or monopoly. In contextual task, students gave statistical response, because students were able to justify their reason by using classical interpretation and used probability with numbers; connects the number of element target with the number of total elements in the set. However, representation used by students in this task was difference, representation used by high math ability student was a fraction which showing numerator; the number of target event, denominator; the total number of whole, while representation used by low math ability student was percentage of each part of set.

In probability comparison tasks, high and low math ability students gave responses depend on the type of a task. there were difference responses between high and low math ability students in solving drawing marker and contextual tasks. In drawing marker task, high math ability student gave partial statistical response by checking set of less non-target event. Representation used by student was a fraction showing numerator; the number of target event or non-target event, denominator; the total number of whole. Low math ability student gave partial statistical response by checking set of more target event. Representation used by student was a number which indicated the number of target event. In contextual task, high math ability student gave statistical response by checking set of target and non-target events. Representation used by student was a fraction, showing numerator; the number of target or non-target events, denominator; the total number of possible outcomes. Low math ability student gave non statistical response, referred to experience in daily life. However, in rotating spinner task, high and low math ability gave statistical responsedue to the ability to justify his reason by using classical interpretation and used probability

with numbers. But representation used by students in this task was difference, representation used by high math ability student was common fraction or percent that showing the numerator; the number of part, the denominator; the total number of a single circle, while representation used by low math ability student was percentage of size of each color in spinner.

Based on the above statement, there were difference responses between high and low math ability students. High math ability student could list all possible outcomes in 1 and 2 dimensional sample space tasks, while low math ability student failed to do these tasks. Representation used by high math ability student in contextual probability of an event task was fraction, while low math ability student used percentages. In probability comparison task (drawing marker), high math ability student checked set of less non-target event, while low math ability student checked set of more target event. Similarly, In contextual task, high math ability student gave statistical response by checking set of target and non-target events, while low math ability student gave non statistical response, referred to experience in daily life. The difference of probabilistic thinking of high and low math ability students, in line with the research [1] resulted in some differences of probabilistic thinking 3rd grade of elementary school students based on mathematical ability. The result of this study indicated that students with different mathematical ability are also different in terms of probabilistic thinking. This is in line with the results of the study [17]. Further result of the study [1] showed that strategy and representation used by students in responding to different probability tasks, causing the rate of probabilistic thinking students were also at different levels. This is in line with the result of the study [17].

Dealing with responses and strategies were used by students in solving probability tasks depend on the type of a given task [18], these can be seen from responses have been given by students in solving probability of an event and probability comparison tasks.

In throwing dice task, elementary school students gave non-statistical response, because students gave their reason based on their experience in daily life. It can be seen from the response of both high and low math ability students in solving probability of an event task. Meanwhile, in rotating spinner task, elementary school students gave statistical response due to the ability to justify their reason by using classical interpretation and representation used was a fraction or percent. It can be seen from the response of both high and low math ability students in solving contextual probability of an event and probability comparison tasks. Therefore, researcher suggest that probability is firstly introduced to elementary school students through rotating spinner tasks by using spinner as a media in learning. This is because the shape of a circle spinner, can assist students in proportional thinking to response probability tasks. Students tend to connect with the concept of fractions and diagrams which they had learned in previous material.

Researcher suggest that the elementary school curriculum developers in Indonesia to introduce probability at primary level as a foundation to study probability at higher level and able to develop students' probabilistic thinking in early. Spinner media can be used by teachers in teaching probability concept to elementary school students, because spinner media can develop students' proportional thinking to develop students' probabilistic thinking. This is line with the result of this study that probability comparison tasks (in rotating spinner) and contextual probability of an event task, high and low math ability students gave statistical response, but representation used by them was difference. High math ability student used fraction and low math ability student used percentages.

CONCLUSION

There were difference responses between high and low math ability students. High math ability student could list all possible outcomes in 1 and 2 dimensional sample space tasks, while low math ability student failed to do these tasks. Representation used by high math ability student in contextual probability of an event task was fraction, while low math ability student used percentages. In probability comparison task (drawing marker), high math ability student checked set of less non-target event, while low math ability student checked set of more target event. Similarly, In contextual task, high math ability student gave statistical response by checking set of target and non-target events, while low math ability student gave non statistical response, referred to experience in daily life. The results of this study is as reference to mathematics curriculum developers of elementary school in Indonesia to introduce probability at primary level and able to develop students' probabilistic thinking in early. One way of teaching probability to elementary school students through rotating spinner tasks by using spinner as a media in learning. Since the shape of a circle spinner, it can assist students in proportional thinking to response probability tasks. Finally, the students' learning can continue to provide other types of tasks to develop their probabilistic thinking.

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