Volume 1868

Conference collection

The 4th International Conference on Research, Implementation, and Education of Mathematics and Science (4th ICRIEMS)

Research and Education for Developing Scientific Attitude in Sciences and Mathematics

Yogyakarta, Indonesia
15–16 May 2017

Editors
Cahyorini Kusumawardani, Agus Maman Abadi, Slamet Suyanto, Warsono and Insih Wilujeng

AIP | Conference Proceedings

proceedings.aip.org

Conference collection

The 4th International Conference on Research, Implementation, and Education of Mathematics and Science (4th ICRIEMS)

Research and Education for Developing Scientific Attitude in Sciences and Mathematics

Yogyakarta, Indonesia

15–16 May 2017

Editors

Cahyorini Kusumawardani

Agus Maman Abadi

Slamet Suyanto

Warsono

Insih Wilujeng

Yogyakarta State University, Yogyakarta, Indonesia

All papers have been peer reviewed.

AIP Publishing

Melville, New York, 2017

AIP Conference Proceedings

Volume 1868

Editors

Cahyorini Kusumawardani
Yogyakarta State University
Department of Chemistry
Jl Colombo No 1
Karangmalang, Depok, Sleman
Yogyakarta 55281
Indonesia

Email: cahyorini.k@uny.ac.id

Agus Maman Abadi
Yogyakarta State University
Department of Mathematics
Jl Colombo No 1
Karangmalang, Depok, Sleman
Yogyakarta 55281
Indonesia

Email: agusmaman@uny.ac.id

Slamet Suyanto
Yogyakarta State University
Department of Biology
Jl Colombo No 1
Karangmalang, Depok, Sleman
Yogyakarta 55281
Indonesia

Email: slamet_suyanto@uny.ac.id

Warsono
Yogyakarta State University
Department of Physics
Jl Colombo No 1
Karangmalang, Depok, Sleman
Yogyakarta 55281
Indonesia
Email: warsono@uny.ac.id

Insih Wilujeng
Yogyakarta State University
Department of Natural Science Education
Jl Colombo No 1
Karangmalang, Depok, Sleman
Yogyakarta 55281
Indonesia

Email: insih_wilujeng@uny.ac.id

ISBN 978-0-7354-1548-5
ISSN 0094-243X
Printed in the United States of America

Preface: 4th International Conference on Research, Implementation, and Education of Mathematics and Sciences (ICRIEMS)

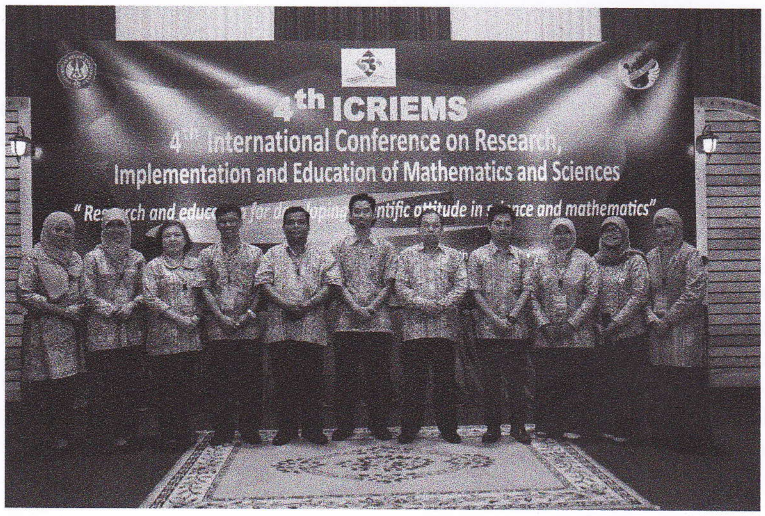
This is the proceedings of the 4th International Conference on Research, Implementation, and Education of Mathematics and Sciences (ICRIEMS) held by the Faculty of Mathematics and Science, Yogyakarta State University, Indonesia. All of the articles in this proceeding are obtained from a selection process by a team of reviewers and had already been presented in the conference on 15 – 16 May 2017 in the Faculty of Mathematics and Natural Sciences, Yogyakarta State University. This proceedings comprises 9 fields, that is mathematics, mathematics education, physics, physics education, chemistry, chemistry education, biology, biology education, and science education.

The theme of this 4th ICRIEMS is '*Research And Education For Developing Scientific Attitude In Sciences And Mathematics*'. The main articles in this conference are given by six keynote speakers, which are Dr. Jean W.H. Yong (University of Western Australia & Curtin University), Assoc. Prof. Khajornsak Buaraphan, Ph.D. (Mahidol University, Thailand), Prof. Maitree Inprasitha, Ph.D. (Khon Kaen University, Thailand), Prof. Dr. Zuhdan Kun Prasetyo, M.Ed. (Yogyakarta State University, Indonesia), Dr. Liem Peng Hong (NAIS Co. Inc., Japan), and Assoc. Prof. Dr. Nor Azowa Ibrahim (Universiti Putra Malaysia). Besides the keynote and invited speakers, there are also parallel articles that present the latest research results in the field of mathematics and sciences, and the education. These parallel session speakers come from researchers from Indonesia and abroad.

Hopefully, this proceeding may contribute in disseminating research results and studies in the field of mathematics and sciences and the education such that they are accessible by many people and useful for the Nation Building.

Yogyakarta, May 2017

Editorial Team



The 4th International Conference on Research, Implementation, and Education of Mathematics and Science (4th ICRIEMS)
AIP Conf. Proc. 1868, 010001-1–010001-1; doi: 10.1063/1.4995086
Published by AIP Publishing. 978-0-7354-1548-5/$30.00

The analysis of probability task completion; Taxonomy of probabilistic thinking-based across gender in elementary school students

Dwi Ivayana Sari, I. Ketut Budayasa, and Dwi Juniati

Citation: AIP Conference Proceedings **1868**, 050004 (2017); doi: 10.1063/1.4995131
View online: https://doi.org/10.1063/1.4995131
View Table of Contents: http://aip.scitation.org/toc/apc/1868/1
Published by the American Institute of Physics

The Analysis of Probability Task Completion; Taxonomy of Probabilistic Thinking-Based Across Gender in Elementary School Students

Dwi Ivayana Sari[1, a)], I Ketut Budayasa[2, b)], Dwi Juniati[3, c)]

[1]*STKIP PGRI Bangkalan (Soekarno Hatta Street no. 52, Bangkalan, East Java, Indonesia)*
[2, 3]*Universitas Negeri Surabaya, Indonesia*

[a)]dwiivayanasari@yahoo.com
[b)]ketutbudayasa@yahoo.com
[c)]dwi_juniati@yahoo.com

Abstract. Formulation of mathematical learning goals now is not only oriented on cognitive product, but also leads to cognitive process, which is probabilistic thinking. Probabilistic thinking is needed by students to make a decision. Elementary school students are required to develop probabilistic thinking as foundation to learn probability at higher level. A framework of probabilistic thinking of students had been developed by using SOLO taxonomy, which consists of prestructural probabilistic thinking, unistructural probabilistic thinking, multistructural probabilistic thinking and relational probabilistic thinking. This study aimed to analyze of probability task completion based on taxonomy of probabilistic thinking. The subjects were two students of fifth grade; boy and girl. Subjects were selected by giving test of mathematical ability and then based on high math ability. Subjects were given probability tasks consisting of sample space, probability of an event and probability comparison. The data analysis consisted of categorization, reduction, interpretation and conclusion. Credibility of data used time triangulation. The results was level of boy's probabilistic thinking in completing probability tasks indicated multistructural probabilistic thinking, while level of girl's probabilistic thinking in completing probability tasks indicated unistructural probabilistic thinking. The results indicated that level of boy's probabilistic thinking was higher than level of girl's probabilistic thinking. The results could contribute to curriculum developer in developing probability learning goals for elementary school students. Indeed, teachers could teach probability with regarding gender difference.

INTRODUCTION

Mathematics is a lesson which very important to the development of science and technology, because mathematics can read to the other field/disciplines, so it makes sense to be given to students as one of preparation to face the future.

Based on the importance of mathematics, formulation of mathematical learning goals is not only oriented on cognitive product, but also leads to cognitive process, that is probabilistic thinking. Probabilistic thinking has different from other thinking, its instrumental could make decision when one is faced with a situation which contains an element of uncertainty. For example, someone will bring an umbrella when he saw the sky was overcast, someone not only chooses mathematics department but also he chooses mathematics and physics departments when he noticed so many people interested to mathematics department. Evacuation team ask people around volcano to evacuate, when people feel unusual heat, even at night; mountain springs become dry and frequent small earthquakes. This is in line with [1] which stated that probabilistic thinking as a tool for decision making.

Based on the importance of probabilistic thinking in decision-making, then ones' probabilistic thinking needs to be developed. One way is by introducing/teaching probability gradually from primary education to higher education. This is in line with Halpern [2] which stated that probability was the study of likelihood and uncertainty. It played a

The 4th International Conference on Research, Implementation, and Education of Mathematics and Science (4th ICRIEMS)
AIP Conf. Proc. 1868, 050004-1–050004-8; doi: 10.1063/1.4995131
Published by AIP Publishing. 978-0-7354-1548-5/$30.00

critical role in all professions and in most everyday decisions. [3] also stated that probability was a very useful concept that needs to be introduced early in the development of children and continuously revisited. Consequently, many countries had made changes in curriculum by introducing probability of elementary school [4], [5]. It shows that introducing probability at primary level is very important, especially for developing students' probabilistic thinking early on.

In addition, many studies were conducted by experts to investigate students' probabilistic thinking. [6] have formulated, refined and validated. The major constructs incorporated in this framework were sample space, probability of an event, probability comparisons, and conditional probability. For each of these constructs, four levels of thinking, namely subjective, transitional, informal quantitative and numerical. At each level, and across all four constructs, learning descriptors were developed and used to generate probability tasks. Similarly, [7] has identified the most prominent probability frameworks in literacy research used SOLO taxonomy as a basis for characterizing the development of students' thinking. Two research groups were responsible for the development of these frameworks; one in the United States led by Graham Jones and another in Australia led by Jane Watson. The framework consists of prestructural probabilistic thinking, unistructural probabilistic thinking, multistructural probabilistic thinking and relational probabilistic thinking. 1) Description of prestructural probabilistic thinking: student thinking is irrelevant, non-mathematical, or personalized. At this level indicates that student have an intuitive understanding of randomness, student believe outcomes can be controlled or explained, student believe consecutive events are always related, student struggle creating complete sample spaces and distinguishing between fair and unfair situations, student use idiosyncratic thinking when making predictions. 2) Description of unistructural probabilistic thinking: student thinking is quantitative and non-proportional. At this level indicates that student have a tendency to revert to subjective probabilistic thinking, student have a qualitative view of randomness—"anything is possible", student make predictions about most or least likely events by using quantities, student create sample spaces for one-stage experiments and some two-stage experiments, student distinguish between fair and unfair situations, student compare probabilities, student determine conditional probabilities, student become aware that probabilities can change in consecutive events. 3) Description of multistructural probabilistic thinking: student thinking is quantitative and proportional. At this level indicates that student make use of ratios, counts, probabilities or odds in judging probabilistic situations, student create samples spaces for one-stage and two-stage experiments systematically, student provide examples of random situations or methods of random generation, student recognize changes in probability and independence in without-replacement events, student make predictions that sometimes rely on representativeness strategies. 4) Description of relational probabilistic thinking: student thinking shows an interconnection of probabilistic ideas. At this level indicates that student give reason with probabilities, student determine probabilities for complex situations including non-equally likely situations, student generate sample spaces for two-stage and three-stage experiments systematically, student connect sample spaces and probabilities, student examine distribution of outcomes without reverting to representativeness strategies, student show an appreciation of randomness by not being influenced by order or balance of outcomes.

Level of probabilistic thinking of every student is different. Factor of differentiate levels of students' probabilistic thinking are gender. Because gender is one of distinguishing boy and girl based on aspects of social and cultural relations. Gender is derived from English language meaning "grouping into male and female; sex ". Furthermore, according to [8] concept of gender refered to boy or girl based on socio-cultural and psychological dimensions. In related to ability of boys and girls, whereas [9] found that girls had higher scores in certain areas than boys. Verbal skills of girl was higher than boy, despite low spatial abilities. However, [8] found that performance of boys better than girls in maths. In regarding to probabilistic thinking and gender, [10] stated that boys scored higher than girls on probabilistic reasoning, whereas [11] produced that girls performed better on every probability tasks.

Based on the above statement, it is necessary to analyze of probability task completion based on probabilistic thinking taxonomy developed by [7] to elementary school students; boy and girl. The results can provide input for elementary school mathematics curriculum developers to formulate learning goals corresponding probabilities for elementary school students based on their level of boys' and girls' probabilistic thinking. In addition, the results can also provide input for elementary school teachers to select teaching and learning methods and media to elementary school students for studying probability by considering students' probabilistic thinking; boy and girl.

METHOD

Subject

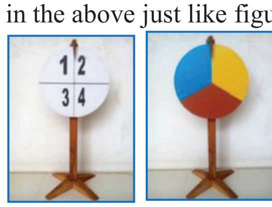
Subjects in this study were boy and girl students of fifth grade who have high math ability and able to be communicated. Subject selection was done by giving math ability test to all students and classified each students based on their scores. There were two categories of math ability, score > 60 (high math ability) and score < 60 (low math ability). Boy and girl were selected in high math ability group.

Instrument

Instruments in this study consisted of:

- Math ability test items was used to select subjects.
- Probability task sheet, containing (a) sample space which related to list or identify complete set of possible outcomes of one- and two- stage experiment, (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 a situation where most probability to generate target events.

TABLE 1. Probability Task Sheet

Probability task	Sample space 1 stage experiment	Sample space 2 stage experiment
Sample space	There is a box contains balls with same type and size. The balls are 5 yellow balls, 4 purple balls, and 3 blue 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?	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!
Probability of an event	There is a box contains balls with same type and size. The balls are 5 yellow balls, 4 purple balls, and 3 blue 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!	
Probability comparison	There are 2 boxes contain markers with same type and size. Box I contains 1 green markers and 3 blue markers. Box II contains 2 green markers and 4 blue markers. You are told to close your eyes and take one marker. If you want to get a blue marker, so which box you will choose? Give your explanation with using a number	

Procedure

This study was an exploratory study with a qualitative approach. Researchers themselves who collected and analyzed data and could not be replaced by others [12]. The data collection was done by providing probability task sheet to subjects. Subjects did probability task sheet according to their ability. Then, researchers interviewed subjects to determine level of students' probabilistic thinking in solving probability tasks. The data analysis was done by categorizing data, reducing data, presenting data, interpreting and drawing conclusions.

RESULTS AND DISCUSSION

Level of Boys' Probabilsitic Thinking

Boys' response in solving sample spaces task for one-stage experiments can be seen from the following interview.

R : What color ball can be drawn?
B : Yellow, purple and blue balls
R : What is your reason?
B : All of balls can be drawn, but every balls have different possibilities
R : What do you mean by "all of balls can be drawn, but every balls have different possibilities"?
B : Yeah, all of balls can be drawn because our eyes is closed. And hmmm,,, the number of every balls are different, so that possibility of every balls are different

Boy made sample space for one-stage experiment by stating that yellow, purple and blue balls could be drawn. His reason because his eyes was closed, and then boy predicted that probability of each balls were different because the number of each balls in box were different.

Boys' response in solving sample spaces task for two-stage experiments can be seen from the following interview.

R : What pairs of digit and color can be designated?
B : 1, 2, 3, 4, blue, yellow, and red
R : What is your reason?
B : All of digits and colors in spinners can be designated and we don't know what digit and color can be designated because every digits or colors have the same size and chance
R : What do you mean by "we don't know what digit and color can be designated"?
B : Because spinner is rotated, don't directed. So I don't know directly
R : What do you mean by "every digits or colors have the same size and chance"?
B : On spinner A, there are 3 colors. Every colors have the same size, so that chance of each color is equal to be designated by arrow. On spinner B, there are 4 digits. Every digits have the same size, so that chance of each digit is equal to be designated by an arrow.

Boy didn't make pairs of digit and color could be designated by an arrow, but he just mentioned 1, 2, 3, 4, blue, yellow, red without pairing. His reason because all digits and colors in spinners could be designated. And then he did not know what digit or color could be designated because spinner was rotated, don't directed. In addition, he also predicted that probability of each digit or color in spinner were equal because size of each number or color in spinner were same.

Boys' response in solving probability of an event task can be seen from the following interview.

R : What color ball is most likely to drawn?
B : Yellow ball
R : Why is yellow ball?
B : Because the number of yellow ball is largest and also its probability is great
R : How do you know?
B : The number of yellow ball is 5, the number of purple ball is 4, the number of blue ball is 3. The number of yellow ball is largest than others
R : If the number of ball is largest, why is ball most likely to drawn?
B : If the number of ball is little, then probability of ball is small. The ball can't be drawn, or can be taken but this probability is smaler than yellow ball
R : What is probability of yellow ball?
B : 5/12
R : Why?
B : Because hmmm,,, if fraction, the number of yellow ball per the number of all balls
R : Why do you relate it to fraction?
B : Because I don't know by using percent
R : What is probability of purple ball?
B : 4/12
R : Then what is probability of blue ball?

B : 3/12

Boy explained that yellow ball was most likely to be drawn because the number of yellow balls was largest. The number of yellow balls was 5, while the number of the purple balls was 4 and the number of blue balls was 3. In addition, boy predicted that probability of yellow ball was 5/12, while probability of purple ball was 4/12 and possibility of blue ball was 3/12. It showed that boy used quantitative and proportional to predict possibility of ball to drawn.

Boys' response in solving probability comparison task can be seen from the following interview.

R : What box is you choose to get a blue marker?
B : Box I
R : Why do you choose box I?
B : The number of green marker in box I is less than in box II. I chose box I because the number of green marker is 1/4 and the number of blue marker is 3/4. Whereas in box II, the number of green marker is 2/6 and the number of blue marker is 4/6.
R : What do you mean?
B : Hmmm,,, probability of green marker in the box I is smaller than probability of green marker in the box II
R : If probability of green marker in the box I is smaller than probability of green marker in the box II, why is box I easier to get blue marker?
B : Because I don't pay attention on the number of blue marker
R : What do you pay attention?
B : Small possibility of a green marker.
R : Why?
B : Because if possibility of green marker in box is smaller, so we have great opportunity to draw blue marker.
R : What is probability of blue marker in box I?
B : 3/4
R : What do you mean of 3/4?
B : 3/4 is the number of blue marker per the number of all markers in box I, green and blue markers.

Boy explained that if he drawn a blue marker, he should draw marker in box I. His reason because the number of green marker in the box I less than the number of green marker in the box II. So possibility of green marker in box I was less than probability of green marker in box II. Boy didn't pay attention the number of blue marker in box I and II, but he pay attention less likely to draw green marker. It was because if probability of green marker was smaller, then probability of blue marker was larger. He explained that probability of blue marker in box I was 3/4. It showed that he used quantitative and proportional in predicting box which most likely to produce blue marker.

The above results indicated that the level of boys' probabilistic thinking showed multistructural probabilistic thinking because he created sample space for experimental 1 stage systematically. Although he did not make sample space for two-stage experiments 2, but he predicted probability of each item in set based on size and the number of item. In addition, he predicted probability of an event by using ratio. He used fraction representation. The result were consistent with the result of [13] stated that invented language was used in the sense that one or more students suggested their own ways of describing probabilities and others then adopted their language. This language was used in both oral and written forms. An example of such invented language was the use of "one out of three" to describe a probability rather than the more conventional use of one third. But the result were not consistent with the result of [14] stated that student gave partial statistical response in solving probability of an event and comparison probability tasks because student's reason refered to proportionality misconception.

Level of Girls' Probabilsitic Thinking

Girls' response in solving sample spaces task for one-stage experiments can be seen from the following interview.

R : What color ball can be drawn?
G : Yellow, purple and blue, because every color can be drawn
R : What do you mean by "every color can be drawn"?
G : Because if I answer just yellow, then purple and blue have chanced to be drawn.

Girl made sample space for one-stage experiment by stating that yellow, purple and blue balls could be drawn. Her reason because any color could be drawn, so that if she answered just yellow, then purple and blue had chance to drawn.

Girls' response in solving sample spaces task for two-stage experiments can be seen from the following interview.

R : What pairs of digit and color can be designated?
G : If digit, 1, 2, 3, and 5. If color, blue, yellow and red. My reason because every digit and color can be got
R : What do you mean by "every digit and color can be got"?
G : If I answer 4 only, then 1, 2, and 3 can be got. If I answer blue only, yellow and red can be got
R : So, how many pairs of digit and color?
G : If it is digit, there is 4 and if it is color, there is 3

Girl didn't make pairs of digit and color could be designated by an arrow, but she just mentioned 1, 2, 3, 4, blue, yellow, red without pairing. Her reason that all digits and colors on spinner may be designated by arrows. So if she answered one number or color only, then others digit or color had opportunity to be designated by arrows.

Girls' response in solving probability of an event task can be seen from the following interview.

R : What color ball is most likely to drawn?
G : The most likely drawn are yellow
R : Why?
G : Because the number of yellow more than purple and blue
R : do you know, why if it is the number of ball is more than the others in the box, then it will be most likely drawn?
G : Because if the number of ball is more than others in the box, then the ball in upper will be inside box. So that if we draw then we can get yellow. If the number of ball is most then others, then the ball more easily to get
R : Can you give reason in number why is yellow ball most likely to get?
G : The number of yellow is 5 more than 4 and 3. So We easily get 5 balls
R : How many percentage is easy to get yellow ball?
G : 80%.
R : Why?
G : Because if purple is 10%, blue is 10%. Because the number of yellow ball more than purple and blue, than I give 80%
R : Why are purple 10% and blue 10%?
G : Because if 80%, there is remainder 20%, if the total is 100%, than I divide 10% of purple and 10% of blue
R : Why do you use this strategy?
G : It Depends on the number of balls If the ball is most than other, I give percent based on the number of the ball

Girl explained that yellow ball was most likely drawn because the number of yellow most then others. So that, yellow ball is more easily drawn. She explained that the number of yellow balls was 5, while the number of purple balls was and the number of blue was 3. In addition, She predicted probability of yellow ball using percentages as a result of her estimation based on the number of each color balls in box, namely possibility of yellow was 80%, while probability of purple and blue were 10%, so that when it was added, it became 100%. She used quantitative but non proportional to predict possibility of ball to be drawn.

Girls' response in solving probability comparison task can be seen from the following interview.

R : Where will you take blue marker, box I or II?
G : Box I and II because different of blue and green in box I and II is equal
R : Can you give reason in number?
G : In box I, the different of blue and green is 2, because 3 minus 1 equal 2. In box II, the different of blue and green is 2 too, because 4 minus 2 equal 2. So that if the different of blue and green in box I and II are equal, then if we want to draw blue marker, we can draw from box I or box II
R : If the difference of blue and green in box I and II are equal, why will you get same blue markers?
G : If in box I, there are 1 green and 5 blue then I will draw in box I, because different of blue and green in box I more than in box II
R : If the difference of blue and green in box I more than box II, why will you draw in box I
G : If the number of blue more than the number of green, then in box I will be easier to get blue marker
R : How many percentage is easy to get blue marker?

G : Beside I pay attention on the number of blue marker, I pay attention on the number of yellow marker
If the number of blue marker more than the number of green marker, than I will easily get blue marker. In box I blue marker was 90% and in box II blue marker was 80%
R : Why?
G : Because the number of green marker in box I is just 1 then 100% minus 10% equal 90%. While in box II the number of green markers is 3, if the number of blue marker was 4, than 80%

Girl explained that if she wanted to draw blue marker, she should draw marker from box I and II. Her reason because difference the number of blue and green markers in box I and II were equal. She explained that difference the number of blue and green marker in the box I was 2 because 3 minus 1 equals 2, while difference the number of blue and green marker in box II also 2 because 4 minus 2 equals 2. The next, she explained that if in box I, the number of green was 1 and the number of blue was 5, difference the number of blue and green markers in box I more than in box II, so it was easy to get blue marker. She predicted probability of blue marker in box I and II by using percentage as a result of her estimation based on the number of blue marker in box I and II. She explained that the easy to get blue marker in box I was 90%, while the easy to get blue marker in box II was 80%. Her reason because in box I, the number of green marker was 1 so that the possibility of green marker was 10%. She used quantitative but non proportional to predict possibility of ball to be drawn.

The above results indicated that level of girls' probabilistic thinking showed unistructural probabilistic thinking because she created sample space for experimental 1 stage systematically but she did not create sample space for experimental 2 stage. In addition, she predicted probability of an event based on quantity but non proportional. She used percentage representation as a result of her estimation.

The results showed that level of boys' probabilistic thinking was higher than level of girls' probabilistic thinking. The results were consistent with the result of [10] stated that boys' scored higher than girls on probabilistic reasoning, but the results was in contrast to [11] stated that girls performed better on every probability tasks. Boy used quantitative and proportional in predicting probability of an event, whereas girl used quantitative but non proportional. Although girl used percentage, but her percentage was as a result of her estimation based on the number of item in the set. While boy used fraction representation. It showed a proportional of each item in the set.

The implication of this result could contribute to curriculum developers in Indonesia to introduce probability to elementary school students. Sample space, probability of an event and probability comparisson were first concepts of probability could be introduced to elementary school students. These concepts were basic to learn probability in higher level. Morever, elementary school students could use classical interpretation to solve probability tasks by using fraction representation. While, for teachers could teach probability by using teaching and learning method with pay attention on gender difference. Discussion method was teaching and learning method can be done by forming heterogen groups. Each group includes boy and girl. So that, through face-to-face interaction and discussion, students could learn together in understanding and solving probability tasks.

CONCLUSION

The results was level of boy's probabilistic thinking in completing probability tasks indicated multistructural probabilistic thinking, while level of girl's probabilistic thinking in completing probability tasks indicated unistructural probabilistic thinking. This indicated that level of boy's probabilistic thinking was higher than the level of girl's probabilistic thinking. The results could contribute to curriculum developer in developing probability learning goals for elementary school students and for teachers could teach probability with pay attention on gender difference. In addition, the other researcher should do research about probabilistic thinking for elementary school students on other aspects.

ACKNOWLEGMENT

The authors would like to thank to the Director of Research and Community Service, Directorate General for Strengthening Research and Development, Ministry of Research, Technology and Higher Education that has provided research costs. Indeed, the Chairman of the institute of Research and Chairman of the Mathematics Education STKIP PGRI Bangkalan who have given permission for research.

REFERENCES

1. I. Lamprianou, and T. A. Lamprianou, *International Group for the Psychology of Mathematics Education*, **3**, 173 – 180, (2003).
2. L. S. Hirsch, and A. M. O'Donnell, *Journal of Statistics Education*, **9** (2), (2001).
3. F. M. Taylor, *Louisiana Association of Teachers of Mathematics Journal*, **2**, (2001).
4. J. Threlfall, *Cambridge Journal of Education*, **34** (3), 297–314, (2004).
5. Z. Nikiforidou, J. Pange, *Early Childhood Educ J.*, **38**, 305–311, (2010).
6. G. A. Jones, C. W. Langrall, C. A. Thornton, and A.T. Mogill, *Educational Studies in Mathematics*, **32**, 101–125, (1997).
7. E. S. Mooney, C. W. Langrall, and J. T. Hertel, "A Practitional Perspective on Probabilistic Thinking Models and Frameworks," in *Probabilistic Thinking Presenting Plural Perspective*, edited by E. J Chernoff, and B. Sriraman (Spinger, New York, 2014), pp.495-507.
8. Santrock, *Psikologi Pendidikan*. *Educational Psychology. (3nd ed.)* (Salemba, Jakarta, 2009).
9. S. M. Dagun, *Maskulin dan Feminim: Perbedaan Pria dan Wanita dalam Fisiologi* (Rineka Cipta, Jakarta, 1992).
10. A. Yenilmez, S. Sungur, C. Tekkaya, *Hacettepe Üniversitesi Egitim Fakültesi Dergisi*, **28**, 219-225, (2005).
11. H. Tsakiridou, & E. Vavyla, *American Journal of Educational Research*, **3**(4), 535–540, (2015).
12. J. W. Creswell, *Qualitative Inquiry & Research Design: Choosing Among Five Approach 2nd Edition* (Sage Publication, London, 2007).
13. G. A. Jones, C. W. Langrall, C. A. Thornton, & A. T. Mogill, *Journal for Research in Mathematics Education*, 30(5), 487–519, (1999).
14. D. I. Sari, I. K. Budayasa, & D. Juniati, "Probabilistic Thinking of Elementary School Students in Solving Contextual and Non Contextual Probability Tasks," in Proceeding of 3rd International Conference on Research, Implementation and Education of Mathematics and Science (3rd ICRIEMS, Yogyakarta, Indonesia, 2016), pp. ME-323 – ME-330, May 16-17.