Research Article

Analysis of Mathematical Representation Skills in the Topic of Probability Reviewed from the Read or Write Learning Style

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Abstract.

This study describes mathematical representation on students' read/write learning style in solving probability problems. It uses qualitative research to study the students of class VIII A of SMPN 3 Ngawi. The research data is based on the results of learning style tests given to students and mathematical representation tests. Subjects with a read/write learning style were given a mathematical representation test followed by an interview test. They were found to have symbolic representation ability which is conducive to understanding the given problems, having good visual representation skills in understanding the problem of opportunity events, good image representation skills in understanding the given problems.

Keywords: mathematical representation, probability, learning style

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1. INTRODUCTION

Mathematics is one of the general sciences which has an important role in human life. Every student is required to study mathematics because this knowledge will always be used in continuing to a higher level of education, and can even be applied in everyday life. The importance of studying mathematics makes efforts to improve the quality of mathematics learning need to be carried out continuously.

Efforts to improve mathematics learning need to be carried out comprehensively so that learning objectives can be achieved. The National Education Standards Agency (2006) (1) explained that "The general objective of mathematics learning is so that students can have abilities such as understanding, reasoning, problem solving, communication, and an attitude of appreciating the usefulness of mathematics in life" (p. 139). This goal further strengthens the importance of providing quality mathematics learning. This subject will be very useful for students to have the ability to understand

and solve problems using mathematical logic. Nurdiansyah, et al. (2017) (2) stated that "Mathematics learning is expected to end with a comprehensive student understanding. The expected student understanding is not only to fulfill the objectives of mathematics learning substantively but also expected to have accompanying effects from the learning" (p. 278). This accompanying effect can be in the form of better logic, students becoming more innovative and creative in dealing with problems, being able to combine mathematics with other fields, and so on.

One form of mathematical ability is mathematical representation. Instructions from the Ministry of Education, Culture, Research and Technology (2022) (3) state that the purpose of learning mathematics is to communicate ideas with symbols, tables, diagrams, or other media to clarify a situation or problem, and to present a situation into a mathematical symbol or model (mathematical communication and representation). Mathematical representation is an important aspect of mathematics learning. Mathematical representation is related to the process of creating and using symbols, tables, diagrams, or other forms to communicate mathematical ideas and modeling. This process also includes flexibility in changing from one form of representation to another, and choosing the most appropriate representation to solve the problem (p. 8) (3). Salma and Sumartini (2022) (4) argue that representation skill is a fundamental ability for students to develop and possess. Mathematical representation skill is considered important, because it is closely related to other mathematical abilities, such as communication and mathematical problem solving (p. 266). Mathematical representation skill also helps students in building and understanding concepts, expressing mathematical ideas, and also makes it easier for students to develop their abilities.

The achievement of learning objectives is determined by the accuracy in choosing learning that is in accordance with the differentiation of student characteristics. Yusuf and Amin (2016) (5) stated that teachers are not enough to just plan teaching, because each student has differences in several aspects, such as intelligence, talent, behavior, attitude, learning style (p. 86). Hartati (2015) (6) Students' learning styles can be recognized easily. A person's learning style is one of the characteristics of the individual learning, in other words, learning style is reflected in a person's personality and abilities (p. 225). So basically learning style is the easiest way for an individual to learn something.

The results of previous research by Hardianti and Effendi (2019) (7) found that the mathematical representation of class XI MIPA 2 students at the school in linear program topic was in the medium category (p. 1093). Previous research by Zulfah and Rianti (2018)

(8) found that in the visual representation ability of table presentation, students were able to represent data or information from a table into other forms such as row patterns. In this representation, there are various forms or patterns that are given so that they show good visual representation skills. Visual representation ability of images where students make pictures of geometric parts to solve problems and facilitate problem solving. The ability of symbolic representation or mathematical equations or expressions possessed by students is already possessed by almost all students (p. 118). The previous research findings above show the importance of students' mathematical representations. Skills in representation is the ability of students to interpret a problem in the form of an image, symbol, number, word or sentence, so that it is easy to understand and find a solution (9). Mathematics education in the classroom still emphasizes the description of students without giving opportunities to students to try various representations in mastering a concept (10).

The learning style of each individual student is basically different. The difference in learning styles is thought to affect student learning outcomes. This condition needs to be considered by teachers in order to know the right steps to improve student learning outcomes. Where in the process of knowledge students have unique learning styles (p. 236) (11). Learning style is the easiest way for individuals to absorb, organize and process the information received. This is in accordance with the opinion of Amin and Suardiman (2016) (12) that the appropriate learning style is the key to a person's success in learning. Students really need to be helped and directed to recognize learning styles that suit themselves in learning activities, so that learning goals can be achieved effectively (p. 15). This research became is very important because there is still a lack of information or reference about the style students, so that most of them. Teachers choose learning methods without considering the style (13).

Student Learning In mathematics learning at junior high school level, the average student has learning problems in certain subjects. The results of an initial interview with Mrs. Wulan, as one of the mathematics teachers at SMPN 3 Ngawi, obtained information that students have learning problems in the topic of probability. The topic of probability requires conceptual understanding and using logical thinking. Understanding of this topic of probability can be improved by improving mathematical representation skills. The mathematical representation skills of each student need to be known in order to overcome the learning problems of the topic of probability. Differences in the mathematical representation skills of individual students need to be analyzed

based on the students' learning styles. Diverse learning styles are thought to have an impact on students' mathematical representation skills. Each component of the learning style has its own characteristics. Characteristics of the read/write learning style include easily receiving information by reading, liking to rewrite what is in the book, recording information conveyed by the teacher neatly and in detail, and tending to read quietly. Students who have a read/write learning style type can reason at the stage of understanding problems and solving them to present mathematical problems, as well as mathematical manipulation at the stage of solving. Students who have a read/write learning style type can reason at the stage of understanding problems and solving them to present mathematical problems, as well as mathematical manipulation at the stage of solving (Ahmad, 2019) (14).

2. METHOD

The research form used is qualitative. According to Sugiyono (2017) (15), qualitative research method is a research method based on the philosophy of positivism, used to research the natural conditions of objects, where the researcher is the key instrument. This qualitative research is used to obtain facts related to the ability of mathematical representation in the topic of probability reviewed from the learning style of SMPN 3 Ngawi students. The research strategy used is a case study. Case studies are an effective means of showing the relationship between researchers and respondents. The qualitative case study method is a model that emphasizes the exploration of a system that is related to each other. The selection of this case study strategy was carried out to answer the previously established problem formulation.

The subjects of this study were 30 students of class VIII A of SMP Negeri 3 Ngawi, consisting of 19 female students and 11 male students. This study will discuss the ability of mathematical representation in the topic of probability in terms of the learning styles of SMPN 3 Ngawi students. The determination of the subjects of this study used purposive sampling. Sugiyono (2017) (15) argues that "Purposive sampling is a technique for determining samples with certain considerations" (p. 85). Not all students of class VIII A were used as research subjects. The subjects of the study were determined based on the results of the questionnaire determining the students' learning styles. Each learning style is represented by two students who are determined with the consideration that

the measurement of mathematical representation abilities can be represented by each learning style applied by the students.

This research used indicators of mathematical representation, namely:

1) Word representation, which is solving problems with word explanations.

2) Visual representation, which is using visual information provided to solve problems.

3) Image representation, which is presenting mathematical representations in the form of images to solve problems.

4) Symbolic representation, namely writing equations or formulas and carrying out calculations for the given problems.

3. RESULTS AND DISCUSSIONS

The research data taken in this research is based on the results of learning style tests and mathematical representation tests. The results of the learning style test are analyzed to determine the type of subject's learning style. Based on the results of the learning style test, it will be used to group the mathematical representation abilities of each learning style. After determining the student's learning style, a mathematical representation test will be carried out. To obtain the results of the mathematical representation ability test, a written test and an interview test are used. The subjects given the mathematical representation test are two subjects from each of the learning styles that have been determined. The following are the written test and the mathematical representation interview.

3.1. Subject A1 Data

Subject A1 is a subject who has been given a learning style test and a written mathematical representation test. Subject A1 is determined based on the results of the learning style test that has been given. Subject A1 gets the highest score in the read/write learning style. The following are the results of the representation test for subject A1 data 1 and data 2:

1. Word Representation Skills

The results of the answers from the written test on subject A1 for number 1 data 1 are:

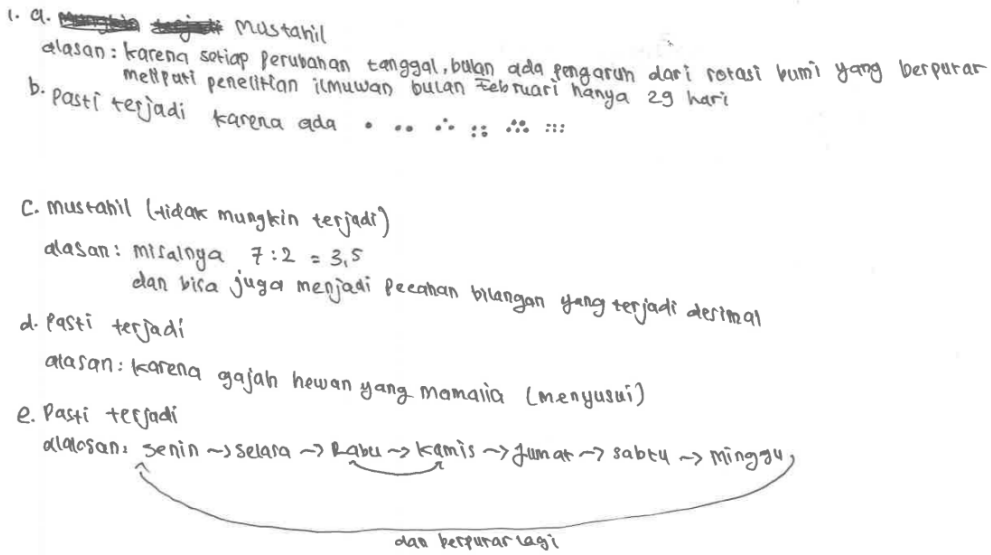

Figure 1: the written test on subject A1 for number 1 data 1.

The results of the written test for subject A1 for number 1 data 2 are:

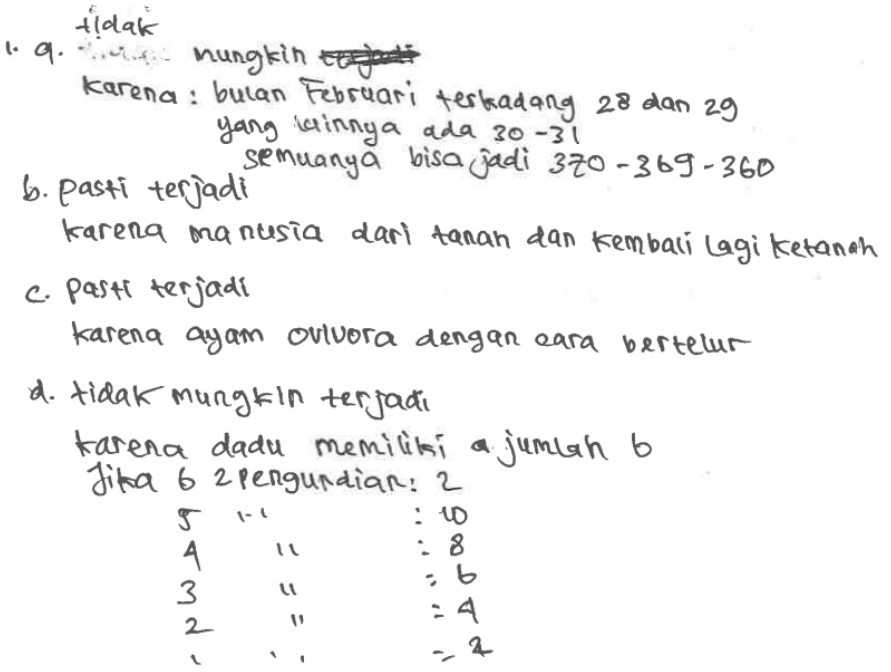

Figure 2: the written test for subject A1 for number 1 data 2.

Data 1 and data 2 will be compared to determine the valid word representation capability

TABLE 1: Triangulation of symbolic representation ability test results.

Data test result 1	Data test result 2
Subject A1 is able to understand the given problem. Subject A1 was able to answer some of the possible opportunities	Subject A1 is less able to understand the given problems. Subject A1 was able to answer a few of the problems given.
Subject A1 was less able to provide precise and clear reasons for answers written using words	Subject A1 only gave a few precise and clear reasons for the answers written using words
Subject A1's word representation ability is less able to answer the probability of an event and explain the reasons for the event in words. Subjects were quite able to answer some of the chance events but were less able to give correct and clear reasons.	

2. Visual representation skills

The results of the answers from the written test on subject A1 for number 2 data 1 are:

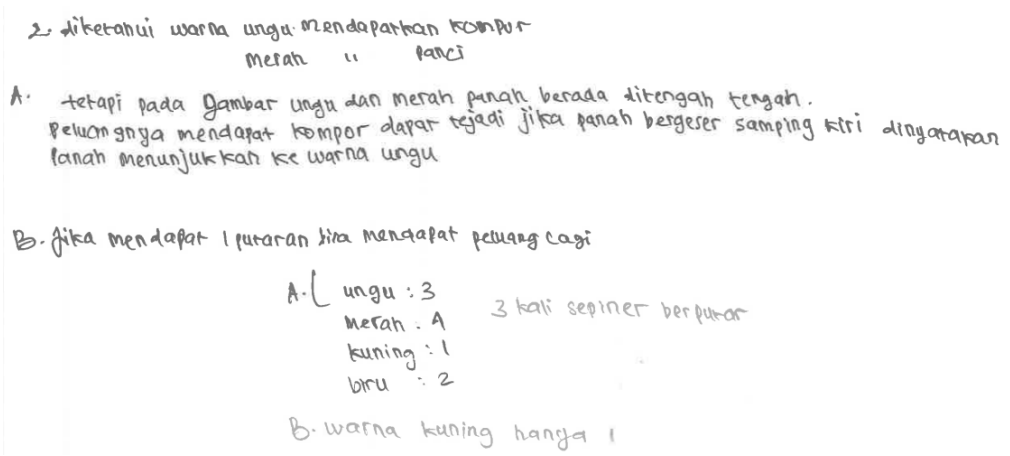

Figure 3: the written test on subject A1 for number 2 data 1.

The results of the written test for subject A1 for number 2 data 2 are:

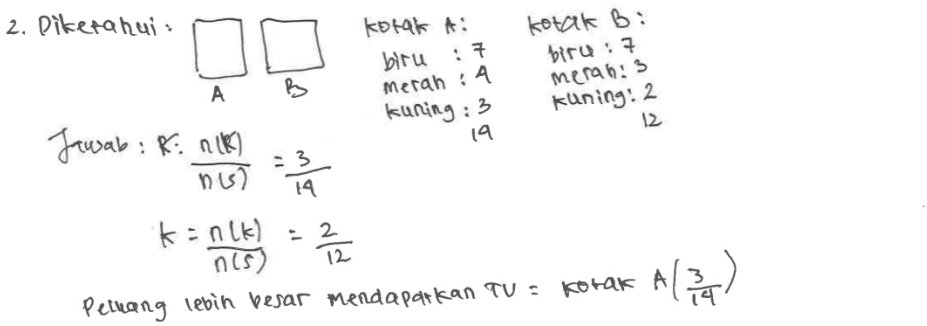

Figure 4: the written test for subject A1 for number 2 data 2.

Data 1 and data 2 will be compared to determine the valid word representation capability.

TABLE 2: Triangulation of visual representation ability test results.

Data test result 1	Data test result 2
Subject A1 is less able to understand the problem of chance events. Subject A1 wrote only part of the information about the problem given.	Subject A1 is able to understand the problem of chance events well. Subject A1 can write down information from the given problem well, namely writing down the contents of each colored ball in each box.
Subject A1 is less able to solve the problem of chance events from the picture in the question.	Subject A1 is quite able to answer the problem of the opportunity events given. Subjects wrote answers that were formulaic and correct answers, but did not provide systematic answers.
Subject A1's visual representation ability is quite capable of solving an opportunity event with the visual information provided to solve the problem. The subject presented information from the picture of the problem but did not provide complete formula information.	

3. Image representation ability

The answer results from the written test for subject A1 for number 3 data 1 are:

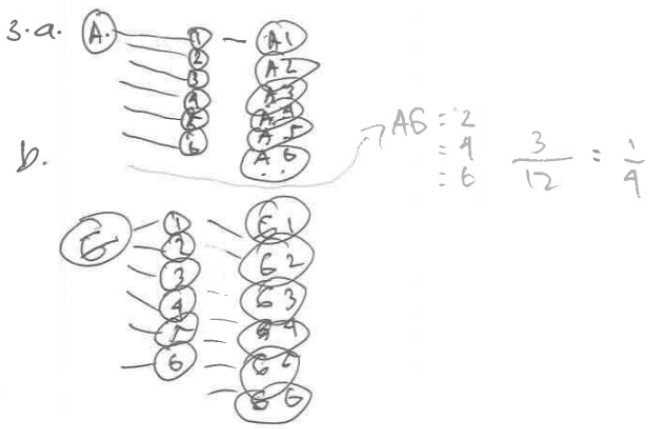

Figure 5: the written test for subject A1 for number 3 data 1.

The results of the written test for subject A1 for number 3 data 2 are:

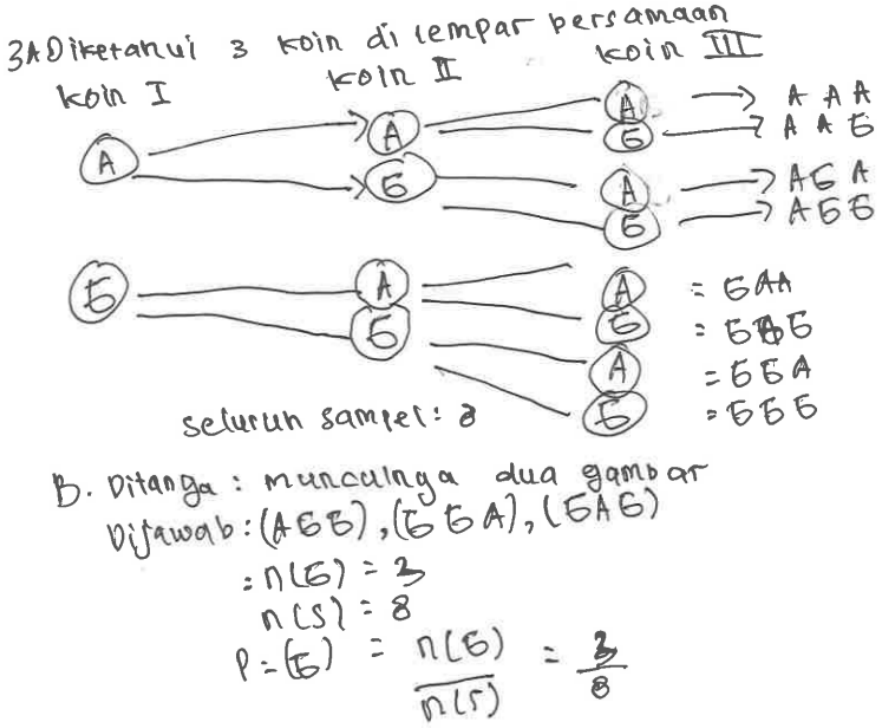

Figure 6: the written test for subject A1 for number 3 data 2.

Data 1 and data 2 will be compared to determine the valid word representation capability.

TABLE 3: Triangulation of image representation ability test results.

Data test result 1	Data test result 2
Subject A1 understands the problem given quite well. Subject A1 was able to present a tree diagram image quite well but did not write down the number of sample spaces for the image information presented.	Subject A1 is able to understand the given problem well. Subject A1 can present a tree diagram well.
Subject A1 is less able to understand the problem of the given opportunity event. The subject did not solve the problem from the image information he made.	Subject A1 is able to understand the problem of the opportunity given. The subject writes the correct answer, and provides mathematical formulas and explanations.
Subject A1's image representation ability is able to determine how to present mathematical representations in the form of tree graph images and use the image information created to solve problems. The subject can present a tree diagram image well and then use the image information to solve probability problems.	

4. Symbolic representation skills

The results of the answers from the written test on subject A1 for number 4 data 1 are:

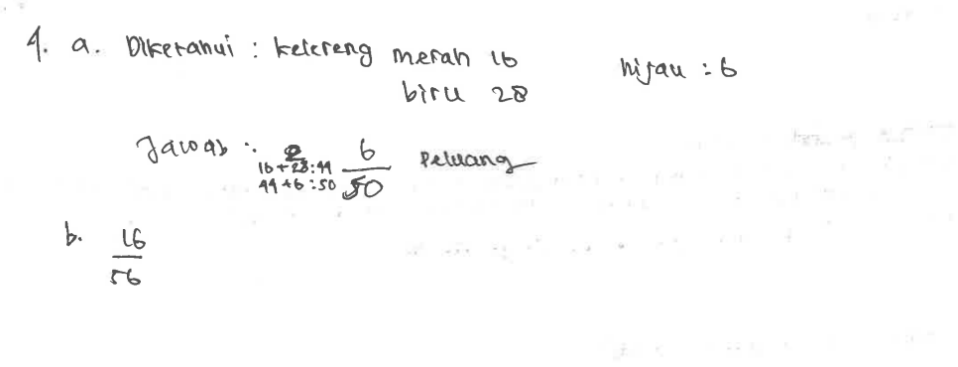

Figure 7: the written test on subject A1 for number 4 data 1.

The results of the written test for subject A1 for number 4 data 2 are:

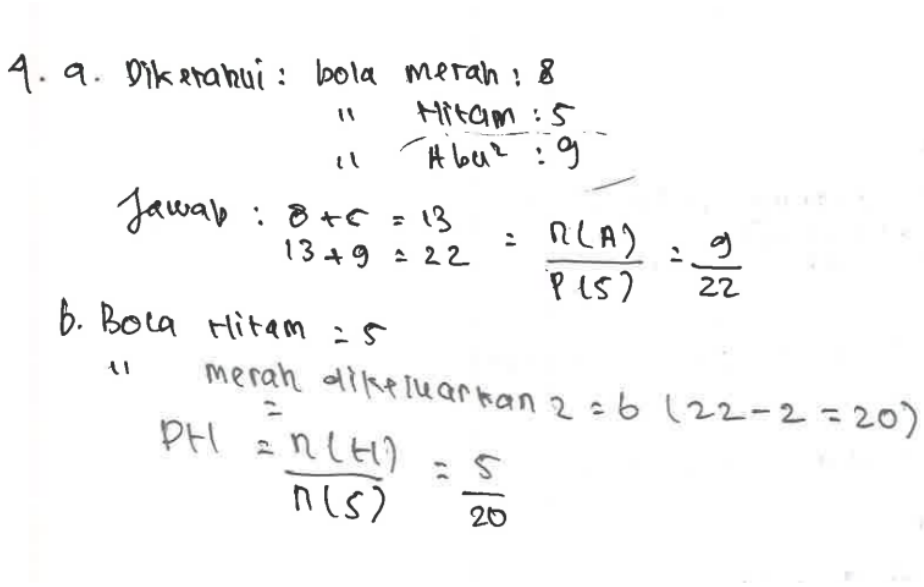

Figure 8: the written test for subject A1 for number 4 data 2.

Data 1 and data 2 will be compared to determine the ability of valid word representation.

3.2. Subject A2 Data

Subject A2 is a subject who has been given a learning style test and a written mathematical representation test. Subject A2 is determined based on the results of the learning style test that has been given. Subject A2 gets the highest score in the read/write learning style. The following are the results of the representation test for subject A2 data 1 and data 2:

TABLE 4: Triangulation of symbolic representation ability test results.

Data test result 1	Data test result 2
Subject A1 is less able to understand the problem given properly. Subject A1 presented information from the questions only partially.	Subject A1 is quite able to understand the problem given well. Subject A1 presented information from the questions given, although it was incomplete
Subject A1 was unable to understand the given probability event problem. The subject wrote an incorrect answer and did not write the probability equation formula.	Subject A1 is able to understand the given probability event problem well. The subject writes the correct answer, and the probability equation formula is written correctly.
Symbolic representation ability Subject A1 is quite capable of determining the probability of an event by writing an equation or formula and performing calculations from the given problem. The subject presents only part of the information from the given question then writes the correct answer, and the probability equation formula is written correctly.	

a. Word representation ability.

The answer results from the written test of subject A2 for number 1 data 1 are:

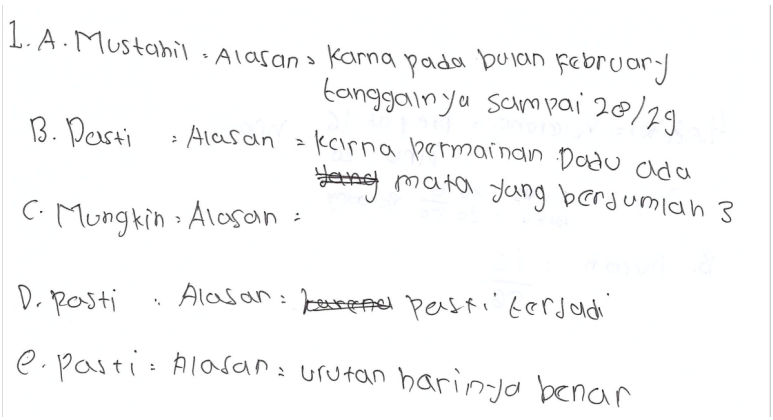

Figure 9: the written test of subject A2 for number 1 data 1.

The results of the written test for subject A2 for number 1 data 2 are:

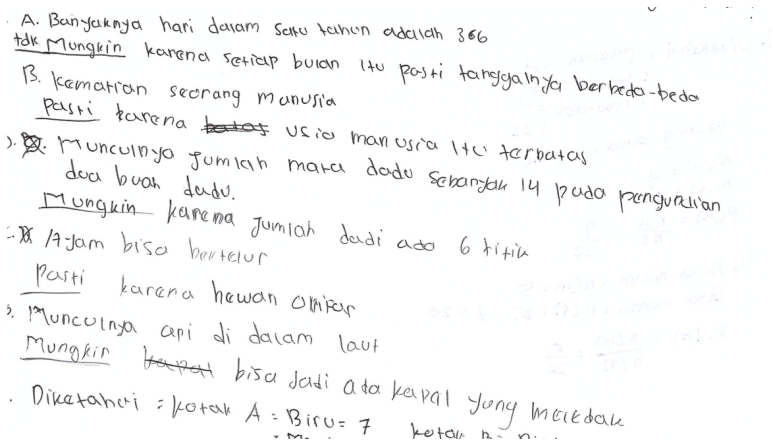

Figure 10: the written test for subject A2 for number 1 data 2.

Data 1 and data 2 will be compared to determine the ability of valid word representation.

TABLE 5: Triangulation of word representation ability test results.

Data test result 1	Data test result 2
Subject A2 was less able to answer all the statements given. Subject A2 was only able to answer some probability events correctly. There is a date of February 30th is impossible and after Wednesday is Thursday is certain.	Subject A2 was less able to answer all the statements given. Subject A2 was only able to answer some of the chance events correctly. The death of a human being is certain and the appearance of fire in the sea is possible.
Subject A2 was less able to explain the reasons for the opportunity event. Subject A2 only explains some chance events. There is a date of February 30th is impossible because in February the date is until 28 or 29 and after Wednesday is Thursday is certain because the order of the days is correct.	Subject A2 was less able to explain the reasons for the opportunity event. Subject A2 only explains some chance events correctly. The death of a human being is certain because human life span is limited and the emergence of fire in the sea is possible because there could be a ship that explodes and the fire is still burning.
Subject A2's word representation ability is less able to answer the probability of an event and explain the reasons for the event in words. The subject is only able to answer and explain the reasons for some probability events correctly.	

b. Visual representation ability

The answer results from the written test of subject A2 for number 2 data 1 are:

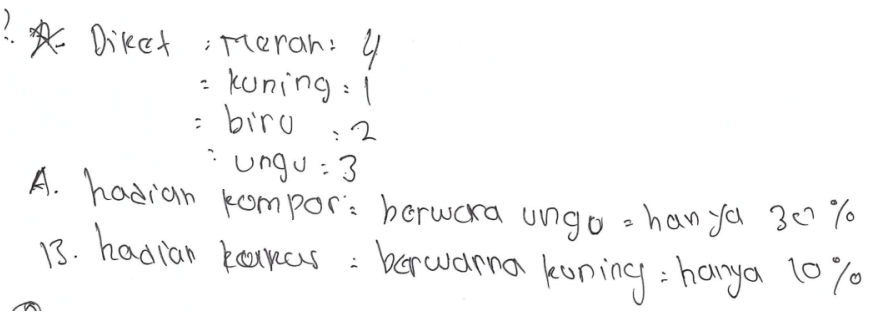

Figure 11: the written test of subject A2 for number 2 data 1.

The results of the written test for subject A2 for number 2 data 2 are:

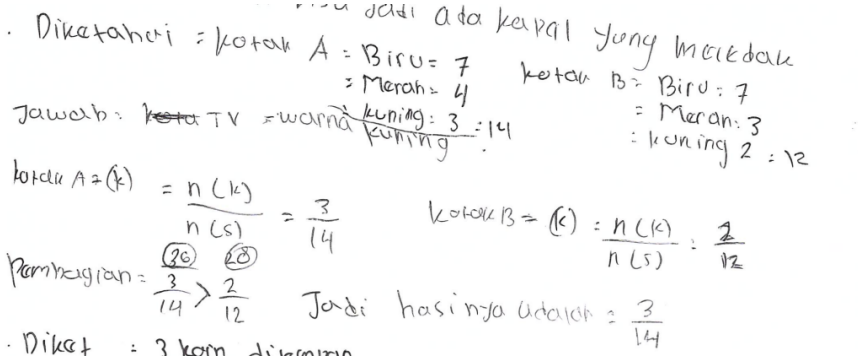

Figure 12: the written test for subject A2 for number 2 data 2.

Data 1 and data 2 will be compared to determine the ability of valid word representation.

TABLE 6: Triangulation of visual representation ability test results.

Data test result 1	Data test result 2
Subject A2 was less able to understand the problem of chance events. Subject A2 wrote down some information from the given picture. Subject A2 only wrote down the number of red, yellow, blue and purple colors.	Subject A2 was able to understand the problem of the opportunity given. Subject A2 wrote down some information from the question picture. Subject A2 only wrote down the number of ball colors from each box A and box B.
Subject A2 was less able to solve the problem of opportunity events. In question number 2a, subject A2 was unable to answer the problem given. In question number 2b, subject A2 answered the probability problem correctly but did not provide a mathematical method.	Subject A2 was able to solve the problem of opportunity events. Subject A2 solves the problem given with the information obtained in the picture. Subject A2 determines the probability in box A and box B correctly and solves the problem given in the question.
Subject A2's visual representation ability is quite capable of solving an opportunity event with the visual information provided to solve the problem. The subject writes down some information from the problem picture and then solves the problem given from the information obtained in the picture.	

c. Image representation ability

The answer results from the written test of subject A2 for number 3 data 1 are:

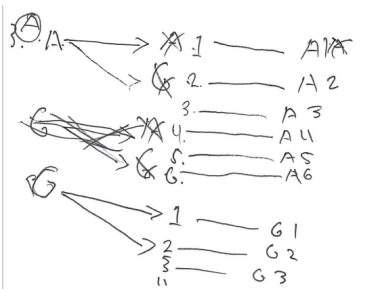

Figure 13: the written test of subject A2 for number 3 data 1.

The results of the written test for subject A2 for number 3 data 2 are:

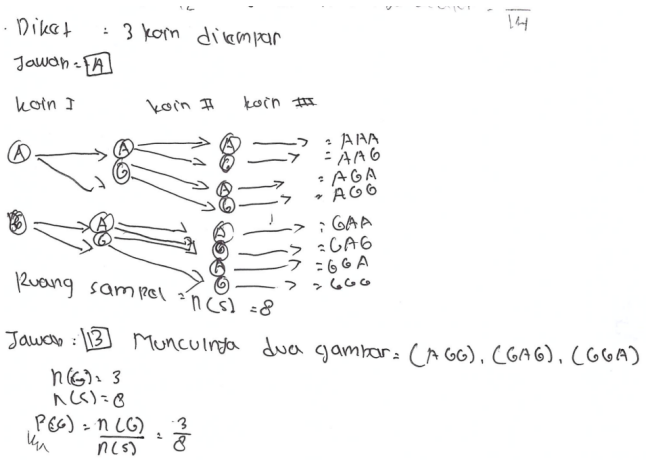

Figure 14: the written test for subject A2 for number 3 data 2.

Data 1 and data 2 will be compared to determine the ability of valid word representation.

TABLE 7: Triangulation of image representation ability test results.

Data test result 1	Data test result 2
Subject A2 is less able to understand the given problem. Subject A2 only presents a partial image of the tree diagram. The image presented is only the sample space of the coin number probability while the sample space of the coin image is not written completely.	Subject A2 quite understands the problem given well. Subject A2 can present a complete tree diagram image and provide the number of sample spaces for the image he made.
Subject A2 was less able to understand the problem of the given opportunity event. Subject A2 did not write any answers at all to solve the problems given.	Subject A2 was able to understand the problem of the given opportunity event well. Subject A2 wrote the correct answer and provided a mathematical method for the image information he made.
Subject A2's image representation ability is able to determine the presentation of mathematical representations in the form of tree graph images and use the image information created to solve problems. Subject A2 can present a complete tree diagram image and then solve problems using the correct information.	

d. Symbolic representation ability

The answer results from the written test of subject A2 for number 4 data 1 are:

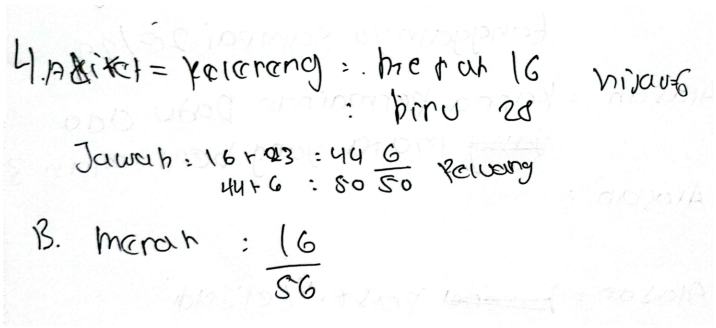

Figure 15: the written test of subject A2 for number 4 data 1.

The results of the written test for subject A2 for number 4 data 2 are:

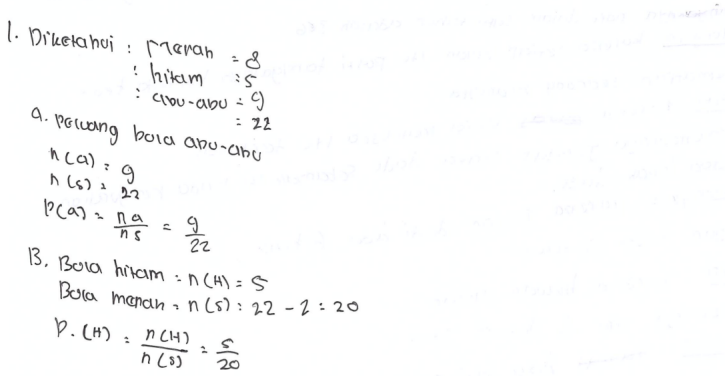

Figure 16: the written test for subject A2 for number 4 data 2.

Data 1 and data 2 will be compared to determine the ability of valid word representation.

Table 8: Triangulation of symbolic representation ability test results.

Data test result 1	Data test result 2
Subject A2 was less able to understand the problem given properly. Subject A2 only presents some of the information from the questions given. Subject A2 wrote down the number of red, green and blue marbles then answered the question correctly but did not write down the equation or formula and did the calculation of the given problem.	Subject A2 was able to understand the problem given well. Subject A2 presents information from the given question even though it is incomplete. Subject A2 wrote down the number of red, green and blue marbles but did not write down the number of all the marbles, then answered the question correctly and wrote the equation or formula and carried out calculations for the problem given.
Subject A2 was less able to understand the problem of the given opportunity event. The subject did not write down the information from the question and then answered correctly but did not write down equations or formulas or carry out calculations for the problem given.	Subject A2 was able to understand the problem of the opportunity given. The subject writes down information from the question then can answer correctly and write down equations or formulas and do calculations from the given problem.
Subject A2's symbolic representation ability is quite capable of determining the probability of an event by writing an equation or formula and performing calculations from the given problem. Subject A2 writes down the information from the question and then can answer correctly and write down equations or formulas and carry out calculations for the problem given.	

The results of the data obtained will be analyzed between subjects from the read/write learning style to determine the ability of mathematical representation.

a. Analysis of Word Representation Ability

The following are the results of data analysis on word representation abilities in Subject A1 and Subject A2:

Table 9: Results of word representation ability data analysis.

Competency Achievement Indicators	Subject A1	Subject A2
Students are able to solve problems by explaining words.	A1 is less able to answer opportunities for events and explain the reasons for events in words.	A2 is less able to answer opportunities for events and explain the reasons for events in words.
Subject A1 and Subject A2 were less able to understand the problems given and only answered some of the possible opportunities correctly. Subject A1 and Subject A2 were less able to explain the reasons for opportunity events and only explained some opportunity events clearly and well.		

b. Visual Representation Ability Analysis

The following are the results of the data analysis on visual representation ability in Subject A1 and Subject A2:

Table 10: Results of visual representation ability data analysis.

Competency Achievement Indicators	Subject A1	Subject A2
Students are able to solve an event of opportunity with the visual information provided to solve the problem.	Subject A1 is quite capable of solving an opportunity event with the visual information provided to solve the problem.	Subject A2 is quite capable of solving an opportunity event with the visual information provided to solve the problem.
Subject A1 and Subject A2 were able to understand the problem of the opportunity given. Subject A1 and Subject A2 wrote down some information from the problem picture, were able to solve problems of chance events, solved the problems given with the information obtained in the picture.		

c. Image Representation Ability Analysis

The following are the results of the data analysis on image representation ability in Subject A1 and Subject A2:

Table 11: Results of image representation ability data analysis.

Competency Achievement Indicators	Subject A1	Subject A2
Students are able to determine how to present mathematical representations in the form of images to solve problems.	Subject A1 was able to determine how to present mathematical representations in the form of tree graphic images and use the image information created to solve problems.	Subject A2 was less able to determine how to present mathematical representations in the form of tree graphic images and use the information from the images created to solve problems.
Subject A1 and Subject A2 are able to understand the problem of the opportunity given. Subject A1 and Subject A2 can present a tree diagram image well from the information given in the problem.		

d. Analysis of Symbolic Representation Ability

The following are the results of the data analysis of symbolic representation abilities in Subject A1 and Subject A2:

Table 12: Results of image representation ability data analysis.

Competency Achievement Indicators	Subject A1	Subject A2
Students are able to determine the probability of an event by writing equations or formulas and performing calculations from the given problems.	Subject A1 is quite capable of determining the probability of an event by writing equations or formulas and performing calculations from the given problems.	Subject A2 is quite capable of determining the probability of an event by writing an equation or formula and performing calculations from the given problem.
Subject A1 and Subject A2 were quite able to understand the problems given well, present information from the questions given, write down the number of marbles for each color then answer the questions correctly and write equations or formulas and carry out calculations from the problems given		

The diversity of learning styles that students have in the classroom should be a reference for a teacher in developing students' mathematical representation skills so that the learning provided can be in accordance with the student's condition (p. 41) (16).

This student's learning style is suspected to have an impact on students' mathematical representation ability.

Symbolic representation ability that is quite good in understanding the given problems well, presenting information from the given questions, writing down the number of marbles of each color, then answering questions correctly and writing down equations or formulas and carrying out calculations from the given problems. As written by Ilham (2018) (17) characteristics of the read/write learning style include easily receiving information by reading, liking to rewrite what is in the book, recording information conveyed by the teacher neatly and in detail, and tending to read quietly.

4. CONCLUSION

Based on data analysis, it can be concluded that subjects with a read/write learning style have:

1. Less word representation ability in understanding the given problems and only answering some of the possible chance events correctly, less able to explain the reasons for chance events and only explaining some of the chance events clearly.

2. Good visual representation skills in understanding the problem of opportunity events given, writing down some information from the picture of the problem, being able to solve problems of chance events, solving problems given with the information obtained in the picture.

3. Good image representation skills in understanding the given problems well and being able to present tree diagrams well from the information provided in the questions.

4. Symbolic representation ability that is quite good in understanding the given problems well, presenting information from the given questions, writing down the number of marbles of each color, then answering questions correctly and writing down equations or formulas and carrying out calculations from the given problems.

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