Differences of Visual, Auditorial, Kinesthetic Students in Understanding Mathematics Problems

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ABSTRACT

Characteristics of students who are diverse, such as different learning styles will also lead to the possibility of differences in students' ability to understand the learning material and every problem given, especially at the stage of understanding the problem given, because this stage is the most important step to determine the next problem solving step. Therefore this study aims to reveal and illustrate how different characteristics of visual, audio and kinesthetic students in understanding problems. Data retrieval was done in class VIII of Arjasa 1 Junior High School with test methods, interviews, and questionnaires. Data were analyzed through stages of data reduction, analysis, and decision making. Furthermore, based on the data analysis that has been done, it can be concluded that there are differences in the characteristics of understanding problems for visual, auditory and kinesthetic students in terms of completeness and regularity of information writing, quantity of repetition of reading questions, marking important information and activity/movement habits done during the process of understanding the problem.

1. INTRODUCTION

When teaching in class, we will always be faced with different conditions, characteristics, learning processes, thought processes and abilities of students. Because God created humans in different conditions since they were born. So that each individual has their own characteristics that make one with the other unique and there are no two individuals who are the same between them (Ghufron and Risnawati, 2012). One of them is about learning styles. Learning style is one of the characteristics that students have that is easiest to observe and study during the learning process in the classroom. According to Keefe (1979) that "Learning styles are cognitive characteristics, behavior and psychological learning styles are also the easiest way an individual has to absorb, regulate, and processing information received by students (Bire et al. 2014). So, understanding student learning styles is a very important thing to be able to help and guide students towards success and minimize failure. There have been many opinions that agree that broadly by understanding the learning styles and preferences of students it will be beneficial for students and teachers (Awla, 2014).

Broadly speaking, the classification of learning styles can be Broadly speaking, the classification of learning styles can be divided into three main types, namely cognitive, personality (psychology), and sensory. In this type of sensory learning style,

there will be three general learning styles that are often used and have been divided into three sub-types of learning styles by De Porter (2016), which include visual, audio and kinesthetic learning styles (Dornyei, 2005; Oxford, 2001), According to Dunn and Dunn in Gilakjani (2011) states that only about 20-30% of school-age children belong to the type of auditory learning style, 40% are students with visual learning styles, and 30-40% as kinesthetic or visual learners/tactics. In addition, Barbe and Milone (1981) specify that in elementary school children, the most common learning styles are visual (30%), or mixed (30%), then followed by hearing (25%) and subsequently kinesthetic learning styles (15%). Rose and Nicholl in Zahroh (2014) explained that based on research in the United States conducted by Professor Ken and Rita Dunn from St. University. John in Jamaica, New York, and Neuro-Linguistic Programming experts who have identified three different learning and communication styles state that: a) Visual learning styles, intended for students who learn through seeing things, namely by looking at diagrams or pictures, shows, watching videos or demonstrations; b) Auditory learning styles, namely learning through hearing something that can be like listening to lectures, audio tapes, debates, verbal discussions and instructions (orders); and c) Kinesthetic learning styles that are characteristic of learning through physical activity and direct student involvement, namely by moving, feeling, touching or experiencing themselves. Meanwhile, based on the results of

research conducted by Widiyanti (2011) found that student learning styles had an effect of 3.62% on mathematical problem solving abilities. This statement is also echoed by the opinion of Aljaberi (2015) who also stated that "students' ability to solve mathematical problems varied depending on their learning style".

The process of problem solving carried out by students is also very diverse, differences that occur are very possible one of them because it is influenced by differences in the tendency of learning styles that they have with each other. As expressed by Indrawati (2017) in the results of his research which stated that the differences in problem solving abilities possessed by each student with different learning styles, namely 1) students with auditory learning styles (SA), have been able to understand the problem well and able to make a problem solving plan by linking the facts that are known to the concepts they have before, 2) students with a visual learning style (SV) are less able to understand the problem so that it influences the answers it produces, students with this learning style also do not check back towards the results that he had obtained and this happened because SV habits that did not really like reading, while 3) students with kinesthetic learning (SK) in the process of understanding the problem SK read the questions while moving their limbs, felt anxious when reading questions that caused him not able to maintain his focus in understanding questions, this directly affects the answers given by the decree which are not in accordance with the results desired by the researcher. Based on the explanation of the results of this study, we have obtained evidence that reinforces the notion that differences in learning styles will also affect each problem solving process carried out by students, both in terms of understanding problems, making completion plans, implementing plans for problem solving until the process of re-examining answers they get.

Cognitive problem solving is one of the essential life problems contexts and mathematical problem solving is seen as the most important part in the field of mathematics (Aljaberi, 2015). In the opinion expressed by Lestari & Yudhanegara (2017) saying that problem solving ability is the ability to solve routine problems and not routine either application problems or which are not applied in the scope of mathematics. There are several ways/strategies that we can do about how to solve problems, and the way that is considered the most successful is by learning problem solving skills obtained through meaningful contexts (Mayer, 1998).

There are four problem-solving steps proposed by Polya which can be used as a measurement tool for problem solving analysis process. Polya (Anglin, 2004) states that the four stages of problem solving include: understanding the problem, making a problem solving plan, implementing the plan that has been made and re-examining the results that have been obtained. Problem solving skills require training often enough. Basically, mathematical problem solving is an ultimate goal that is very important in determining the final outcome of a learning process. This is seen as a correct approach to show thinking in general. But, in fact, problems often arise in the process of problem solving during teaching and learning activities. These problems occur as a result of gaps between individuals and the achievement of their objectives or during the problem solving process. Weaknesses in understanding problems by students are caused by a lack of mastery of mathematical strategies that can help the problem solving process and motivation are low (Soancatl, et al., 2010). Understanding the problem, can do by reading the problem, determine information/elements of the

problem (Nurkaeti, 2018).

Understanding the problem during the implementation of the problem solving process is a problem that is considered the most important to be resolved immediately, especially for most beginners who are required to solve problems. Heller and Hungate in Kaur (1997) stated that

"In several empirical and theoretical analyzes related to scientific problem solving and noted that novices are deficient with respect to understanding problems in fundamental principles or concepts. They cannot, or do not, construct the problem representation that is helping in achieving solutions. Research problems using a process of successive refinements - unless they are & with a simple problem for which they immediately recall a specific solution method. The results of this research are based on the results of the analysis and qualitative analysis before beginning to generate equations. Novices do not have the knowledge required to approach problems in this way and tend to go directly from the problem text to equations. Experts have a large amount of domain-specific factual knowledge that is both technically correct and well organized. Experts also have knowledge about the concepts and practices, and procedures for interpreting and applying their factual knowledge. Novices lack much of this knowledge, do not have their knowledge well organized, and often exhibit better preconceptions rather than scientifically correct ideas. Experts have a repertoire of universal patterns and the knowledge of problem types and solutions novices have not yet developed. "

In addition, in the results of his research, Novriani (2017) tells us that students' difficulties in solving problems occur because 1) students have difficulty in solving problems in the part of reading questions or questions, 2) students are always wrong in interpreting problems, 3) If students are incorrect in understanding the problem, they will guess the answer to the problem, 4) students do not want to know the solution to the problem given, and 5) students have difficulty understanding the problem so they cannot interpret it into a symbolic form. From the results of these studies indicate that 4 of the 5 difficulties experienced by students at the time of problem solving lies in the step of "understanding the problem" which results in students failing to solve the problem.

This problem underlies us to reveal how the activities, activities, and behavior of students in understanding problems during the process of solving the problems they face. In this article, the subject will be taken from students who have different learning styles. This is because several studies show that children's ability to solve problems can differ according to the learning styles they have. Therefore, this article aims to reveal and illustrate how students differ from each of the visual, audio and kinesthetic learning styles in understanding the problems given to them. This information is expected to help alleviate students in finding strategies in understanding problems that are in accordance with their learning style habits and can provide an overview to parents, guardians or teachers of the students' unique behavior that they might do while understanding the problem.

2. RESEARCH METHODS

This research is a qualitative descriptive study that aims to reveal and systematically describe the facts and characteristics of the object and subject under study, namely about how different ways to understand the problems carried out by students with visual, audio and kinesthetic learning styles as

long as they solve mathematical problems. The data analyzed in this study is qualitative data which is divided into 1) Primary data in the form of speech or writing or even observing the attitude/behavior of selected subjects which shows how students with each learning style try to understand the problems they face and 2) Secondary data obtained from the results of the questionnaire determining the learning style group and the results of the students' initial math skills test results. The data was taken in class VIII-B of SMP Negeri 1 Arjasa Jember in Academic Year 2018/2019.

Determination of the subject begins by categorizing the students in class VIII in each group learning style conducted by paying attention to the results of student answers to questionnaires that have been compiled and developed based on the characteristics of learning styles proposed by DePorter and Hemacki. The questionnaire used included a closed questionnaire consisting of 63 questions consisting of each of the 21 question items in each group of learning styles which were further divided into 14 positive statements and 7 negative statements. The questionnaire conclusion is based on Yulianti's (2017) research which states the following:

1. Visual learning style, if the total score for the visual statement is greater than 3 points from the audio and kinesthetic statements.
2. Audio learning style, if the total score for audio statements is greater than 3 points from visual and kinesthetic statements.
3. Kinesthetic learning styles if the total score for visual statements is greater than 3 points from visual and audio statements.

Then the determination of the subject is done by paying attention to the results of the written test to find out the students' mathematical abilities until it is chosen that there are 3 subjects which consist of 3 students who each have different learning styles with high mathematical abilities. mathematical problems and then interviewed regarding the results of the work.

So that the data collection methods used by researchers in this study include: 1) Test methods, namely written tests that aim to determine mathematical abilities and problem solving tests; 2) Questionnaire method; and 3) interview method. For retrieval of data to be processed, researchers first provide a written test in the form of a problem solving test to each subject alternately, at different times and carried out 2 times. Subjects are given full supervision during the process of problem solving questions with the aim of capturing every detail of the characteristics, gestures, habits, actions, speeches, and writings carried out by the subject in understanding the problem. After giving a written test and the subject has completed it, then a semi-structured interview is based on the results of solving problems that have been done by the subject in question. This is done in order to be able to dig deeper information and reveal information that might not have been revealed/seen in the results of the written test of the subject's work. Data that has been obtained through the results of the interview are then processed into a form of interview transcript that aims to facilitate researchers in the process of analyzing data. Whereas for data analysis activities carried out, researchers conducted activities 1) data reduction, 2) data presentation and 3) data analysis carried out sequentially.

3. RESULTS AND DISCUSSION

The test for determining the learning style group was conducted on 28 students of class VIII-B at SMP Negeri 1 Arjasa shortly before the mathematics learning process was carried out by the subject teachers. The data obtained after the questionnaire is done by students include:

Table 1. Data on Number of Classifications of Class VIII B. Students' Learning Styles

No.	Ninitial Names	Learning Styles			
		V	A	K	Category
1.	S04B	33	27	27	SV
2.	S11B	30	26	22	SV
3.	S14B	46	35	39	SV
4.	S16B	37	32	31	SV
5.	S20B	39	32	30	SV
6.	S24B	37	32	22	SV
7.	S27B	39	35	28	SV
8.	S01B	27	32	28	SA
9.	S02B	27	32	27	SA
10.	S03B	34	40	31	SA
11.	S05B	35	40	26	SA
12.	S10B	29	36	24	SA
13.	S28B	25	37	29	SA
14.	S12B	29	30	34	SK
15.	S21B	33	28	43	SK

Based on the data shown in Table 1, it can be seen that there are 7 students who have visual learning styles, 6 students with audio learning styles and 2 students who have a tendency for kinesthetic learning styles. While 13 other students did not get the tendency of learning styles among the three. This shows that the number of students with a tendency towards VAK learning styles is more than 50% of the total number of students in the class, according to the opinion of Kharb et al. (2013) which states that the majority is 61% of the multimodal Visual, Auditory, Reading students and Kinesthetic preferences and among 39% of the respondents had a unimodal learning preference that the most common unimodal preference was kinaesthetic, followed by visual, auditory and read and write.

After successfully grouping class VIII-B students into their respective learning styles tendencies, the researchers continued to give the math ability test to the 15 students listed in Table 1 to obtain 5 students in the high-value category. The following are the results obtained after giving a math ability test.

Table 2. Students Data for Early Ability Test (TKA) High Category Class VIII B

No.	Name	Value	Category
1.	S05B	80	Tinggi
2.	S14B	85	Tinggi
3.	S15B	80	Tinggi
4.	S18B	80	Tinggi
5.	S21B	80	Tinggi

So that if the data available in Table 1 and Table 2 are combined, the research subjects will be selected as shown in Table 3 below:

Table 3. Data on Subject Selection

| No. | Initial | Learning Style | | | | Ability |
		V	A	K	Category	Category
1.	S04B	33	27	27	SV	Low
2.	S11B	30	26	22	SV	Medium
3.	S14B	46	35	39	SV	Height
4.	S16B	37	32	31	SV	Low
5.	S20B	39	32	30	SV	Low
6.	S24B	37	32	22	SV	Low
7.	S27B	39	35	28	SV	Low
8.	S01B	27	32	28	SA	Low
9.	S02B	27	32	27	SA	Medium
10.	S03B	34	40	31	SA	Medium
11.	S05B	35	40	26	SA	Height
12.	S10B	29	36	24	SA	Low
13.	S28B	25	37	29	SA	Low
14.	S12B	29	30	34	SK	Low
15.	S21B	33	28	43	SK	Height

Based on the data shown in Table 3, information was obtained that the chosen subject was S14B as a subject with a tendency towards visual learning style (SV) because the highest scores from visual questionnaires and test of mathematics ability results were high, S05B as a subject with a tendency towards audio learning styles (SA) because it has the highest audio questionnaire value and the test of mathematics ability scores are included in the high category, and S21B as the subject with the tendency of kinesthetic learning style (SK), because it has the highest kinesthetic questionnaire value and the test of mathematics ability scores are included in the high category.

After the research subject has been determined, then the implementation of the problem-solving test is carried out, followed by conducting semi-structured interviews based on the results of problem solving that has been done by each subject, each of which is done twice. Based on the results of the tests, the results are that:

a. Students with visual learning styles.
During the process of understanding the problem, on the answer sheet the results of the visual subject work show that the subject is seen scribbling on the question sheet and answer sheet and deleting some of his writing to correct his thinking and this is done as long as SV resolves the problem do, write down all information obtained and needed by him clearly and systematically as in the part that is known, asked and answered. This activity shows that in addition to correcting the correctness of his understanding, SV also tries to reveal everything he needs in written form (visual form) in order to make it easier to solve problems. As shown in figure 1.
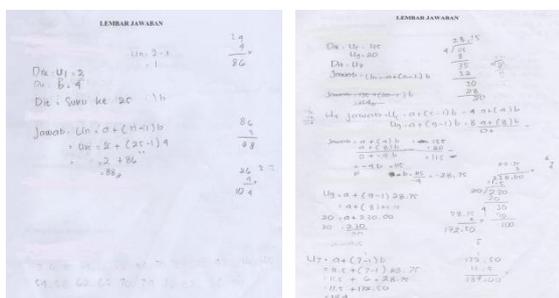

Fig 1. Results of SV Work in the Answer Sheet

While the results of the interview obtained information that the first activity carried out by students with this learning style is to read the questions given to him as much as 2 to 3 times. This is done because the subject is less able to understand the problem given if only once read the question of the problem given. Then the subject looks for the sequence of information that will be needed during problem solving and writes the information that has been obtained. This can be seen in the following picture of the interview transcript.
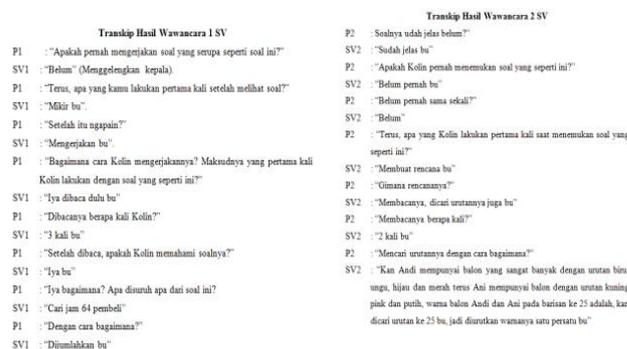

Fig 2. Excerpt of SV First and Second Interview Results

Thus, from the overall results of the analysis carried out on the results of the work and interviews conducted to SV, it can be concluded that 1) the visual subject always writes what he understands and thinks, 2) writes the information obtained systematically and in accordance with the parts (known, asked and answered), 3) scribbled information that was deemed inappropriate (incorrect), and 4) read the questions given 2 to 3 times which were done while underlining the information on the question.

b. Students with audio learning styles.
Based on the results obtained from the SA answers on the answer sheet given by students with audio learning styles during the process of understanding the problem, we get information that the subject is seen writing what he understands on the answer sheet, crossing out the writing that is not in accordance with his understanding, writing down the calculation process that is being done, but not written systematically and divided into parts (known, asked and answered). This can be seen in figure 3 below.
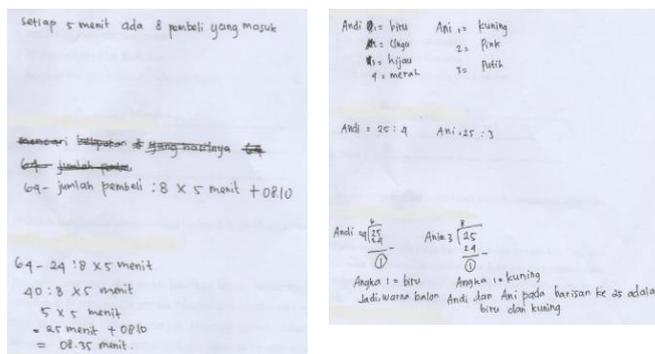

Fig 3. Results of Work in the SA Answer Sheet

Furthermore, based on the results of the interviews based on the results of the subject's work carried out on the SA, information was obtained that the first time SA did was read silently (without speaking) questions to find out the information needed to solve the problem. This is done by the subject as

much as 4 times while sometimes moving his lips when reading the question. As shown in the following interview quote.

Fig 4. Results of interviews with SA

Based on the exposure of the data above, we can conclude that during the process of understanding the problem, SA does 1) Reads the question 4 times to get an understanding of the problem that is being worked on, 2) SA reads the problem while occasionally (sometimes) moving his lips, 3) SA cross out the writing or the results of his understanding that are felt to be inappropriate / incorrect but, 4) SA does not distinguish the known parts, ask and answer correctly.

c. Students with kinesthetic learning styles.

This time, the students with kinesthetic learning style, based on the results of the subject's writing on the results of the work on the answer sheet, obtained data that there were not many writings made by the subject on the answer sheet but there were streaks such as the correction of wrong work and the subject giving signs certain that feels important to him.
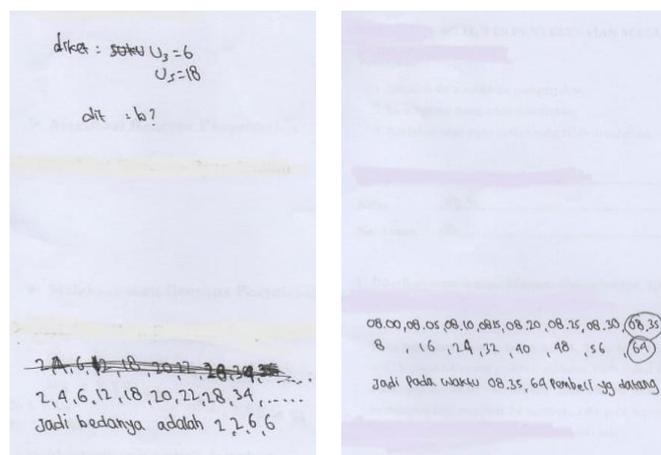

Fig 5. Results of Work on the Answer Sheet SK

As for the results of the analysis that appears on the transcript of the results of interviews and observations that have been made, information is obtained that in order to understand the problem given, the subject first needs to read the questions in his heart (not loud). The subject added that he needed 2 to 3 times the activity before he made sure he really understood the problem given. In addition, the subject also explained that the decree needed to designate the part of the question when it was thinking and understanding the problem, this was done unconsciously because SK said that his hand

moved on its own. And as long as the problem solving process takes place, especially when thinking and understanding the problem, SK often moves parts of his body, such as rubbing his hands or playing his fingers. More details can be seen in the following transcript of the interview.

Fig 6. Footage of Transcript of SK Interview

After analyzing the data that has been collected from the kinesthetic subject, we can conclude that during the process of understanding the problem, the subject 1) does not write much about what he has understood and the information he has found, 2) there are scribbled corrections from the wrong understanding, 3) give a sign on the information (writing) that is considered important, 4) read the question as much as 2 or 3 times to be able to understand the questions given, and 5) do certain movements that show that he is thinking, such as pointing questions, playing fingers and nails and rubbing his hands.

Based on some of the data described above, we will be able to see differences in each subject with different learning styles that will show specific characteristics for each of them. These differences can be displayed in table form as follows:

No	Activity / Behavior / Attitude / Kinesthetic	Visual	Audio	Kinesthetic
1	Write down what is understood	completely and systematically (known, asked and answered)	Complete but not systematic	Less complete
2	Cross out information that is not appropriate/ amended	Yes	Yes	Yes
3	Repetition quantity reads questions	2 to 3 times	4 times	2 or 3 times
4	Subject activities when reading questions	In the heart while writing down the information	In the heart while moving lips (muttering)	In the heart while pointing to the sentence on the

				question
5	Perform certain movements such as pointing paper questions, playing fingers, rubbing hands or other movements	No	No	Yes
6	Give a sign on the important information	No	No	Yes

Table 4. Comparison of Differences in the Ways of Visual, Audio and Kinesthetic Students in Understanding Problems

In table 4 above, we can all know that it has been informed that there are several different ways, attitudes/behaviors or habits carried out by each subject with visual, audio, and kinesthetic learning styles which will be explained in the following detail:

1) In the part of the writing that looks visually, the three subjects do leave marks that have made mistakes during the process of understanding the problem. Furthermore, for the completeness and clarity of the information written, the visual subject work appears most complete and systematic by writing down whatever information is known, asked and answered. After that followed by subjects with audio learning styles who also write down information that they know but not systematically (not distinguished parts that are known, asked and answered). Whereas for kinesthetic subjects, this subject is the subject that reveals the least information or what he is thinking in writing, but it is precisely the subject with a kinesthetic learning style that leaves a mark on important information that is needed, for example using circled signs. This characteristic is very much in line with what was conveyed by DePorter (1992) and Huda (2013) that a student who is visually very likely has the following characteristics: a) neat and orderly, taking care of everything and maintaining his appearance; b) through the details; c) remembering with pictures, preferring to read rather than read; c) requires a comprehensive picture and purpose to be able to capture details or remember something; and d) having problems remembering verbal instructions unless written and often asking for help from others to repeat them.

2) In terms of the quantity of repetition of the subject in reading the questions also obtained differences. The quantity of repetition is mostly done by subjects with audio learning styles, namely as many as 4 times reading the questions. Whereas for subjects with visual and kinesthetic learning styles do the same repetition, which is approximately 2 to 3 repetitions of reading.

3) The activities carried out by the subject while understanding the problem also showed differences for each subject with a different learning style even though the three of them admitted that they both read silently. In subjects with visual learning styles, while reading questions in the heart, subjects with this learning style are also seen to always write down whatever information they get into written forms that are presented in a complete and systematic manner. Subjects with audio learning style, do the process of reading silently while moving their lips like muttering to themselves (without loud voices). This is one of the four characteristics of students with auditory learning styles that have been delivered by DePorter in Siwi (2016), namely "these learning styles to access all kinds and words that are created or remembered. Music, tone, rhythm, Rhyme, internal dialogue and prominent voice in this learning style. Students were very auditory can be characterized as follows: attention is split; talk to the rhythmic pattern; learning by listening and moving the lips/voice while reading, and; dialogue internally and externally ". Whereas for subjects with kinesthetic learning styles, this subject reads the questions while pointing to the sentences in the questions, especially if there is something he thinks.

4) Another activity that is only carried out by subjects with kinesthetic learning styles is to play with their nails or fingers to rub their hands together while thinking. Whereas for subjects with both other learning styles do not do this activity. This activity indeed shows the characteristics possessed by kinesthetic learners delivered by DePorter in Syofyan (2018) which states that "kinesthetic learning styles access all types of motion and emotion created nor remembered. Movement, coordination, rhythm, emotional response and physical comfort prominently in this learning style. Students were very kinesthetic may be as follows. First, students tend to like touching people, stand close together and a lot of moves. Second, students learn by doing, pointing/writing while reading, and responding physically. Finally, students love to go and see. "

4. CONCLUSION

The knowledge and understanding of learning styles have become more important as classroom sizes increase and technological advances continue to mold the types of students entering higher education. While I was researching this area, it was very important to understand and explore each individual's learning style. This is because in each different learning style will give different characteristics and attitudes to each individual. So based on the results of the research that we have done, it can be concluded that the differences in characteristics for each learning style in an effort to understand the problem are as follows:

a. Students with a visual learning style, understand the problem by reading questions in their hearts 2 to 3 times while writing down every piece of information they get in full, detailed and systematic. Students with this learning style are very concerned about the appearance and beauty of their writing.

b. 2. Students with audio learning styles, try to understand the problem by reading the questions given in their hearts while moving their lips (muttering) and repeating the activity 4 times. Students with this learning style are incomplete and not so systematic in putting down the information he has gotten.

c. 3. Students with kinesthetic learning styles, understand the problem by reading the questions silently while pointing to the question sheet, moving their limbs, playing their nails or fingers or rubbing their palms together if there are things being considered. This heart reading activity is done 2 to 3

times. The results written on the answer sheet that appear for this subject are very few writings, only the subject always gives a sign on information that is felt important and needed by him.

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