Mathematical Cognitive Ability Viewed from Learning Style at Students

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Mathematical Cognitive Ability Viewed from Learning Style at Students

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Abstract:
In essence, learning mathematics requires intellectual readiness and the mental activity of students to learn rules or arguments. Students learn from logical, critical, and objective thinking in order to solve the problems of everyday life. However, their conceptual abilities are still very low. Low conceptual knowledge is caused by various things, including learning styles. In this study, the intended learning styles are: Visual, Auditory, and Kinesthetic. For this reason, the study tries to analyze the cognitive abilities of students in terms of their learning styles. This study uses a comparative method, with a total of 106 students with the time of implementation from January to July 2019. The results of the study showed a difference in students' cognitive mathematical abilities for the three learning styles.

Keywords: cognitive ability, Islamic students, learning style

I. INTRODUCTION

Mathematics is a science that underlies current technological developments and has a very important role in various other disciplines. Mathematics is applied in other sciences such as medical and social sciences even economics and psychology. Mathematics is taught from the most basic level to higher education level. This is because mathematics is an important science as an introduction and the basis of other sciences.

However, most students consider mathematics as a difficult subject (Siregar, 2017). This statement is also supported by the results of Marpaung's (2007) study stating that: (1) In general students are afraid of mathematics; (2) Mathematics is considered difficult, abstract and meaningless; (3) Mathematics learning makes students stressed; (4) excessive Materials should be learned; (5) Mathematics is full of formulas; (6) Mathematical teachers are generally too fierce; (7) Mathematics is a serious and unpleasant subject. These negative images of Mathematics make many students lack interest in learning mathematics and they lead to a decreasing motivation of students to improve their ability to learn and understand mathematics. The ability to understand and learn mathematics is different from one student to another. This difference is possible because of distinct learning styles.

Learning styles are the inherent skills of students since they were born. They greatly influence the learning process of students in carrying out activities (Boydak, 2001) or the process of how students get information (Kolb, 1984). Similarly, (Felder, & Brent, 2005) define learning styles as characteristics of students on how they obtain information by employing cognitive, affective, and psychomotor aspects.

Determining student learning styles is very important for the learning process. When the teacher knows the student's learning styles, the teacher can likely choose teaching methods, techniques, strategies that are better in the learning process (Aşkar, & 1993). In fact, the teacher cannot design specific learning conditions for each student but they may have the opportunity to design learning conditions that reflect the dominant

learning styles of students within their class. Generally, students have learning activities appropriate for learning styles, they will accomplish those activities easier and faster than those who do not study based on their learning styles (Tatar, & 2007). So it is likely that when the teacher does not apply a learning style that matches the characteristics of students, they tend to fail in learning (Mutlu, & Aydoğdu, 2003; Yilmaz, Koparan, & Hancl, 2016). As a result, these cognitive abilities cannot be improved.

Bloom's cognitive domain has six levels or aspects, namely: 1) Knowledge; 2) Understanding; 3) Application; 4) Analysis; 5) evaluation; 6) create (Anderson, *et.al*. 2001). Students' low cognitive abilities in learning mathematics will result in low grades, but if their cognitive abilities are high, the learning outcomes will also be high. Low mathematics learning outcomes are influenced by the cognitive ability of students. The purpose of this study is to try to analyze the mathematical cognitive abilities of the State Islamic Insitute students majoring at Islamic Elementary Education in relation to Visual, Kinesthetic learning style, and Auditory learning styles.

II. LITERATURE REVIEW

According to Neisser (1976), the term cognitive comes from the word cognition which is in the form of knowing. In a broad sense, cognition encompasses the acquisition, organization, and use of knowledge. The cognitive domain is the domain that includes mental activities (brain). All efforts concerning brain activity are included in the cognitive aspect. The cognitive domain has six levels or aspects, as follows: 1) knowledge; 2) comprehension); 3) Application (application) 4) Synthesis; 5) evaluation; 6) Creation. To better optimize the achievement of 6 cognitive domains, it is necessary to have ways that help individuals be more able to digest and process the information.

Learning style is the easiest way owned by individuals in understanding, organizing, and processing the obtained information. An appropriate learning style will be the key to students' success in learning. Learning styles are many because they are influenced by our five senses. Therefore, in teaching and learning activities students need to be assisted and directed to recognize learning styles that are appropriate to the students' characters so that learning objectives can be achieved effectively and efficiently. It can also be concluded that learning style is a cognitive characteristic, affective and psychomotor behavior, as an indicator that acts relatively stable for learners to feel interconnected and react to the learning environment. There are three modalities (types) in learning styles namely visual, auditory, and kinesthetic (Deporter & Hernacki, 2000).

III. METHODOLOGY

This study uses a comparative method which is an analysis of the research set to compare two conditions or more (problems) that are being investigated to determine whether there are any differences among the variables which are examined (Mundir, 2013). This study was to compare the cognitive abilities (memorizing, understanding, applying, analyzing, evaluating, and creating) of Surakarta State Islamic Institute students majoring at Islamic Elementary Education with their learning styles. In this context, the learning styles include Visual, Auditory, and Kinesthetic which are described in Figure 1 below.

The research was conducted in January 2019 until July 2019. The populations of this study were Surakarta State Islamic Institute students majoring in Islamic Elementary Education. There were 145 students and the selected research samples were 106 students. The sampling technique used was a probability sampling technique that

provided equal opportunities for each element (member) of the population to be selected as members of the samples. In its application, the technique used was random sampling.

To answer the problems, a data source was needed to analyze. Table 1 below describes the data sources that were the instruments in this study.

Table 1
Research Instrument

No	Formulation of the problem	Data collection technique	Data Source
1	Mathematical Cognitive Ability	Documentation, and Test	College student
2	Mathematics Learning Style	Documentation, and Questionnaire	College student
3	Differences in Student Mathematical Cognitive Capabilities are reviewed from learning styles	Documentation, and Test	College student

IV. RESULT AND DISCUSSION

Respondents in this study were 106 students who had different learning styles, consisting of Audio, Visual, and Kinesthetic learning styles. The learning style of 106 students was divided into 3 learning styles with a percentage ratio of each as presented in Figure 1, below.

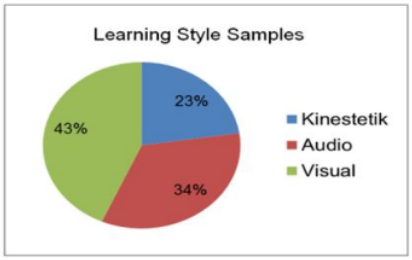

Figure. 1 Distribution of Samples Based on Percentages

Each respondent with a learning style was given a cognitive test in mathematics learning to be able to analyze how the level of cognitive understanding of students' mathematics in relation to their learning styles. The followings are the results of the learning style cognitive abilities in mathematics presented in Table 2.

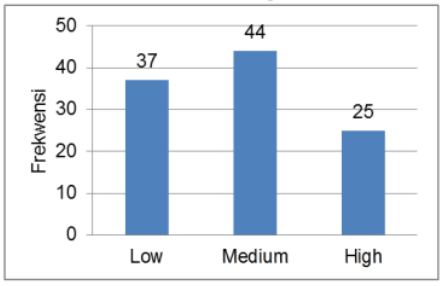

Table 2. Cognitive Ability To Learn Mathematics

Based on Table 2 and Figure 1, it can be seen that the cognitive abilities of students to learn mathematics are mostly in the medium category by 44 students or 41.50%. While there were 37 students or 34.90% stood at the low category, and only 25 students or 23.58% could reach the high category. The following will describe the cognitive abilities in relation to each learning style.

Data on Cognitive Ability to Learn Mathematics with Visual Learning Styles

The results of the analysis on the cognitive abilities to learn mathematics with the Visual learning style revealed that most of the students were in the moderate category as many as 22 students or 47.82%. Interestingly, students who stood on the low and high categories had equal numbers which were 12 students or 26.08% of the participants. This can be seen in Figure 3.

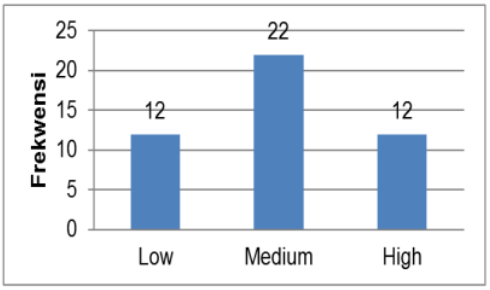

Figure 3. Cognitive capabilities of learning mathematics in visual learning styles

Data on Cognitive Ability to Learn Mathematics with Auditory Learning Styles

Data analysis on cognitive ability to learn mathematics in relation to the auditory learning style showed that most students reached the low category by 11 students or 50.77%. While, 11 students or 30.53%, were in the medium category and only 6 students or 16.66% were in the high category. This can be seen in Figure 4.

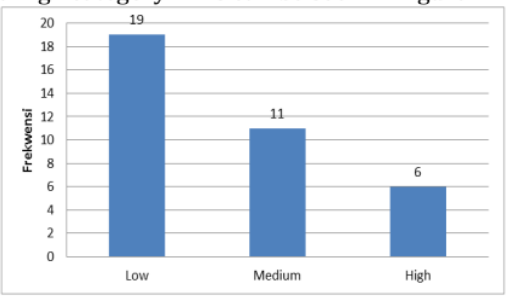

Figure 4. Cognitive Ability of Learning Mathematics in Audio Learning Styles

Data on Cognitive Ability to Learn Mathematics with Kinesthetic Learning Styles

Data analysis on the cognitive abilities to learn mathematics in the overall Kinesthetic learning style indicated that most of the students were in the Moderate category by 12 students or 50.00%. The high category had 8 students or 33.33% while the low category had the least number by 4 students or 16.66%. This information can be seen in Figure 5.

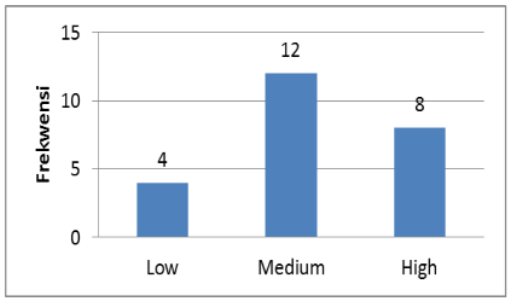

Figure 5. Cognitive Ability of Learning Mathematics with Kinesthetic Learning Styles

Generally, the students learning skills will likely develop better when a teacher or lecturer uses learning styles that match the characteristics of students (Jena, & Chakraborti, 2018). Furthermore, there is a significant influence between learning styles and cognitive abilities or in other words learning styles can influence individuals in the learning process (Baltaci, Yildiz, & Özcakir, 2016). It is because individuals' learning styles will be highly correlated with mathematical performance (Bosman, & Shulze, 2018).

Data analysis for the three learning styles showed that cognitive abilities for the Visual learning style were in the moderate category; cognitive abilities for the Audio learning style were in a low category; the cognitive abilities for the Kinesthetic learning style were in the medium category. However, they varied for each indicator of students' cognitive abilities.

The indicators of students' cognitive abilities for visual learning styles show high knowledge and evaluation abilities, but the ability to analyze and create is low, while the remaining indicators are in the medium category. This is in line with the research conducted by Vidayanti, Sugiarti, and Kurniati (2017) showing that for the learning style the evaluation component had the highest increase in learning outcomes tests. This means that students with visual learning styles can evaluate cognitive abilities high.

Regarding audio learning styles, Students' cognitive abilities in terms of knowledge and evaluation indicators are also at a high level. However, applications and analysis are at a low level while the other indicators are in the medium category. Even this learning style is similar to other studies that for audio learning styles the position of knowledge indicators occupies a high category (Vidayanti, Sugiarti, & Kurniati, 2017) for kinesthetic learning styles an indicator of high memory ability, high ability to understand or comprehension, moderate application ability, low analytical ability, moderate evaluation ability and the latter being moderate ability to create.

The relationship between different cognitive abilities of each student and a learning style is very complex. It can be influenced by several factors, including demographic variables such as gender (Ren, 2013; Kiwanuka, et al., 2015); culture (Joy, & Kolb, 2009; Naik, 2013; Ramburuth, & McCormick, 2001); age (Hilawaty, 2008). Thus, effective learning styles for learning English or history may not be valuable for mathematics learning and vice versa (Bosman, & Shulze, 2018).

V. CONCLUSION

Based on the results of the research and discussion, several conclusions were obtained that the cognitive ability for the Visual learning style was the medium category; the learning style of the Audio learning style was in a low category; the Kinesthetic learning style was in the medium category. Based on the conclusions of the above research, it can be suggested as follows: for students who need training and understanding of mathematical cognitive abilities. Whereas it is suggested that the basic mathematics lecturers of Islamic Elementary Education of Surakarta State Islamic Institute or to those related to mathematics learning make learning innovations through other approaches to improve mathematics learning achievement, especially in algebraic materials. In addition, in the implementation of learning processes, the lecturer should pay attention to the different learning styles so that they can try to handle the problems or difficulties of students in solving math problems.

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