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Research Article

Learning Style Inventory (Kolb Models) and the Achievement of Learning Outcomes Geometry

Anwar Anwar*, Saiman Saiman, Muhammad Zaki

Department of Mathematics Education, Universitas Samudra, Indonesia

ORCID
Anwar Anwar: https://orcid.org/0000-0001-7976-211X
Saiman Saiman: https://orcid.org/0000-0002-3377-733X
Muhammad Zaki: https://orcid.org/00009-0007-1015-6411

Abstract.
A person will be more effective in learning if he already understands his character in learning. There are various kinds of ways that a person has in learning, namely by hearing, reading, or seeing and learning by finding. The way to process this information is known as learning style. This paper aims to explain the tendency of Kolb's learning style and the achievement of geometry learning outcomes in junior high school students. This is quantitative research with an ex-post facto design, with 120 subjects and data collection techniques using the Learning Style Inventory (LSI) questionnaire and geometry learning outcomes test. The results showed that students who learn through concrete experience were 17.3%, reflective observation 32.7%, abstract conceptual 22.5%, and active experiment 27.5%. Whereas in the learning style dimension which has a diverger type of 39.3%, assimilator 41.1%, converger 11%, and accommodator 8.6%. So students who have a diverger learning style are more appropriate if their learning uses the lecture and question and answer method, accommodators are more appropriate to use the problem-based method, while students having a converger learning style will have better learning outcomes using investment-based learning strategies.

Keywords: geometry, kolb models, learning outcomes, learning style inventory.

Corresponding Author: Anwar Anwar; email: anwarmath@unsam.ac.id

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1. INTRODUCTION

Learning mathematics is how students obtain information that is built to be able to solve a problem. To obtain information, it cannot be separated from the thought process. Thinking is a mental activity, Santrock explains that thinking involves manipulating information in memory [1], Solso states thinking is a process to produce mental representations through information transformation [2]. and according to Rose & Nicholl stated that thinking is a complex combination of words, pictures, scenarios, colors and even sound or music [3].

Someone in solving geometric problems will involve a thinking process, but the thinking process is different from one child to another. However, the difference in thought processes is caused by the experience each child has, and the difference in understanding and processing the information given to him. This difference is called a learning style which is defined as an individual preference for the process or activity in learning. Vermunt uses the term learning style as a whole of three domains, namely the process of cognition and affection towards material, mental learning models and learning orientation [4]. Learning orientation can be interpreted as a whole domain that contains goals, intentions, motives, hopes, attitudes and interests regarding the individual in the learning process [5].

Santrock defines that learning style is the way a person chooses to use his abilities [1]. This shows that learning styles are related to the way children learn, as well as the way they like to learn. As the way he likes, then someone in learning will often use it and find it easy when learning with it. James & Gardner argues that learning styles are complex ways in which students perceive and feel most effective and efficient in processing, storing and recalling what they have learned [6] This is also in line with the opinion of Deporter & Hernacki that learning style is a combination of how it absorbs and then organizes and manages information [7].

Several experts share learning styles through various perspectives including Deporter and Hernacki classifying learning styles based on how to receive information easily (modalities) into three types, namely visual, auditory, and kinesthetic. Children with the visual learning style type tend to be dominant in capturing learning through their eyes, while the auditory type is more dominant in capturing learning by hearing and the last is the kinesthetic type where children in acquiring knowledge (learning) are more dominant in capturing learning with visible physical movements.

However, it is different from Kolb classifying a person's learning style based on experiential learning or involving students' new experiences, developing observations/reflecting, creating concepts and using theory to solve problems [8]. Humans can understand knowledge in two different ways, through concrete experiences and abstract concepts. Then you can change the experience in two ways, through reflective observation or active experimentation. So, Kolb divides four types of learning styles, namely converger (abstract concept and active experiment), diverger (concrete experience and reflective observation), assimilator (abstract concept and reflective observation), and accommodator (concrete experience and active experiment) [9].

In addition, the learning method is also one of the factors of one's learning achievement. According to Degeng, learning methods are different ways to achieve different

learning outcomes under different conditions [10]. To obtain good learning outcomes, of course, educators do not only focus on one method or learning strategy, but educators must also pay attention to the condition of students who will of course have to change learning methods and strategies. This is also in line with Degeng's opinion that learning strategies are referred to as structuring ways, so that a sequence of procedural steps can be realized that can be used to achieve the desired results. Therefore, it is necessary to study strategies or learning methods that are in accordance with the learning styles of each student.

Based on this, the authors are motivated to conduct more in-depth research on the relationship between the Kolb model's learning style and students' mathematical abilities in studying geometry material and the appropriate learning methods for each of these learning styles.

2. RESEARCH METHOD

The research approach used in this research is quantitative research with a comparative causal design that is ex-post facto, meaning that data is collected after all the events obtained have passed. This study is to reveal the possibility of a causal relationship between variables without manipulating a variable. Research in this design is carried out by observing the effect variable first and then observing the variable that is suspected to cause it. The population in this study were all junior high school students (SMPN 19) in Banda Aceh City, while the samples in this study were class IX students at SMPN 19 Banda Aceh City as many as 120 people. Observation data collection techniques to find out how to teach teachers; learning style test instrument adopted from the Kolb Learning Style Inventory (LSI) with a reliability of 0.683[10]. While data analysis using ANOVA[11].

3. RESULT AND DISCUSSION

Students' learning styles can be seen from the results of the LSI given to students, the LSI can distinguish students' learning styles according to Kolb's theory which consists of diverger, assimilator, converger and accommodator. The four learning styles can be measured from the dimensions of student learning styles which include learning to rely on feelings, learning in groups, being open to others, learning from observation, being careful in listening to meaning, learning in various ways, thinking logically, and

learning through practice. Meanwhile, after collecting research data by distributing LSI instruments to students, the following results were obtained shown in Table 1.

Table 1: Student learning style.

Learning Style Inventory		frequency	%
Types of learning styles			
	Concrete experience	21	17.5
	Abstract conceptualization	27	22.5
	Reflective observation	39	32.5
	Active experimentation	33	27.5
	Total	120	100
Dimensions of learning style			
	Accomodator	11	9.0
	Assimilasition	49	41.0
	Convergen	13	11.0
	Divergen	47	39.3
	Total	120	100

Based on Table 1 shows that the highest type of student learning uses reflective observation (32.5%) as many as 39 students, the second is followed by active experimentation (27.5%) as many as 33 students, the third is abstract conceptualization (22.5%) as many as 27 students and the last is concrete experience (17.5%).) as many as 21 students. While the highest dimension of student learning is in the assimilation learning style dimension (41.0%) as many as 49 students, the second is followed by the divergent dimension (39.3%) as many as 47 students, the third is followed by the convergent dimension (11.0%) as many as 13 students, while the lowest dimension is accommodator (9.0%) as many as 11 students.

Furthermore, descriptive statistics about the learning methods applied by the teacher in teaching geometry material can be seen in Table 2.

Based on Table 2. It shows that in the procedural method, students who have a converger learning style get a higher average learning outcome of 73.40% then the assimilator learning style of 61.22%. Then in the class that applies the discussion method, the average geometry learning outcomes are the highest for students who have a converger learning style of 82.30% and a diverger 75.44%. while in the class that uses the problem-solving method, the average geometry learning result is the highest for students who have an accommodator learning style of 83.41% and an assimilator 72.21%.

Then in Table 3 below shows that students who have a converger learning style tend to be more appropriate to use the lecture and discussion learning methods. It can be seen that the calculated F in the procedural method is 5,321 with sig .002

Table 2: Descriptive statistics about learning methods and learning outcomes.

Learning Style		Mean (%)
Procedural	Acommodator	56.02
	Assimilator	61.22
	Converger	73.40
	Diverger	58.90
	total	62.39
discussion	Acommodator	61.20
	Assimilator	63.21
	Converger	82.30
	Diverger	75.44
	total	70.54
Problem solving	Acommodator	83.41
	Assimilator	72.21
	Converger	45.61
	Diverger	43.27
	total	61.13

smaller than 0.05, meaning that the hypothesis is accepted and the calculated F value in the discussion method is 6331 with sig .001 smaller than .005, meaning that the hypothesis is also accepted. Students who have divergent learning styles tend to be more appropriate to use the 6331-discussion learning method with sig .001 smaller than .005, meaning that the hypothesis is accepted. Students who have an accommodator or assimilator learning style are more appropriate to use problem solving methods. It is also seen that F count 8,201 with sig .000, the sig number is less than 0.05, meaning that the hypothesis is accepted. Look at Table 3.

Table 3: Test of between-subjects effects.

Method	procedural		discussion		Problem solving	
Source	F	Sig.	F	Sig.	F	Sig.
Corrected model	5.321	.002	6.331	.001	8.201	.000
Intercept	13448.677	.000	13697.243	.000	8357.221	.000
Gaya belajar	5.321	.002	6.331	.001	8.201	.000

Based on the results of the LSI test distributed to junior high school students (SMPN 19) in Banda Aceh. Of the 120 students who were used as samples in this study, the distribution of assimilation learning style students was 49 students at 41.0%, divergent as many as 47 students at 39.3%, then convergent as many as 13 students at 11.0%, while the lowest was the accommodator as many as 11 students at 9%. This shows that most students always understand the problem broadly and then conclude it and usually they

prefer rationalized theory or logic rather than practical values. The same results were also obtained by Holley, Palasota and Wu that law students were assimilator (41.3%) diverge (23.3%), accommodator (18.1%), and finally converge (17.3%) [12].

Based on the distribution of the data, most students have an assimilation learning style that has learning criteria, namely always liking theories that can be rationalized or logical rather than practical values, taking a lot of time to think deeply and in their activities they like activities such as reading. In addition to assimilation learning styles, there are also many students who have divergent learning styles, meaning that they have criteria like learning in groups and respecting the opinions of others. This is in line with Paula & Marion's view that the four learning styles accrue from combining different pairs of learning modes: diverge, assimilator, converger, and accommodator. Divergers are imaginative problem solvers who prefer to feel and watch. Assimilators are rational theory builders who prefer to watch and think. Convergers are practical problem solvers who prefer to think and do. Accommodators are hands-on learners who prefer to do and think [8]. Likewise, the opinion of Holley & Jenkins states that the assimilator these learners reflect on abstract concepts and convert the information into logical form, using inductive reasoning to achieve theory building [13]. Likewise with the accommodator learning style, Kablan & Kaya mentions that the accommodator learning style is a combination of feelings and doing [14].

In effective learning, an educator should first look at the learning styles of the students before continuing into the learning process. Because each has their own style in absorbing and processing the information provided so that it becomes a new knowledge for him. This also agrees with Tulbure which states that educators and students must recognize their learning styles to achieve learning goals [12]. Here, educators must first know the learning styles of their students in order to understand their strengths and weaknesses which are used as the basis for carrying out learning activities.

In the class that uses the procedural method on geometry material, it can be seen that students who have the highest average learning outcomes are students with divergent learning styles (73%), and assimilators (61.22%). This shows that students who have diverge and assimilator learning styles are more appropriate to use the lecture learning method. This is also in line with the results of Tulbure's research, diverges respond well to all types of discussions, lectures and types of learning experiences. Furthermore, in the class that applied the discussion learning method, it was seen that students who had the highest average learning outcomes were students who had converge learning styles (82.30%) and diverges (75.44%). This shows that students who have a converge or diverge learning style are more appropriate to use the discussion learning method.

Where diverges prefer to work in groups because they are more attracted to ideas and appreciate feedback even though it is personal [12].

Furthermore, in classes that apply problem solving learning methods, it can be seen that students who have the highest average value of learning outcomes are students who have accommodator (83.41%) and assimilator (72.21%) learning styles. It also shows that students who have accommodator and assimilator learning styles are more appropriate to use problem solving methods. Students who have this accommodator style tend to prioritize challenging experiences such as solving problems that are problem solving or problem-based questions, they learn from people who have broad information and insight.

Individual problem-solving in mathematics and other scientific disciplines can promote assimilation and reflection while providing opportunities for active trial-and-error experimentation and the development of critical thinking skills. In addition, students can be asked to summarize their knowledge (for example, by using flow charts, diagrams, and compare-and-contrast tables) as part of the assignment. Opportunities for reflection and analysis will appeal to divergers, while convergers will be stimulated by real-life application problems. The instructor can organize sessions to teach students how to approach problem-solving in order to relieve the feelings of anxiety and inadequacy that some students experience regardless of learning style.

4. CONCLUSION

In learning mathematics, the same mathematical problem, for example, is given to several individuals, so that they will get different responses or responses in solving them. The difference in how to solve it is because each individual is unique in himself. Another thing that might give rise to individual differences in responding to a problem is the difference in learning styles. Learning styles relate to how students acquire, store, process and use information to deal with a situation or problem they are experiencing. Based on the results and discussion, that of the 120 students who were used as samples in this study, the distribution of assimilated learning style students was 49 students by 41.0%, divergent by 47 students by 39.3%, then convergence by 13 students by 11.0%, while the lowest namely accommodator as many as 11 students by 9%. This shows that most students always understand the problem broadly and then conclude it and usually they prefer rationalized theory or logic to practical values.

Based on the results of the research and discussion above, students who have an accommodator and assimilator learning style are more appropriate to use problem-solving or problem-based learning methods. Students who have a divergent learning style are more appropriate to use the lecture or question and answer learning method. Meanwhile, students who have a converge learning style are more appropriate to use discussion-based or group-based learning methods.

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