

# The Impact of Learning and Thinking Styles on the Learning Outcomes of High School Students

A Putri\*

Department of Science Education  
Universitas Syiah Kuala  
Aceh, Indonesia  
\*aiyuni@mhs.unsyiah.ac.id

Yusrizal, Evendi, A Halim, Elisa

Department of Physics Education  
Universitas Syiah Kuala  
Aceh, Indonesia  
yusrizal\_fkip@unsyiah.ac.id

**Abstract**—Based on the results of the analysis of previous studies, it shows that learning styles affect student learning outcomes, as well as thinking styles. However, there is no data which dominantly affects learning outcomes, learning styles or thinking styles. Through this study will be studied the influence of learning styles on learning outcomes and thinking styles on learning outcomes. Besides, it also examines the styles of learning styles and thinking styles that most dominantly affect learning outcomes. This research uses a quantitative approach, survey methods and descriptive techniques. The target population is all high school students in the city of Banda Aceh, while the sample is 90 grade 2 students at State Senior High School 5 Banda Aceh. Data analysis used descriptive and inferential statistical tests with the Two-Way ANOVA technique. The results of the analysis show that there is a significant difference between the impact of learning styles and thinking styles on student learning outcomes taught by the Discovery Learning model. In addition, it was also found that visual, auditory and kinaesthetic learning styles predominantly affect learning outcomes compared to visual styles. As for the thinking style, it is found that the style of concrete sequential thinking style is more dominant in influencing learning outcomes compared to other styles of thinking style.

**Keywords**—learning styles, thinking styles, discovery learning, learning outcomes

## I. INTRODUCTION

One of the student success standards in the educational process is the acquisition of an achievement index or known as student learning outcomes. There are a lot of factors influences student learning outcomes, one of them learning style and thinking style. Student learning styles are known as student' choices in obtaining and processing information [1]. The teacher insight into each student learning style in the learning process are fundamental. Every student had their own strengths and weakness in processing information [2]. Differences also occurs in individual learning style. One way that can help teacher present proper information is understanding student different learning styles [3]. Teaching activity without an attention to student learning styles, will make it difficult for student to absorb the information. Understanding student

learning types expected to improve student learning outcomes, especially in studying physics.

Besides having a different learning style, every individual also has a different thinking style. Thinking styles refers to the way a person's natural predisposition with dominance of left or right brain in processing information and creating solutions to solve problems in all situations and conditions. There are four student thinking styles developed by Anthony Gregorc, it is concrete sequential, abstract sequential, concrete random, and abstract random [4]. Teachers should comprehend student thinking styles, because it is related to the teaching methods which to use and help create a conducive teaching environment that supports great impact on student learning outcomes/ learning credits [5].

Based on National Examination data in the last 3 years, the student score in the physics subject in Banda Aceh is relatively low, with details of the average value in 2017 of 30.96, 2018 of 34.33 and 2019 of 34.17 [6]. And the results for last semester exams credits also showed the similar reality. According to observations in this high school, it is known that the learning model used is still a conventional teaching model, lack of the use of media, and lack of teacher attention to student learning and thinking styles. All its factors might be causing student minim interest on making lessons more engaging for them, then bring achievement of poor study scores. The best learning outcomes in the school only going to accomplished when the students and teachers completely synergized with the lesson materials, learning medias, learning and thinking styles, and learning models to achieve succesful learning.

Learning and thinking styles have a straight affect to learning outcomes. There are massive research about learning and thinking styles come under education field, at least there are the analysis of learning and thinking styles in VAK learning types (Visual, Auditory and Kinesthetics ) [7,8], the influence of learning strategies and styles to learning outcomes [9], the influence of discovery learning strategies with expository and thinking styles [10], thinking styles with intelligence [11] ], the relationship between thinking styles and teaching models [12], the relationship between thinking styles

and motivation [13], and barriers to creative thinking and thinking styles [14].

Maximum learning outcomes will not be achieved when it is only connected to the material presented and does not pay attention to learning styles, thinking styles, and learning models. Therefore, knowing learning styles, thinking styles, and using learning models that are suitable for a teacher, especially a physics teacher effort that is very important to realizing successful learning.

## II. METHODS

The research uses the quantitative approach with descriptive analysis technique. The data obtained were tested statistically and analysed into descriptive form. The population in this research were all of student in second grade high school SMAN 5 Banda Aceh. The sample was 90 student who came from 3 classes of second grade student in high school SMAN 5 Banda Aceh. The sample selected by using *Random Sampling Technique*.

The instrument used in this research the *Learning Styles Questionnaire* consisting of 30 validated and tested statement items, the *Thinking styles Questionnaire* consisting of 15 question items, which were adopted based on a questionnaire developed by John Le Tellier from Anthony Gregorc adaptation [3] and the *Learning Outcomes Test* in the multiple-choice forms contained 10 questions that also have been validated and tested. The data was collected by, First, student tested with *Learning and Thinking styles Questionnaire* styles. Second, student learn the physics material chapter temperature and heat transfer were taught using *Discovery Learning Models*. An the last, student are given *Learning Outcomes Test* as post-test.

The *Learning Styles Questionnaire* data analysed by using the Likert Scale technique. After getting the total score form the testee answer calculations, *The Percentage Test* used to find out the highest score. The highest score result explains the learning styles that testee have. The *Thinking styles Questionnaire* types analysed through the answers that testee selected and then added up based on the columns follow on the questionnaire form. The sum of each column were multiplied by 4 num, the highest score result explains the thinking styles that testee have. And the last, *Learning Outcomes Test* be calculated by the testee learning outcomes test scores (credits). To determine the differences in learning outcomes in terms of learning and thinking styles, the data obtained were analysed using the *Two-Way ANOVA* test with a significant level of  $\alpha = 0.05$ , after previously prerequisite test was carried out, it is the normality and homogeneity test.

## III. RESULTS AND DISCUSSION

Based on the learning and thinking styles questionnaire score results for 90 students, the scores were calculated so that each testee/ student obtained learning and thinking styles outcome were analysed as follows.

### A. Analysis of Learning Styles and Learning Outcomes

Learning styles are the way for student to receive or absorb information to be learned. Every individual had their own different learning styles. The learning outcomes in this research were obtained from the after student learn the physics material on chapter temperature and heat transfer which were taught using *Discovery Learning Model*. The learning process using several media such as video, audio, and practicum. The purpose of using media is to support each of the learning types possessed by student. Based on the questionnaire results and student post-tests, data for each learning types and the average value of students learning outcomes are presented in Table 1.

TABLE I. LEARNING STYLES AND IT OUTCOMES

No	Learning Styles	Total Students	Percentage (%)	Average Learning Outcomes	Learning Outcomes Category
1	Visual	41	46	75,61	Good
2	Auditory	30	33	86,00	Verry Good
3	Kinesthetic	19	21	65,79	Sufficient

According to Table 1, *Visual Learning Styles* are dominant than others, it peaks to 46 percent. Visual learning styles are learning styles that rely on visual activity in the learning process. student with a visual learning type reached an average value of 75.61 in the good category learning outcomes. They showed comprehend enough in learning chapter temperature and heat transfer materials with *Discovery Learning Models*. For student with a visual learning style are more likely enjoy learning by viewing videos, phenomena, and the results of the experiments being studied. When taught about temperature and heat transfer, the teacher provides video media, conducts experiments and illustrations of environmental conditions related to the material, student can see directly what is being learned, so that they get maximum learning experience and best credits. Research conducted by Kadir et al. between visual learning styles and learning outcomes of physics had a positive effect [15].

The auditory learning styles in this research reach 33 percent. The auditory learning styles is the learning styles that relies on hearing to understand and remember the information presented by the tutor. Student with an auditory learning style gained learning outcomes with an average score of 86.00 in the very good category. The score explains that by using the *Discovery Learning Model*, student with the auditory learning styles got excellent learning experience and outcomes on the chapter material temperature and heat transfer compared to other learning styles. In the learning process, the auditory learning styles has a way of learning or obtaining information by listening to what is being learned. In this study the teacher used the lecture method to present information and following with student discussions.

Conversely, only 21 percent the kinaesthetic learner in this research. The kinaesthetic learning styles is a learning styles that relies on movement or touch, making direct interactions

with what is being learned. Student with a kinaesthetic learning style as much learning outcomes with an average value of 65.79 in the sufficient category. In this research, when using the *Discovery Learning Model*, student with a kinaesthetic learning style got the lowest earning outcomes compared to the others. For student, with kinaesthetic learning styles has a way of learning or obtaining information by making movements that are directly involved in the learning process. In this research student conducted experiments on the material being studied. Student with kinaesthetic learning styles usually cannot sit still in the learning process, they will move their limbs such as shaking their legs or playing with a pen while studying. Based on the two-way ANOVA test, the differences in student learning outcomes in terms of learning styles can be described in Table 2.

TABLE II. LEARNING STYLES AND ITS OUTCOMES (TWO WAY ANOVA)

Source of Variance	RJK	F <sub>score</sub>	F <sub>table</sub>	Dk	Sig.	K
Learning Outcomes Scores in terms of Learning Styles	871,204	9,922	3,96	2	0,000	Significant

Based on the two-way ANOVA calculation, it shows that there are significant level of 0.000 differences in student learning outcomes taught with *Discovery Learning Models* on the physics chapter material of temperature and heat transfer according to their learning styles. Every learning styles as visual, auditory and kinaesthetic learning styles obtains different learning outcomes which means that learning styles surely affect learning outcomes. There is a positive and significant influence between learning styles and learning outcomes [15], and there is an effect of learning styles on learning outcomes of learning physics subject [9].

**B. Analysis of Thinking styles and Learning Outcomes**

Thinking styles are the learner way of processing information. Thinking styles caused by the development of idea concepting to solve a problem or in learning outcome's purpose. This is due to the relation of information stored in the individual's brain so that they can process information in learning activity. Learning outcomes for thinking styles contains 10 multiple choice questions. Based on the results of the *Thinking styles Questionnaire* answers and student *Learning Outcomes Tests*, data for each learning styles and average value of learning outcomes are described in Table 3.

TABLE III. THINKING STYLES AND LEARNING OUTCOMES

No	Thinking Styles	Total Students	Percentage (%)	Average Learning Outcomes	Learning Outcomes Category
1	Abstract Random	26	29	77,69	Good
2	Concrete Random	17	19	71,18	Good

Table 3. Cont.

3	Abstract Sequential	10	11	65,00	Sufficient
4	Concrete Sequential	37	41	82,43	Verry Good

Based on table 3, Abstract random thinking styles in this research reach 29%, students with abstract random thinking styles obtained learning outcomes with an average value of 77.69 with good categories. Student with abstract random thinking styles get good learning results when taught with discovery learning models on temperature and heat transfer material. Abstract random thinking styles student have a way of thinking or processing information dominated by the right brain. Students enjoy learning by watching videos rather than hearing the explanations. Some students with abstract random thinking styles take a long time to process information and process information irregularly [21].

There are 19% student with a concrete random style of thinking. Student with concrete random styles are dominated by the left brain but they are less structured in processing information. Student with a concrete random thinking styles with an average value of 71.18 in good categories. Concrete random thinking styles student have a great curiosity in the learning and have high curiosity in finding solutions, enjoy learning by experience and clever in answering questions, which in good way helps student get best learning outcomes.

There are 11 percent student with abstract sequential thinking styles. Abstract sequential thinking student reach as with an average value of 65.00 in the sufficient category. Student with abstract sequential thinking styles readily accept information by means of reasoning, analysing concepts, dominated by their left brain producing conceptual reasons, think regularly. This type are not comfortable in such noisy class because it decrease their learning interest, concentration and focus.

And the last, as much as 41 percent student have a concrete sequential thinking style, dominant than other thinking styles. Concrete sequential thinking styles is a thinking styles that is dominated by the left brain in processing information. Students with a concrete sequential thinking styles reach learning outcomes with an average score of 82.43 in the very good category. The research shows student with concrete sequential thinking styles reach highest value of learning for the physics subject tested with all the media and instrument offered. They collaborated the logical, rational and intellectual way of thinking [17]. Based on the *Two-Way ANOVA Test*, the differences in student learning outcomes in terms of learning types can be described in Table 4.

TABLE IV. THINKING STYLES AND LEARNING OUTCOMES (TWO-WAY ANOVA)

Source of Variance	RJK	F <sub>score</sub>	F <sub>table</sub>	Dk	Sig.	K
Learning Outcomes Scores in terms of	664,490	7,567	3,96	3	0,000	Significant

Thinking Styles						
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Based on the two-way ANOVA calculation, it shows that there are significant differences in student learning outcomes who taught with *Discovery Learning Models* on the physics subject material of temperature and heat transfer according to their thinking styles with a significant level of 0.000. It is also shows that student learning outcomes are having big impact from abstract random thinking styles, concrete random, abstract sequential and concrete sequential thinking styles. Student' thinking styles are also an internal factor that can drive student learning outcomes [11]. Several previous research results also show that thinking styles, learning types and learning outcomes have significant effect to the material that teacher presents. Besides, it affects the understanding of quantum concepts (in physics) [18], influences students problem solving skills [19], forms student high-order thinking skills (HOTS) [20], had opportunities for misconceptions in physics learning [21], facilitates the implementation of learning with the Problem Based method Learning [22] and easy to use learning media and interactive or online-based evaluation [22,23,24,25,26].

#### IV. CONCLUSION

From the research, it is clear from other learning styles, students in this research have more dominant in visual learning styles. There are also various kinds of thinking styles developed by Anthony Gregorc, in this research, concrete sequential thinking styles are more dominant in the student. It is also proven that there are significant differences in learning outcomes according to the learning styles (Visual, Auditory and Kinaesthetic) on the physics subject material of temperature and heat transfer which is taught by *Discovery Learning Model*. Meanwhile, higher learning outcomes was reached by students who have auditory learning style. There are also significant differences in learning outcomes in terms of thinking styles (abstract random, concrete random, abstract sequential and concrete sequential) in the physics subject material of temperature and heat transfer which is taught using *Discovery Learning Models*. Student with concrete sequential thinking styles get higher learning outcomes than others.

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