Correlation between Learning style and achievement in Physics Learning

A Halim¹,²,³* A Wahyuni¹, Susanna¹, Elisa¹, A.Hamid¹, Irwandi²,³

¹Department of Physics Education, Teacher Training and Education Faculty, Universitas Syiah Kuala, Banda Aceh, Indonesia 23111
²Department of Physics, Faculty of Science and Mathematic, Universitas Syiah Kuala, Banda Aceh, Indonesia 23111
³Centre of STEM Study, Intergrated Laboratory, Universitas Syiah Kuala, Banda Aceh, Indonesia 23111

*bdhalim@yahoo.com

Abstract. This study aims to determine the relationship between learning styles and student learning outcomes in physics subjects. The research using survey techniques and documentation with using questionnaires and documentation method for data collection. Questionnaires are used to obtain data of learning style variables, while documentation is used to obtain data of learning outcomes variables. The results of data analysis, with the product moment correlation technique, show that there is a correlation of positive and significant relationship between learning styles and student learning outcomes in physics course. In addition, the results of the study also showed that the greatest contribution of learning styles to learning outcomes was in analytic and holistic learning styles.

1. Introduction

Learning is not only limited to the time or time an education takes place, but is part of the whole human life. Learning is a process that lasts a lifetime [1,2]. In everyday language, the notion of learning is usually limited to a skill (for example, carving and batik) and learning a knowledge (such as English, and Acehnese history). In the context of psychology, the meaning of learning is broadly defined, including learning is a change in behavior, which occurs as a result of experience [3,4]. There are two terms that are often discussed in the world of learning, namely learning styles and thinking styles [5,15]. The term "learning style" refers to the concept that each individual has their own way of learning and that learning style is effective for them [6].

According to educational psychology experts, the characteristics of learning styles possessed by students are divided into holistic learning styles and analytical learning styles [9], and other experts say there are three types of learning styles that students have, namely visual, auditory, and kinesthetic [10]. Holistic learning styles are learning styles that emphasize understanding of all learning material or all problems faced in learning. While the analytical learning style is a learning style that emphasizes mastery of subject matter part by part, the problem is analyzed based on its components. A person can be said to have a visual learning style, which is learning with an emphasis on vision, that is, concrete evidence must be shown first so that they understand, the auditory learning style relies on hearing to
both understand and remember, while the kinesthetic learning style requires the individual to touch something that gives certain information in order to remember it \cite{5,9,10}.

Several research results indicate that student learning styles are highly dependent on the teaching methods applied by the teacher. There are certain teaching methods that can be effectively applied to students with certain learning styles, but for students with different learning styles, these teaching methods are not effective. In other words, the learning method that proved to be the most effective for students with certain learning styles, was not the most effective method for students with different learning styles \cite{7}. This is because learning styles are closely related to students’ thinking styles. In other words, learning styles are one of the preferred ways students think, process, and understand information \cite{8}. Therefore, both learning styles and thinking styles will affect learning outcomes. This is indicated by several research results that learning styles and motivation have a positive impact on learning outcomes \cite{11}, with each learning style there is a tendency for students to have different English language skills \cite{12}, and learning styles significantly influence learning outcomes. Student learning outcomes in the General Biology course \cite{13}, and there is a significant effect of learning styles on mathematics learning achievement \cite{14,17}.

Based on several previous research results, although not in physics learning, psychologically it can be said that learning styles will also have an impact on learning outcomes in physics courses. Any type of learning style that dominantly influences student achievement in learning physics. As far as the influence of all types of learning styles on student achievement in learning physics. These are some of the problems that have been answered through the description in this short article.

2. Research Method

2.1. Approach and Type of Research

The approach used in this research is a quantitative approach, namely research with the data used is quantitative facts or numerical data and everything that can be calculated as has been widely used in previous studies \cite{16,17,18}. Correlation research is one of the descriptive studies conducted to find the relationship between two factors in a group of research subjects \cite{19,20,21}. Descriptive correlation research is considered in accordance with this research because it aims to find or clarify the relationship between two variables, namely: Learning Style (as variable X), and student learning outcomes (as variable Y).

2.2. Population and Sample

The population in this study were all students of class XI-IA, namely XI-IA1, XI-IA2, XI-IA3, and XI-IA 4 in Unsyiah Laboratory High School, totaling 120 students. According to correlation research experts, if the subject is less than 100, it is better to take all of them, but if the number of subjects is large, it can be taken between 10 - 15\% or 20-25\% or more \cite{22}. In this study the total population was 120 students, thus the number of samples studied was 25\% \times 120 = 30 students. The sample was taken using simple random sampling technique. The simple random sampling method included in this research is by drawing or selecting a list of numbers from a random number list.

2.3. Collection of Data

2.3.1. Learning Styles. Many ways have been used by psychologists in education related to assessing student learning styles, including using formative assessment \cite{23}, using learning style questionnaires \cite{24}, and using Kolb’s learning style inventory \cite{26}. Based on the experience of previous researchers and the sample conditions and the location of the research implementation, the measurement of learning styles in this study used a questionnaire with reference to Kolb’s learning style inventory instrument \cite{26}. The questionnaire instrument developed consisted of 50 items with details of 10 items for aspects of visual learning styles, 10 items for aspects of auditory learning styles, 10 items for aspects of
kinesthetic learning styles, 10 items for aspects of analytical learning styles and 10 items for aspects of holistic learning styles.

2.3.2. Achievement in Physics Learning. Physics learning outcomes data were collected through documentation study of the physics score archives in the Middle School Lab. Syiah Kuala University School. The collection technique with this method is in accordance with the views of educational research experts who say that the way of collecting data through written remains, such as archives and including books on opinions, theories, postulates and others related to research problems is called documentation techniques \[16\]. This method is used to obtain data regarding student learning outcomes in physics subjects whose data is obtained from the odd semester report cards for the 2019/2020 school year.

2.4. Data Analysis
Data processing is meant here is the processing of data obtained by using the existing formulas or rules in accordance with the research approach or design taken. The implementation of data processing from correlation research uses the following stages.

2.4.1. Editing. The activity is to check the completeness and filling of the questionnaire or questionnaire that has been successfully collected so that mistakes or mistakes are avoided.

2.4.2. Scoring. The activity is to provide a score for each questionnaire answer using a Likert scale with four alternative answers: often with a score of 4, sometimes with a score of 3, rarely with a score of 2, and never with a score of 1.

2.4.3. Calculation of r correlation. After data collection is carried out, the next stage of the data is analyzed. The analysis technique uses descriptive analysis, namely the acquisition of a percentage because this research is descriptive and describes the independent variables and the dependent variable. Then to find out how the relationship of the independent variable (X) to the dependent variable (Y) is used the formula product moment \(r_{xy}\) \[16\]. The rxy interpretation as stated in table 2.1. Interpretation of the product moment correlation index with "r" listed in the table at the 5% significance level.

| No | Interval of coefficient | Level of relationship |
|----|-------------------------|----------------------|
| 1  | 0.00 – 0.199            | Very Low             |
| 2  | 0.20 – 0.399            | Low                  |
| 3  | 0.40 – 0.599            | Middle               |
| 4  | 0.60 – 0.799            | Strong               |
| 5  | 0.80 – 1.00             | Very Strong          |

Sources : \[16\].

After giving an interpretation using the r table value. The next step is to find the significance of the relationship between variable X (student learning styles) and variable Y (learning outcomes of physics), in this case the writer uses the t test formula.

3. Result and Discussion
The results and discussion in this study only focused on two variables, namely those related to student learning styles and student learning outcomes. The results and discussion of the two variables are combined into one unit, meaning that the results and discussion are described in one section.

3.1. Visual Learning Styles
The results of the research data analysis showed that there was a positive relationship between visual learning styles and student learning outcomes in physics subjects at Unsyiah Laboratory High School
with a correlation value of \( r_{xy} = 0.367492 \). If the data is interpreted simply by matching the results of the calculation with the product moment correlation index, it turns out that the amount of \( r_{xy} \) obtained is between 0.20 - 0.399, which means that between variable X and variable Y there is a low correlation.

Next is to find how significant the relationship between variable X (visual learning style) and variable Y (learning outcomes of physics). The value of \( t \) count obtained is 2.09, if the error rate is 5% with \( N = 30 \) then \( t_{table} = 2.05 \). So that the price of \( t_{count} \) > \( t_{table} \) (2.09 > 2.05), which means that the relationship between visual learning styles and learning outcomes is significant (applicable to the population where the sample was taken). Meanwhile, the amount of contribution made by the visual learning style is 5.98% and the remaining 94.02% is influenced by other variables.

Based on the results of the research conducted, it was found that there was a positive and significant relationship of 0.367492 between visual learning styles and student learning outcomes. The results of this study are in line with research conducted by previous researchers who stated that there was a positive and significant effect of visual learning styles on student learning outcomes in cube and block material. This is reflected in the number of students 10 people (43.48%) using a visual learning style. These results were obtained because researchers used power point media and lecture methods during the teaching and learning process so that children tended to use visual learning styles [34].

The amount of contribution of visual learning styles to learning outcomes is classified as low, amounting to 13.50%. This is because the teaching style of the teacher has not been able to meet the overall learning styles of all students. So that students become easily bored and less interested in the lessons they are learning, this can be seen from the low post-test scores that students get every time the teaching and learning process is completed. This is in accordance with the findings of previous researchers who said that many students were considered slow and failed to accept material from the teacher due to the mismatch of the teacher's teaching style with student learning styles [23]. Other researchers also said that teachers must use many methods at the time of teaching, variations in methods resulted in the presentation of lesson material more attractive to students' attention, and the class came to life. The method of presentation that is always the same will bore students [27].

In addition, children with visual learning styles have one of the characteristics that is constrained such as being late or slow in copying lessons written on the blackboard. So that students with a visual learning style need more time to take notes and answer questions, this can be seen clearly when the researcher is in the room during the teaching and learning process. Based on data from 30 students in each class, around 13-15 students always need more time to take notes or even borrow notes from friends who are already ready. Thus, a lot of time is wasted when the student is writing or taking notes. However, not all of them are due to being late, some of which are around 3% because they are lazy to take notes. This is in accordance with the findings of previous researchers who say that the method or strategy used for children with visual learning styles is Mind MapMT. This method is useful for note-taking, summarizing, and reviewing students' subject matter. The media that are often used in physics learning to create a visual representation that supports the visual learning style include using the Elvis II [28], PhET-based practicum modules [29], PhET-assisted worksheets [30], using eduplaza [31], and using a smartphone [32].

3.2. Auditory Learning Styles

Please ensure that affiliations are as full and complete as possible and include the country. The addresses of the authors’ affiliations follow the list of authors and should also be indented 25 mm to match the abstract. If the authors are at different addresses, numbered superscripts should be used after each surname to reference an author to his/her address. The numbered superscripts should not be inserted using Word’s footnote command because this will place the reference in the wrong place—at the bottom of the page (or end of the document) rather than next to the address. Ensure that any numbered superscripts used to link author names and addresses start at 1 and continue on to the number of affiliations. Do not add any footnotes until all the author names are linked to the addresses. For example, to format
3.3. Kinesthetic Learning Style

Based on the results of data analysis, it was found that there was a positive relationship between kinesthetic learning styles and student learning outcomes in physics subjects at Unsyiah Laboratory High School with a correlation value of $r_{xy} = 0.366905$. If the data is interpreted simply by matching the results of the calculation with the product moment correlation index, it turns out that the amount of $r_{xy}$ obtained is between 0.20 - 0.399, which means that between variable X and variable Y there is a low correlation. Furthermore, looking for how significant the relationship between variable X (kinesthetic learning style) and variable Y (learning outcomes of physics), the value of t value obtained is 2.09, with an error rate of 5% and N = 30, then the obtained t table = 2.05. So the price of tcount > ttable (2.09 > 2.05), which means that the relationship between kinesthetic learning styles and learning outcomes is significant (applicable to the population where the sample was taken).

Meanwhile, the contribution was 13.46%, and the remaining 86.54% was influenced by other variables not discussed in this study.

Based on the research conducted, it was found that there was a positive and significant relationship of 0.366905 between kinesthetic learning styles and student learning outcomes. This finding is in line with the research conducted by Nisa which states that based on the three learning styles being compared, namely visual, auditory and kinesthetic, it is found that students who have a kinesthetic learning style who have the highest average value of mathematical problem solving abilities than students who have visual learning styles and auditoria [34]. While the contribution of kinesthetic learning styles to learning outcomes is 13.46%, this result is low when compared to visual, auditory, analytical and holistic learning styles. This happens, because during the learning process, students often do practicum by using PHET simulations rather than direct practicum. Even though children with kinesthetic learning styles should learn by touching or moving, even though through computer media they can touch (by moving the cursor), it will be very different if they can directly practice it.

3.4. Analytic Learning Style

The results of the research data analysis using the product moment correlation showed that there was a positive relationship between analytical learning styles and student learning outcomes in physics subjects at Unsyiah Laboratory High School with a correlation value of $r_{xy} = 0.408898$. If the data is interpreted simply by matching the calculation results with the product moment correlation index number, it turns out that the amount of $r_{xy}$ obtained is between 0.40 - 0.599 which means that between variable X and variable Y there is a moderate correlation.

Then looking for how significant the relationship between variable X (analytical learning style) and variable Y (learning outcomes of physics), the value of the t value obtained is 2.45, with an error rate of 5% and N = 30, then the obtained t table = 2.05. So the price of tcount > ttable (2.45 > 2.05), which means that the relationship between analytical learning styles and learning outcomes is significant (applicable to the population where the sample was taken). Then look for how much the contribution of analytical learning styles to learning outcomes obtained by 16.72%, and the remaining 83.28% is influenced by other variables not discussed in this study. This is because students have high persistence which is the main character or characteristic of children with analytical learning styles. This can be seen from the number of students, namely 25 or 83% of students choose to answer that for them academic achievement (ranking) is very important and must be fought for.

In addition, the cause of the high contribution of analytical learning styles compared to other learning styles is because before the teaching and learning process takes place, the teacher has first provided teaching materials to students, such as modules, textbooks, and student activity sheets. The teaching materials have been arranged systematically and in detail, making it very easy for students to quickly understand the material they are learning. This reason is supported by the findings of previous researchers who say that students with analytical learning styles have high conscientiousness and accuracy [33].
3.5. Holistic Learning Style

The results of data analysis using the product moment correlation formula obtained a positive relationship between holistic learning styles and student learning outcomes in physics subjects at Unsyiah Laboratory High School with a correlation value of \( r_{xy} = 0.38795 \). If the data is interpreted simply by matching the results of the calculation with the product moment correlation index, it turns out that the amount of \( r_{xy} \) obtained is between 0.20 - 0.399, which means that between variable X and variable Y there is a low correlation. After that, looking for how significant the relationship between variable X (holistic learning style) and variable Y (physics learning outcomes), the value of \( t_{count} \) obtained is 2.23, with an error rate of 5% and \( N = 30 \), then \( t_{table} = 2.05 \). So the price of \( t_{count} > t_{table} \) (2.23 > 2.05), which means that the relationship between holistic learning styles and learning outcomes is significant (applicable to the population where the sample was taken). After being analyzed, it turns out that the holistic learning style variable contributed to the increase in learning outcomes by 15.05%, and the remaining 84.95% was influenced by other variables not discussed in this study.

Holistic learning outcome data shows that there is a positive and significant relationship between holistic learning styles and student learning outcomes with a \( r_{xy} \) value of 0.38795. This shows that if the holistic learning style has a big influence on learning outcomes, when compared to the analytical learning style as evidenced by the large contribution value of the holistic learning style to learning outcomes, which is 15.05%. This is because the material is presented in a systematic and detailed form. So that it is very easy for students with a holistic learning style, because children with a holistic learning style tend to see everything as a whole and with a big picture, they can see the relationship between one part and another. This is what causes the contribution of a holistic learning style to be high compared to visual, auditory and kinesthetic learning styles.

However, the contribution of holistic learning styles is not higher than analytical learning styles. This is because the teaching style or media used by the teacher when teaching is less attractive for students to see and read. Like the use of power point media, power point media will usually be attractive to students when presented with various colors, images, fonts, and followed by a charming background design. But what happens is the opposite, the media used is only in the form of writing and pictures and is not accompanied by an attractive and beautiful design so that it does not attract the attention of students.

3.6. Relationship between Learning Style and Learning Outcome

Student learning outcomes in physics subjects are manifested in the form of learning scores taken from semester 1 report cards. Overall the results of the analysis show that there is a positive relationship between learning styles and student learning outcomes in physics subjects at Unsyiah Laboratory High School with a correlation value of \( r_{xy} = 0.4658484 \). If the data is interpreted simply by matching the results of the calculation with the product moment correlation index, it turns out that the amount of \( r_{xy} \) obtained is between 0.40 - 0.599, meaning that between variable X and variable Y there is a moderate correlation.

The next step is to find how significant the relationship between variable X (student learning style) and variable Y (learning outcomes of physics), the value of \( t_{count} \) is 2.78, with an error rate of 5% and \( N = 30 \), then \( t_{table} = 2.05 \). So that the price of \( t_{count} > t_{table} \) (2.78 > 2.05), which means that the relationship between learning styles and learning outcomes is significant. This means that there is a real / significant relationship between learning styles and student learning outcomes. Learning style variables on learning outcomes contributed 21.70%. These results indicate that the learning style variable has an effect of 21.70% on students' physics learning outcomes, while 78.30% is determined by other factors. The conclusions from the results of data analysis obtained can be seen in table 3.1.
### Table 3.1 Result of Analysis between Learning Styles and Learning Outcome

| Indicator of Learning Styles (X) | $r_{xy}$  | $t_{cal}$ | $t_{table}$ | Learning Outcome (Y) |
|---------------------------------|-----------|-----------|-------------|----------------------|
| Visual                          | 0.367492  | 2.09      |             |                      |
| Auditory                        | 0.364932  | 2.07      |             |                      |
| Kinesthetic                     | 0.366905  | 2.09      | 2.05        | 2501                 |
| Analytic                        | 0.408898  | 2.37      |             |                      |
| Holistic                        | 0.387959  | 2.23      |             |                      |

The results obtained, it was found that there was a positive and significant relationship between learning styles and student learning outcomes with an $r_{xy}$ value of 0.4658484. The amount of contribution between learning styles to student learning outcomes is 21.70%, this shows that student learning styles have a considerable influence on learning outcomes obtained by a student. In addition, from the research conducted it was also found that the greatest contribution of learning styles to learning outcomes was in analytic and holistic learning styles, namely 16.72% and 15.05%, while visual, auditory and kinaesthetic learning styles only contributed 13.50%, 13.32%, and 13.46%. The visual learning style ranks third, this is because the teaching materials presented do not have colors, images or other icons, making them less attractive to read. As Nisa said that through reading only 10% can remember, 20% from hearing what is remembered, and from seeing what remembered 30% is. As the old saying goes "I hear I forget, I see I remember, and I do I understand".

So that to attract students’ interest in reading, the presentation of teaching materials is very influential. If the teaching materials are packaged in the form of pictures, plus pictures that are presented in color, the delivery and explanation of information, messages, ideas and so on will make it easier for students to understand information without having to use many verbal languages. On the other hand, several previous studies have also shown that various student learning styles will be one of the reasons for misconceptions [35,37,38], also on student interest in learning [36,39] and the ability or way teachers teach also affect student learning styles [35,37,38, 40,41,42]

### 4. Conclusion

There is a positive and significant relationship between learning styles and student learning outcomes with a positive and high correlation category. The results of this study are consistent with the results of previous studies. While the contribution of learning styles to student learning outcomes is 21.70%, this indicates that student learning styles have a considerable influence on learning outcomes obtained by a student. In addition, it was also found that the greatest contribution of learning styles to learning outcomes was in analytic and holistic learning styles. Meanwhile, visual, auditory and kinesthetic learning styles only contributed to the moderate category

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