The Effect of Physics Virtual Experiments on Mastery Concept Based on Students Learning Style

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Abstract: Enhancing technology be able to create each field easier with no exception in the field of Education. There are a lot of learning media making teaching and learning process work well. One of the media is a virtual media used to do physics experiments. The present study aimed to examine the effect of virtual physics experiments on students' mastery of concepts based on learning styles. The quasi-experimental study held at one of the state senior high schools in West Nusa Tenggara Province. This study used only a posttest control group design. The research sample consisted of two groups, an experimental and a control with 58 respondents consisting of cluster random sampling techniques. The results showed that virtual experiments affect the mastery of the student concepts with auditory and kinesthetic learning style trends, whereas students who have a visual learning style tendency did not affect.

1. Introduction

Teaching and learning are an activity in a learning process occurring through the interaction between educators and students. By this activity, the students are expected to be able to understand or master the information obtained from educators. Teaching and learning process can be interpreted as the relationship between the instructor and the learner so that an atmosphere occurs where the students are actively learning and the teachers are actively teaching. Besides the students not only being able to information mastery that comes from educators but also the students are expected to be able to construct their knowledge based on the information that has been received. The learning process cannot be carried out optimally due to the limited availability of media or tools used to convey information from the educators to the students.

Physics practicum media greatly influence the learning process because it is seen from the characteristics of the physics materials that are quite complex and many of the physics concepts requiring visualization in their delivery. The quality of educational institutions can be determined by three main factors namely students, educators and teaching, and learning facilities [1]. The three factors are closely related to each other in the learning process so that it becomes better [2]. The heat material has several concepts that really need more explanation through practicum, so that the important concepts can be conveyed to the students. The limited availability of laboratory equipment and the lack of quality tools made the measurement results inaccurate and this caused the low ability to construct students' understanding of concepts [3]. The limitations made the educators unable to
convey the information as they should. Therefore, practical tools or media are needed in the learning process of physics.

The result of the observations made at several schools in West Nusa Tenggara found that the limitations of the learning media made educators carry out the learning process using one-way methods such as lectures making the students took down or copied information from the textbooks to their notebooks. Teaching and learning process should be students center that makes them more effective than teacher center because it makes the students inactive. The lecture method causes the students to become bored and bored with subject matter making them passive in teaching and learning activities [4]. One-way learning processes such as teacher center greatly affect the student learning outcomes such as their mastery of physical concepts. Mastery of concepts is one indicator used to see whether or not a physics learning goal is achieved. Through the teacher center learning process, students' mastery of physical concepts is very low.

The limited availability of practicum media also affects the characteristics of students, such as the way they learn, explore or obtain information needed to construct their knowledge. The method is also called the learning style of students. Learning styles are the key to developing performance at work, at school, and in interpersonal situations [5].

Learning styles can influence students’ mastery of physics concepts because it is related to the limited availability of media by their learning tendencies. Learning styles can influence the way students to construct their knowledge in the learning process [6]. Learning style is a way for students to learn, so it is greatly influenced by the media or tools used to obtain information. Bandler & Grinder with Neuro-Linguistic Programming (NLP) learning style identifies learning styles into three learning styles that are Visual, Auditory and Kinesthetic (VAK) which are also called modality learning styles [7]. Learning styles vary depending on the media used in the learning process. In every learning style tendency is very dependent on the media used [8]. People who tend towards visual learning style really need learning media that be able to make them understand just by seeing it. People who have auditory learning styles are more dominant in need of learning media that present information through sound, whereas people who have dominant towards kinesthetic learning styles learn information through hands-on practice. Limitations on instructional media as explained earlier are not able to facilitate students in exploring information based on their learning styles.

If the limitations in learning at this time are not overcome immediately, it will greatly affect towards the low of students’ mastery of physical concepts and in general, will affect the low of the result of the learning area. The low of student physics learning outcomes are caused by several things including ineffective learning media, inadequate laboratories, inadequate use of instructional media chosen by teachers, conventional nature, where students are not much involved in the learning process, and class activity are mostly dominated by the teacher [9]. Out of the several factors causing the low of learning outcomes of Physics, researcher believe that the main factor causing the low quality of Physics learning is due to the inability of teachers to innovate to create or choose learning media. Learning media factors are the main factors influencing students learning outcomes [9].

To overcome these limitations in facilitating students to learn through their respective learning styles, the researchers propose alternatives through the use of instructional media such as virtual experiments. Virtual experiments are computer-based practicum activities in the learning process [3]. Virtual media is an alternative to limited physics experiment tools and helps visualize abstract concepts. Virtual experiment is a part of interactive multimedia containing media such as audio, video, animation, and simulation. The virtual experiment media used in this study had been adapted to students' learning styles [10]. This media can be run anywhere and anytime as long as you have a computer or laptop. Besides, through the use of this media students are expected to be able to construct their knowledge. So that through the learning process using a virtual experiment learning objective are expected to be achieved as desired.

2. Methods

This quasi-experimental study aimed to examine the effect of virtual experiment media on the mastery concept based on student learning styles. The study was conducted at one of the State Senior High Schools in West Nusa Tenggara. The research sample of 2 groups namely the experimental
group totaling 29 students and the control group totaling 29 students taken using cluster random sampling technique. This study used a posttest only control group design. Before the groups were given treatment, they were given a learning style instruments of 20 items in advance to find out the learning style of students’ tendency. Based on the learning style test, there were 8 students with a visual learning style inclines, 27 students with an auditory learning style inclines, and 31 students with a kinesthetic learning style incline. Concept mastery data was obtained after treatment was given to determine the level of mastery of students' concepts.

Data collection mastery of concepts used a multiple-choice instrument with 26 items with five alternatives choices of answers and 6 questions in the form of essays. Mastery of the concept is the learning outcomes of cognitive domain students C1 to C6 in the heat material with sub-material expansion, heat, phase change, Black principle, and heat transfer. The data obtained were first tested for normality and homogeneity as a prerequisite test before being analyzed using a hypothesis test to determine the effect of using virtual experiment media on concept mastery based on learning styles of students.

3. Result and Discussion

Fig 1 shows the average value of students' mastery of concepts based on learning tendencies. From the picture, it can be seen that the concept mastery of the experimental class students in each learning style tendency is higher compared to the control class students. This indicates that the use of virtual experiment media can make mastery of the concepts of experimental class students better than the students in the control class. The use of virtual media in physics learning can improve student learning outcomes as indicated by the obtaining of average scores the experimental class students were higher than the control class [11-14]. This occurred because through the use of virtual experiments, the learning process becomes student-centered and has an impact on student activity. Another thing that makes the use of media such as virtual experiments can increase student interest and learning outcomes is also expressed by Romiszowski that media is as the carriers on messages from some transmitting sources (which may be a human being or inanimate object) to the message receiver (which in our case is the learner) [15]. The use of media in learning can arouse new desires and interests, generate motivation and stimulation of learning activities, even bring psychological effects on students [15]. The use of instructional media at the learning orientation stage will greatly assist the effectiveness of the learning process and delivery of messages and the contents of the lesson at that time [15].

The mastery of concept of experimental class students is higher than the control class because the use of virtual experiment media that allows students to construct their knowledge through the activities provided in the media that were not obtained by the control class students. The high achievement of mastery of the experimental class concept because virtual labs present information through text, images, videos, animations, and simulations that support each sub material and this media supports activities to train students in constructing their understanding of physics concepts independently [16]. Through virtual experiment media, students can conduct experimental activities as an alternative to the limited experiments that can be carried out due to the limited availability of real practical tools. The virtual experiment has been adapted to the learning styles of students, although it is not yet comparable between media that are specifically for students who tend towards visual learning styles, and media for students who tend towards auditory and kinesthetic learning styles.

The use of virtual experiment media in the learning process be able to visualize each abstract concepts of the heat material, making it easier for the students to understand the concepts of physics taught. Abstract messages or information that are visualized are more effective and efficient so that they can make students more concentrated [17]. Virtual media in the form of interactive teaching materials considered effective to increase understanding concepts of learners because the material presented in addition to using text and images, and also equipped with animations and videos that visualize abstract material [18]. The use of interactive multimedia supports the learning process to facilitate students understand the basic concepts of the material being taught because interactive multimedia can display text, illustrations, animations, videos, and simulations [19].
Mastery of concepts of students who have a kinesthetic learning style tendency is higher than students with other learning style trends. The average value of the group of students with a kinesthetic learning style tendency was higher than the group of students with other tendencies [20]. Different results showed that the value of concept mastery of students with a tendency to visual learning style is higher than students with auditory and kinesthetic tendencies [21]. The contribution of students with a tendency visual learning styles was higher than those who had a kinesthetic, auditory, and analytical learning style trend towards their learning outcomes [22]. This is indicated by the acquisition of student learning outcomes that tend towards higher visual learning styles compared to students with other learning style trends. The higher the intensity of students in reading and happy to pay attention to pictures or graphics, it would improve student learning outcomes that tend towards visual learning styles [22].

Fig. 1. Comparison Average Score of Student Concept Understanding Based on Learning Style

Data mastery of students' concepts that have been obtained must first go through a prerequisite test that is the homogeneity and normality test. The prerequisite test intends to find out which test will be used to assess the hypothesis. The results of both tests are presented in Table 1.

| Table 1. Homogeneity and Normality Test |
|------------------------------------------------|
| Test          | Visual | Auditory | Kinesthetic |
| Homogeneity   | 0.372  | 0.852    | 0.272       |
| Normality     | 0.994  | 0.994    | 0.437       |

Based on the results of the normality and homogeneity tests presented in Table 1, the data obtained were in the homogeneous and normal categories. The hypothesis test used was the one-way anova parametric test. One way anova test that has been done is presented in Table 2.

The results of hypothesis test using one-way anova in Table 2 show that the significant value in the visual learning style is greater than the significance level of 0.05, while the significant value in the other learning styles (auditory and kinesthetic) is smaller than the significant level of 0.05. This result explains that the use of virtual experiments affects the mastery of the concepts of students who have auditory and kinesthetic learning tendencies, whereas students with visual learning styles, these media no significant effect. Different results show that there is an influence of the use of instructional media on student learning outcomes in each learning style trend [23]. Learning styles can influence students' mastery concepts of physics in heat material, where students who have a visual learning style have higher mastery of concepts when compared to students who have auditory or kinesthetic learning style tendencies [24].
### Table 2. Hypothesis Test

| Learning style | Sum of Squares | df | Mean Square | F     | Sig. |
|----------------|----------------|----|-------------|-------|------|
| Visual         | 57.889         | 1  | 57.889      | 0.594 | 0.470|
| Auditory       | 566.096        | 1  | 566.096     | 7.607 | 0.012|
| Kinesthetic    | 358.317        | 1  | 358.317     | 4.773 | 0.039|

If seen from the average value of the students’ mastery of concepts in the experimental and control classes in Fig 1, students with a visual learning style tendency got the lowest average difference compared to students who have an auditory and kinesthetic learning style tendency. This is because one of them is the number of students who have a visual learning style tendency of only 8 people compared to the other two learning styles which number 27 people with an auditory tendency and 31 people with a kinesthetic learning style tendency. The thin difference in the average value of students' mastery of concepts with a visual tendency between the experimental class and the control class is also caused because in the experimental class students only work on countless questions less often than students in the control class who are able to work on the count problem because they are used even though to some concepts are not very understood.

Besides the two things above, the lack of support media has an impact on the low level of the students understanding with the visual learning style tendency to heat concepts. Facilitate students with tendency visual learning styles, the approach that can be used is to show real picture and more creative according to their thought maps [23].

Other things were also expressed by experts and researchers who stated that students with visual learning styles had the following characteristics: 1) relying on eyesight as a center for capturing information, observing, and showing objects, 2) relying on colors, notes, visualization of images, and movements dynamic animation, and 3) prefer to read than to hear someone speak, including when teaching teachers prefer to read the material learned rather than writing [25-27]. Students with a tendency of visual learning styles to more easily process information by mapping readings, graphs, pictures, and other objects to make information more meaningful and easier to remember [23]. An approach by displaying words, graphs, and images more allows students with a tendency of visual learning styles easily and strongly in remembering the concepts of an object [28].

The media contained in virtual experiments supporting the students who have a kinesthetic learning style are available in almost all sub-material heat. In the sub expansion, provided practice media is involving students in conducting experiments on the expansion of solid and gas objects. In the phase change, provided a practicum on water heating where the temperature of the water increases. In the Black principle, a practicum provided to determine the thermal balance of two or more objects. Final, in the heat transfer sub, three simulations provided for helping students’ understanding of the concepts of conduction, convection, and radiation. This shows that the use of media contained in virtual experiments be able to facilitate student learning styles. If the media be able to facilitate student learning, then student learning styles will have a positive impact on the mastery of the physics concept. A different opinion that learning styles do not affect the mastery of student concepts [21]. the causes of learning styles not affecting the mastery of student concepts such as errors in analyzing learning style test results that occur because the questions contained in the learning style instrument are not appropriate to provide information about the types of student learning styles [21]. learning styles do not affect the mastery of student concepts because the grouping is done in the learning process between students with a visual learning style tendency with students who have other learning style tendencies so that students can exchange ideas and have skills and understanding the same one [29].

### 4. Conclusion

The use of virtual experiments in learning physics, especially in hot matter, influences the mastery of students 'concepts with auditory and kinesthetic learning styles and does not affect the mastery of students' concepts with visual style tendencies. The important thing gained from this research is the
lack of supporting media for students with visual learning style tendencies. Therefore, adjusting the amount and compatibility of the media is very helpful for students in construct of knowledge through information received so that it has a positive impact in increasing students' mastery of concept.

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