Correlation between increasing mastery concepts of wave and optics and habits of mind prospective physics teacher students

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Abstract. The purpose of this study was to determine the relationship between increasing mastery wave concepts and optics with habits of mind of physics prospective teacher students. This study involved 46 students who programed the Wave and Optics courses in one of the LPTK Physics Education Study Programs in Banjarmasin. The method used is mixed method with an embedded experimental model. Data analysis techniques used N Gain to determine the increase in mastery of concepts and habits of mind, then carried out normalization tests, and correlation tests to determine the relationship between the two. Analysis of the results of the study of increasing the mastery of wave concepts and optics with habits of mind of prospective physics teacher students showed a positive, strong, and very significant relationship with r (46) = 0.64; p = 0.01. This explains that the better the mastery of the concepts held by prospective teacher students, the better habits of mind of prospective teacher students, or vice versa.

1. Introduction

Mastery of concepts is cognitive knowledge that supports science and critical analysis is a standard element that prospective teacher students must have that is recommended by the National Science Teachers Association [1]. This is stated in the content knowledge standard to form an effective teacher. Teacher profession is one of the professions that participate in competing in free trade between ASEAN countries that are members of the ASEAN Economic Community [2].

Mastery of concepts is the ability of students to understand concepts after learning activities. Mastery of concepts is defined as students' ability to understand scientifically meaning both theory and its application in daily life [3]. Mastery of concepts becomes the main means to improve students' thinking habits. Mastery of concepts to solve problems is the main prerequisite in developing thinking habits [4].

The most important goal of education is to develop mental habits that allow individuals to learn about everything they want or need to understand everything related to their lives. Every individual in his life is inseparable from problems, both problems are easy or difficult to solve that are related to personal problems or social problems. In situations where individuals do not know how to overcome or respond to these problems, intelligent behavior is needed as a solution, in the sense that it not only knows

information but also how to act and behave. The ability to behave intelligently is called habits of mind [5].

Dimension of learning consists of: (a) first dimension, attitude and perception of learning, (b) second dimension, obtaining and integrating knowledge, (c) third dimension, expanding and smoothing knowledge, (d) the fourth dimension, using meaningful knowledge, (e) the fifth dimension, utilizing habits of mind. The first dimension and the fifth dimension are the main factors that need to be used in the learning process because the two dimensions that determine the success of other dimensions [6].

Some cognitive psychology researchers suggest that humans have the ability to think, but also have the ability to control their behavior through habits of mind. These thinking are placed through three categories, namely self regulation, critical thinking, and creative thinking [6]. Whereas other researchers [8,9,10] categorize habits from indicators that are similar to habits of mind developed by Marzano[6].

When examined, aspects that exist in mind of mind can be seen that these aspects provide a provision for someone to develop mental habits which are the main purpose of education [6,7,9]. In addition, behavior and behavior are behaving intelligently at the highest level of thinking and solving problems and are a determinant of success in academics, work, and social interaction [8,10].

Thinking skills that support a person who can be better explored, trained and developed than before. In online learning compared to other aspects [11]. Carter [9] in the book he compiled with the title Keys to Effective Learning Developing Powerful Habits of Mind Put forward various types of strategies to explore, train, and develop individual habits of mind.

After observing, aspects of habits of mind as explained earlier, it is considered important to train habits of mind in students in order to produce students who can behave and act intelligently so that students succeed in academic, work, and social interactions as students' supplies. in facing their lives as personal beings and social beings. In line with the opinion expressed by Rustaman [12] who said that habits of mind as intelligent behavior are far more important than providing high-level thinking skills to students through science education. Therefore, students need to be given provisions in developing mastery of concepts and habits of mind. Both of these are competencies needed by students in LPTK that can be done in all subjects. But to achieve this requires good guidance. By learning appropriate concepts, students practice thinking habits [13]. Therefore, to practice the habit of thinking and mastering the concepts, the subjects with suitable characteristics are chosen.

In the physics education curriculum at the LPTK, students are given supplies with study program expertise courses namely Wave and Optics in the fifth semester. Students who take the Wave and Optics program have passed Basic Physics courses as a prerequisite. But in reality, based on preliminary studies, students who have passed Basic Physics cannot be used as a benchmark for mastering the mastery competencies of the Wave and Optics concepts so that they need to be improved again. One way to improve mastery of concepts is to provide learning resources. The ability to master concepts and habits of mind is a competency that must be mastered by students [14]. Students 'competencies are expected to be able to increase students' self-potential. Therefore both of these competencies need to be applied to this course.

2. Method

2.1. Research design

The design of this study uses mixed method with an embedded experimental model as shown in Figure 1.

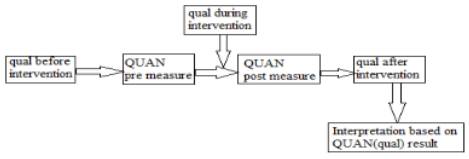

Figure 1. Mixed method design with embedded experimental model.

2.2. *Data Analysis Technique*

Increasing the average mastery score of concepts and critical thinking habits is calculated using N Gain as follows:

$$N\ Gain = \frac{score\ posttest - score\ pretest}{score\ maximum - score\ pretest}$$

Interpretation of N Gain data obtained from calculations is categorized in Table 1.

Tabel 1. N Gain Category

N Gain	Category
$0{,}7 < N\ Gain$	High
$0{,}3 \leq N\ Gain \leq 0{,}7$	Medium
$0{,}3 < N\ Gain$	Low

[15]

The purpose of this data analysis is to find out the correlation between the increase in mastery of concepts and an increase in habits of mind. The data used is the average data of increase in N Gain mastery of concepts and mean improvement data N Gain habits of mind. Before using the correlation test, first use the normality test. To find out the strength of the relationship of mastery of concepts and habits of mind used the Pearson Correlation correlation test with the assumption:

(1) There is no significant correlation if the significance value of pk> 0.01

(2) There is a significant correlation if the significance value is <0.01

3. Result

Concept mastery data were obtained from the results of the pre-test and post-test about Wave and Optics questions consisting of 30 items. Students' pre-test and post-test scores were analyzed to find out how much the mastery of concepts increased by calculating N gain as shown in Table 2.

Table 2. Data on increasing average N Gain mastery of student concepts

N	*Mean* *Pre test*	*Post test*	Percentage (%)	Ideal score	N gain	Category
46	18.63	24.98	21.17	30	0.57	Medium

The average mastery value of the wave and optic concepts of students before the lecture in the experimental class amounted to 18.63. This means that before being given treatment, students have mastered the concept of 62.1%. After being given treatment, the average student mastery concept value becomes 24.98 from the ideal score of 30 or students have mastered the optical wave concept of 83.27%. From the difference in the average value of the post test and pre test which is 6.35, the students experienced a 21.17% increase in mastering the wave and optical concepts.

The value of increasing data N mastery of wave and optic concepts of 0.57 is in the medium category.Students' habits of mind are measured through habits of mind questionnaires given at the beginning and end of lectures. To determine the increase, N Gain calculations are used as shown in Table 3.

Table 3. Average increase in N Gain habits of mind

N	*Pretest*	*posttest*	Percentage (%)	Ideal Score	Mean N Gain	Category
46	2.24	3.16	23	4	0.52	Medium

The increase in the average N Gain of mind of students in the Wave and Optics lectures was 0.52 in the moderate category which came from the initial score (mean = 2.24; 56%) and the final score (mean = 3.16, 79%) with an ideal score of 4. The percentage of the increase is 23% overall.

The relationship between mastery of concepts and habits of mind was tested using a correlation test, where the correlation test aims to see the strength or magnitude of the relationship between two

variables, namely the mastery of concepts and variables of habits of mind. The data used in this correlation test is the average data N Gain mastery of the concept and the average N Gain habits of mind students from ordinal data that has been synchronized into interval data. Before the correlation test is conducted, to find out whether the data is normally distributed, a normality test is carried out. The results of the N normality test for mastery of concepts and students' habits of mind are shown in Table 4.

Table 4. N Gain normality test results mastery of concepts and habits of mind

Score	*N*	*Mean*	*SD*	Distribution (α=0,05) p_n	Note
PK	46	0.57	0.15	0.85	Normal
HoM	46	0.50	0.12	0.73	Normal

From Table 4, the mastery of concept data has a significance value (p_n) of 0.85> 0.05. That is, the data is normally distributed. For habits of mind data, the significance value (p_n) is 0.73. This means that habits of mind data are also normally distributed. Because both data are normally distributed, the requirements for conducting Pearson correlation can be carried out. The results of the correlation test of the two variables are presented in Table 5.

Table 5. Average correlation test N gain mastery of concepts and habits of mind

Variable	*N*	*mean*	*SD*	*r*	*P*	Note
PK	46	0.57	0.15	0.64	0.01	There is correlation
HoM	46	0.50	0.12			

Based on the results of Pearson Correlation, the variable mastery of mind and students showed a positive, strong, and very significant relationship, r (46) = 0.64; p <0.01 between masters of concepts (mean = 0.57; SD = 0.15) and habits of mind (mean = 0.50; SD = 0.12). This means that stronger students have, the stronger the habits of mind of students. The increase in the mean of gain from mastery of concepts is higher than that of students. The class Increased Mean N Gain mastery concept is higher than students' habits of mind is shown in Figure 2, and the increase in mean N Gain mastery is the same as the increase in mean N is shown in Figure 3, the class Increased mean N Gain mastery concept is the same as the increase in mean N Gain habits of mind of students is shown in Figure 4.

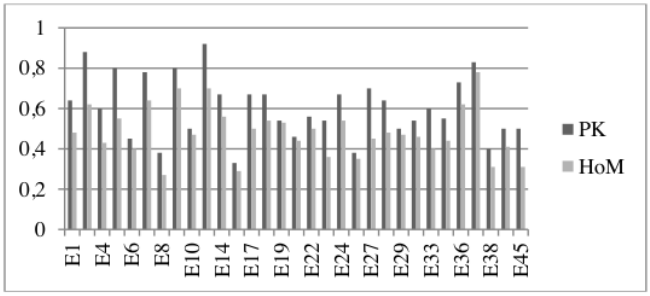

Figure 2. Increased Mean N Gain mastery concept is higher than students' habits of mind

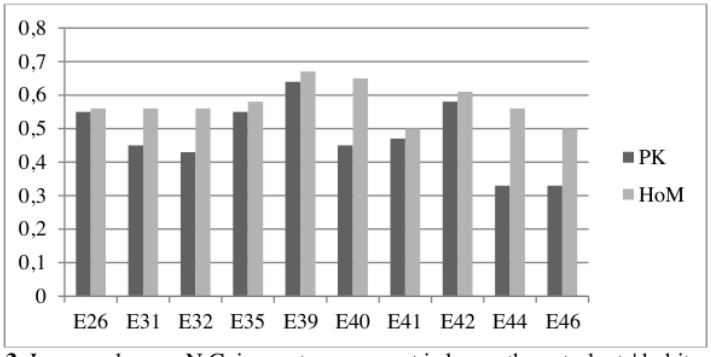

Figure 3. Increased mean N Gain mastery concept is lower than students' habits of mind

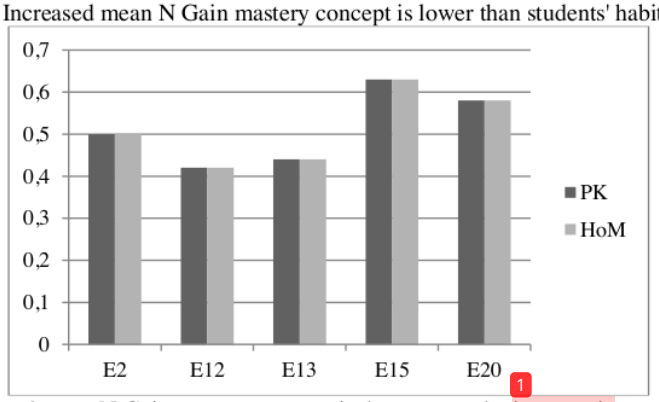

Figure 4. Increased mean N Gain mastery concept is the same as the increase in mean N Gain habits of mind of students

The increase in Mean N Gain mastery concept is higher than the habits of mind of students in the experimental class as many as 31 students (67%), while the increase in the average N Gain mastery of concepts is lower than the students' habits of mind in the experimental class as many as 10 students (22%), and the increase in the mean N Gain mastery concept was the same as the increase in the mean N Gain of the habits of mind of the students in the experimental class as many as 5 students (11%).

4. Discussion

Analysis of the results of the study of mastery of concepts and habits of mind of students showed a positive, strong, and very significant relationship, $r(46) = 0.64$; $p < 0.01$ between variable mastery (mean = 0.57; SD = 0.15) and habits of mind (mean = 0.51; SD = 0.11). This means that the stronger the mastery of the concepts students have, the stronger the habits of mind of students. This finding corroborates the results study which explains that students who have high mastery of concepts will have a habit of thinking better [16]. Furthermore, the other research also states that students' thinking habits help improve mastery of concepts, discuss and work together actively about scientific concepts in learning [17,18].

The results of the study regarding the reciprocal relationship between habitual thinking and mastery of concepts that occur showed that students' thinking habits were influenced by mastery of concepts. Students who have good thinking habits, the mastery of the concept is also good [19]. The results [11] study agree with the study that mastery of students' concepts of learning content influences thinking habits. Mastery of concepts and habits of thought are related to one another [11,20]. By learning appropriate scientific concepts, students can practice the thinking habits [21]. This means, mastery of concepts affects someone's thinking habits [21,23].

5. Conclusion

Based on the results, findings, and discussion it can be concluded that there is a positive, strong and very significant relationship between increasing the mastery of concepts wave and optics with the habits of mind (self regulation, critical thinking, and creative thinking) of prospective teacher students. This explains that the better the mastery of the concepts held by prospective teacher students, the better habits of mind of prospective teacher students. Or conversely, the better habits of mind possessed by student teachers, the better the mastery of the concepts held by prospective teacher students.

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