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The Correlation Between Formal Reasoning Ability and Physics Concept Mastery of Senior High School Nasrani 1 Medan Students in 2018/2019 Academic Year

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Abstract:- This study aims to determine the correlation between formal reasoning ability and physics concepts mastery of Senior High School Nasrani 1 Medan Students in 2018/2019 Academic Year.

The method of correlational research was carried out in this study with a sample size of 40 students from a total of 94 students whose withdrawals were carried out by purposive sampling method. The research instrument used was the Formal Reasoning Ability Test which was adapted from the Test of Logical Thinking (TOLT) and the Physics Concept Mastery Test.

The results of the analysis of formal reasoning abilities show that the transitional reasoning rate is 12.5%, the initial formal is 37% and the formal is 50%. Whereas, the physics concept mastery test was classified as good, with the highest score being 9.5 and the lowest being 6.5 overall. Students can achieve the minimum completeness criteria (KKM) of 6.5. The magnitude of the correlation coefficient index is 0.756 which is classified as high and the coefficient of determination is 57.15%. The t_{count} is 7.113 and the significance (p_{value}) is less than 0.05, it means that the hypothesis is accepted which states that there is a correlation positive and significant between formal reasoning ability and physics concept mastery of senior high school Nasrani 1 Medan students in 2018/2019 academic year.

***Keywords*:-** *Formal Reasoning Ability, Physics Concepts Mastery*

I. INTRODUCTION

Education is one of the important factors in the development of a nation towards a complete human development. Success in the field of education, both in increasing the quantity and quality, is one of the determinants of successful development, which must constantly be improved. In the world of education, it has long been recognized that there are variations in the level of achievement of learning outcomes by students. The quality of learning outcomes or the level of achievement spreads from the lowest to the highest. The tendency of the number of students to obtain low quality learning outcomes is an indicator that shows the low average learning outcomes that students can achieve (Soedijarto, 1982: 57).

Based on data from the Computer-Based National Examination (UNBK) from the administration of SMA Nasrani 1 Medan in the last two years, the average physics score in the 2016/2017 and 2017/2018 school years was 6.65 and 6.70 respectively which were classified as unsatisfactory. In line with the above opinion, Ardhana (1983: 149) asserts that in high school, only 53% of the subject matter taught can be mastered by students. This fact shows that the mastery of physics subject matter is still lacking and students' absorption of the lessons given is still low. The low level of student absorption reflects the gap between the demands of the curriculum and the thinking ability of students. The inability of students to do a task is not only because they do not have the necessary prerequisite knowledge, but also their limited ability to process the amount of information received. This ability is closely related to the level of cognitive development.

The low quality of learning outcomes raises several fairly basic questions: (1). whether the curriculum applied is in accordance with the cognitive development of students? (2). how is the implementation of the learning process, especially in the field of physics that has been carried out so far? (3) is the learning model implemented in SMA not in accordance with the characteristics of physics? The above indications are worth learning, especially for educators to fix and improve their mastery of the material or the quality of student learning outcomes. The assessment of the factors that affect student learning outcomes is the first step that must be taken, so that further steps can be determined and appropriate ways in order to improve and improve the quality of learning outcomes.

Learning outcomes of students are influenced by various factors, one of the factors is the thinking skills of students related to cognitive development. In this connection Nur (1986: 3) states that "cognitive development is a variable that mediates learning science". Physics as part of science consists of various concepts and ideas that are always developing, requiring students' thinking skills to

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process them. One aspect of thinking skills required is formal reasoning ability.

In the last decade, the problem of reasoning has become the center of attention of educational experts. Amien (1992: 2) science education should provide opportunities for graduates with an introduction to concepts, laws and scientific processes, scientific inquiry methods and reasoning. More specifically, Sutrisno (in Supranoto, 1991: 18) argues that "physics education in high school is primarily directed at providing reasoning abilities rather than skills".

Listening to the problem of reasoning, Nur (1986: 1-7) explains that formal reasoning is an aspect of thinking skills that is of great value to efforts to improve Indonesian human intelligence. Intelligence is also the main factor in the success of the technology transfer process and the effort to absorb advanced technology. By attention to the UNBK achievements in the last two years, it is suspected that there is a gap between the thinking skills that students should have and the reality that exists in the students themselves. Will this affect the learning process of students, especially in studying physics? For this reason, it is necessary to know the correlation between formal reasoning skills and mastery of physics concepts as an indicator of learning outcomes, including (1). is there a dependence on students' mastery of physics concepts on their formal reasoning abilities? (2) how much does this dependency factor affect the learning process of students? This input may add information for efforts to improve students' mastery of physics concepts. In addition, the information that will be obtained may be used as a guide in improving the thinking abilities of students.

The ability of formal reasoning which according to Piaget's theory is a level of formal operation is interesting to note. This is because: (1). formal reasoning ability is the highest thinking ability in Piaget's hierarchy of cognitive development, (2). since secondary school the learning system has gradually changed to become more abstract, both in the concepts used and in the ways in which they are conveyed. This kind of learning is certainly difficult for children who have not reached the level of formal operations. Facing this problem, physics learning should not only convey facts or information but try to involve children directly. This is in accordance with Seregeg's (1986: 29) opinion that physics concepts, which are almost completely logical mathematical concepts, cannot be achieved by children without going through direct experience.

The opinion above is in line with the objectives of the physics subject (Mulyasa, 2006: 133) for Senior High School (SMA)/Madrasah Aliyah (MA), which aims to make students have the following abilities: (1). forming a positive attitude towards physics by realizing the order and beauty of nature and glorifying the greatness of God Almighty, (2). fostering a scientific attitude that is honest, objective, open, resilient, critical and able to work with others, (3). develop experience to be able to formulate problems, propose and test hypotheses through experiments, design and assemble experimental instruments, collect, process, and interpret data, and communicate the results of experiments orally and in writing, (4). develop reasoning skills in inductive and deductive analytical thinking by using the concepts and principles of physics to explain various natural events and solve problems both qualitatively and quantitatively (5). master the concepts and principles of physics and have the skills to develop knowledge, and a confident attitude as a provision for continuing education at a higher level and developing science and technology.

This is in line with the objectives of the 2013 curriculum, namely that each student has his or her own potential that needs to be explored and developed, so that later on this potential can be useful in the life of the student later in society. This curriculum was developed based on the principle that every student is in a central position and is active in learning, so it can be said that the teacher is only a facilitator. The role of students in learning activities is prioritized so that the potential that exists in students becomes more channeled and can develop.

The objective to be achieved in this study is to determine the correlation between formal Reasoning Ability and physics concept mastery of senior high school Nasrani 1 Medan students in 2018/2019 academic year.

II. LITERATURE REVIEW

A. Formal Reasoning Ability

In the Encyclopedia Britanica Vol. VIII, reasoning is generally defined as: "a mental process and the name of a philosophical concept of which are treated under through processes" (Rery, 1990: 41). In line with that (Arhamulwildan, 2012) states that "reasoning is a thinking activity that has certain characteristics in finding truth. Reasoning is a thought process in drawing a conclusion in the form of knowledge. "

A reasoning starts from the knowledge that someone already has about something that is true or something that is wrong. In reasoning, the knowledge on which the conclusion is based is the premise. So all the premise must be true. Right here must include something that is true both formally and materially. Formal means that reasoning has the right form, derived from precise rules of thought, while material means the content or material which is used as the right premise. Reasoning produces knowledge which is defined as thinking and not feeling. Thus we should realize that not all thinking activities rely on reasoning. So reasoning is a thinking activity that has characteristics in finding truth. Thinking is an activity to find correct knowledge and human thinking is not the same. Therefore, the thinking process activities to produce correct knowledge also different.

In essence, humans are creatures of thinking, feeling, behaving and acting. His attitudes and actions are rooted in the knowledge obtained through feeling and thinking. Thinking is basically a process that produces knowledge (Suriasumantri, 1984: 1). Whereas, reasoning produces knowledge that is associated with thinking and not feeling.

The ability to think formally or formal reasoning is an intellectual development. According to Piaget, the intellectual development of a person goes through a series of stages. From one stage to another will change qualitatively. These stages are sensorimotor (birth to 2 years), pre-operational (2 to 7 years), concrete operations (7 to 11 years), and formal operational (11 to 14 years to adulthood) (Slavin, 1994: 34).

In connection with intellectual development in formal operations, Seregeg (1985: 19) suggests several levels of cognitive development achieved in these operations the child has: (1). able to solve concrete problems in an integrated way based on theories that are closely related to these real problems, (2). able to reason scientifically, test hypotheses and think in terms of causal relationships, (3). achieve the concept of comparison, for example, the child can say the ratio of the arm length of the scale if the weight ratio is known, (4). achieve the concept of speed and time conservation, (5). able to reason on the basis of assumptions.

Inhelder and Piaget (1958) identified certain operations that can be performed by people who have formal operational skills but cannot be performed by people who only have concrete operating capabilities. Five of them are variable control, proportional reasoning, probability reasoning, correlational reasoning, and combinatorial reasoning (Nur, 1991: 4).

In compiling items of formal reasoning, Roadrangka (1985: 11) identifies a formal operating process consisting of 6 processes, namely conservation or immutability, proportional reasoning, variable control, combinatorial reasoning, probability reasoning and correlational reasoning.

Besides Roadrangka, Inhelder and Piaget, Lawson (in Jatmiko, 1989: 46) has also identified five ways that are included in the classification of formal reasoning. The five ways are (1). Identification and control of variables, (2) combinatorial analysis and various factors relating to possible cases (combinatorial reasoning), considering possible, supportive or unsupportive cases (3). correlational reasoning), (4) recognition of possible natural phenomena (probability reasoning), and (5) formation of functional relationships among variables (proportional reasoning). It can be said that children at the formal stage have been able to identify and estimate the relationship between one variable and another. Therefore, in intellectual development, students of senior high school (SMA) are expected to be at the formal operation stage. The formal reasoning ability is the ability to control variables, proportional reasoning, combinatorial reasoning, probability reasoning and correlational reasoning.

B. Physics Concepts Mastery

Physics concepts mastery is a form of learning outcomes. Learning outcomes can be said to exist if there is something that is remembered and is needed for further learning. In physics lessons that are important to remember are some verbal information and intellectual skills (Wahyana, 1986: 3-4). Verbal information is absolutely necessary for further study. The information referred to is the names of laws, important constants, theoretical concepts and some important concepts that are defined including formal concepts. Meanwhile, intellectual skills are skills in classifying existing concepts, skills in applying some rules, strategies for obtaining information and so on. Included in this category include several important formulas, mathematical solutions, use of physical tools and the like.

Based on the description above, it can be concluded that mastery of the concept of physics is not just knowing which is limited to recalling what has been experienced or being able to produce what has been studied in accordance with what is contained in physics textbooks but also involves higher mental processes, which require the ability in understanding, classifying existing concepts, looking for and connecting several concepts to solve problems, analyze, interpret a problem or event related to the concepts being studied. In short, the mastery of concepts is the result of intellectual activity. When viewed from educational objectives, the results of intellectual activity in the form of conceptual mastery are included in the cognitive domain. According to Bloom's revision of Anderson (in Kemendikbud 2018: 28-29) that the goal of the 2013 curriculum is to categorize higher-order thinking skills (HOTS) in learning to motivate students to think critically, logically, and systematically according to the following characteristics of physics: (1). remembering (presenting facts from memory), (2). understand (interpret the material studied in one's own words/sentences, (3). apply (implement, use procedures for a new situation), (4). analyze (classify information/phenomena in important parts, determine the linkages between components, find thoughts) principal /bias/ author's value, (5) evaluating (Determining whether the conclusion is in accordance with the description /facts, assessing which method is most suitable for solving problems), and (6) creating (developing hypotheses, planning research, developing new products).

As with the classification of cognitive domains above, learning outcomes are organized according to increasing complexity. This sequence begins with relatively simple matters concerning the memory of real information, passes to the lowest level of understanding, then proceeds through increasingly complex levels of application, analysis, evaluation and creation. The learning outcomes are arranged as above in accordance with the mastery of the concepts referred to in this study. Because mastery of this concept involves a high mental process which will be associated with formal reasoning abilities.

As it is known that formal reasoning involves high and complex thinking skills according to Piaget. In addition, this is in accordance with Wahyana's (1986: 6-9) opinion that in the teaching and learning process that requires a higher order of thinking, what needs to be considered is to try to vary the questions so that they cover all aspects according to Anderson's revised Bloom taxonomy.

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C. The Correlation between Formal Reasoning Ability and Physics Concepts Mastery

Based on the nature of formal reasoning abilities, a student who has formal reasoning abilities can be said to have been able to think logically and analytically. Both of these abilities will support the ability of students to think about something that will happen, including thinking about causal relationships, so that it is likely that these students are able to think about abstract things. The ability to think like this seems to be indispensable in studying physics, where almost all of the concepts are formal concepts, where the concept is built from the correlation of several concepts developed in a formal operation.

Through the ability to see cause and effect correlation and the ability to think abstractly, in learning new concepts in the form of both concrete and formal concepts, students will be able to see the correlation between accepted concepts and newly recognized concepts. So that he is able to interpret the new concept well, or in other words students are able to quickly assimilate and accommodate the conceptual structure they already have in order to obtain a new, more stable concept structure. This means that the concepts learned are easier to obtain, understand and understand. By understanding new concepts and having a stable concept structure, students' mastery of the concepts that have been learned will be better. Thus, the higher the formal reasoning abilities students have, it is thought that the easier it will be to master the concepts and correlation between concepts in physics, which in the end will increase the level of mastery of physics concepts.

Several researches that have been carried out on both formal reasoning abilities and their correlation with learning outcomes in physics have obtained different results. Tobin and Patrick's (1985) research (in Rery, 1990: 60-62) regarding students' formal reasoning abilities was carried out in four metropolitan cities of Western Australia using TOLT. The sample consisted of 1371 students consisting of 8 year old students (school years) aged 13 years, 9 year students aged 14 years, 10 year students aged 15 years and 11 year students aged 16 years. The results obtained indicate that the pattern of reasoning develops according to the increase in school years or the age of students with the average score of each reasoning tends to increase. Especially for students in years 10 and 11, respectively, obtained an average score for proportional reasoning of 54% and 66%, variable control of 56% and 63%, probabilistic reasoning of 36% and 52%, correlational reasoning of 52% and 63%, whereas combinatorial reasoning was obtained 41% and 54%.

Furthermore, Tobin reported that there was a positive and significant correlation between the TOLT score and the science score of students who chose chemistry, physics or biology. For the correlation between TOLT and learning achievement scores, especially in chemistry and biology subjects, the correlation was found to be positive and significant. Only in physics the correlation was found to be insignificant. Based on a study conducted by Amien (1987: 64-65), several studies found that there are still many students, even those at the tertiary level, are unable to perform formal tasks well. The corroborating research result is a study conducted at the University of Northhern Colorado, that many senior high school students and students do not function to think formally. In addition, Karplus and Peterson found that many high school students were unable to solve problems that required proportional thinking.

Research on the correlation between each ability to perform logical operations (formal reasoning) and learning achievement in physics was carried out by Liberman and Hudson (1979) at preparatory level students who took a non-physics major but had taken preliminary physics lessons. The correlation coefficient for each reasoning was found to be 0.39 for combined reasoning, 0.26 for variable isolation, 0.27 for verbal analogy, 0.30 for principle abstraction and 0.34 for probability reasoning (in Burhanuddin, 1982: 140). In line with that, Jatmiko (1989: 44) found that there was a significant positive correlation between formal reasoning skills and the ability to understand physics concepts of state senior high school on surabaya city with a correlation coefficient of 0.41, the sample studied was 365 people.

Cohen (in Roadrangka, 1985: 1) indicates that the progress of students' reasoning power at the formal operation stage is an expected educational outcome. Success in science education is not only determined by the science being taught, but also determined by the scientific way of thinking and reasoning (Roadrangka, 1985: 1). Raven (in Roadrangka, 1985: 2) indicates that mastery and understanding of scientific concepts is related to the use of logical operations, namely formal reasoning. Based on the opinions, theoretical and empirical concepts that have been stated, it is assumed that formal reasoning ability has a positive correlation with mastery of physics concepts. Then the research hypothesis is formulated: "there is a positive and significant correlation between formal reasoning ability and mastery of physics concepts."

III. RESEARCH METHODS

This research was conducted on students at SMA Nasrani 1 Medan for four months from May to July 2019. The research method used was descriptive quantitative with correlational research. The research design is as shown in Figure 1:

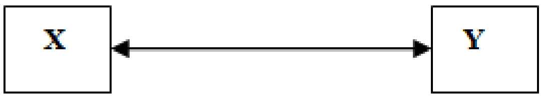

Figure 1: Research Design

Information:
X = Formal Reasoning Ability
Y = Physics Concepts Mastery

The population in this study were 94 students of SMA Nasrani 1 Medan in the semester 2018/2019 academic year, with the following considerations: (1). SMA Nasrani 1 Medan already has a physics laboratory for learning

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activities, (2). the 2013 curriculum has been applied to all students as it should be, (3) physics teachers at SMA Nasrani 1 Medan periodically attend MGMP activities and 2013 curriculum training, who are considered capable of using and operating physics laboratory tools. Furthermore, in terms of determining students based on considerations: (1). students have entered the formal operation stage according to Piaget, (2). the attitudes of students at these ages were consistent, and (3) students had a science program, according to their interests and motivation towards physics. The sampling technique used was purposive sampling, with a sample size of 40 students.

Data collection was carried out using 2 instruments: (1). The formal reasoning ability adapted from the form A Test of Logical Thinking (TOLT) developed by Tobin and Capie (1981) includes the ability to control variables, using proportional reasoning, combinatorial reasoning, probabilistic reasoning and correlational reasoning, with the interpretation of the level of reasoning accordingly with the scores as shown in Table 1, and (2). the test of physics concepts mastery, namely the scores obtained by students after working on the test of physics concepts mastery as many as 10 subjective test items covering all cognitive levels of Anderson's Bloom taxonomy.

Table 1: Meaning of Score on TOLT

Score	**Level of Reasoning**
0 - 1	concrete
2 - 3	transition
4 - 5	early of formal
6 - 10	formal

Source: Nur, Moh. 1991

A. Data Analysis

The research data analysis aims to test the predetermined hypothesis. Before the analysis of hypothesis testing is carried out, the analysis requirements are first tested, including testing the normality of the data distribution obtained and testing the form of correlation or linearity between variables. For the analysis of hypothesis testing used correlation analysis techniques and regression analysis.

1. Normality test

Before testing the hypothesis, the data on the value of formal reasoning ability and the test scores for mastery of physics concepts are tested for normality using the Kolmogorov-Smirnov test whose significance is relevant to the Liliefors test which is analyzed using the help of the Statistical Package for the Social Sciences (SPSS) software package. According to Bama (2013) the steps for analyzing data normality with SPSS are as follows: (1) determining Ho and Ha; Ho: samples come from populations that are normally distributed; Ha: the sample does not come from a normally distributed population, (2) sets the level of significance (α) = 0.05, (3) compares sig. (p_{value}) with α = 0.05, (3) if sig. (p_{value}) > α, then the sample comes from a normally distributed population otherwise if the significance is sig. (p_{value}) < α, then the sample does not come from a normally distributed population.

2. Regression Linearity Test

The linearity test of the independent variables with the dependent variable aims to determine the linearity of the correlation. For this purpose, the researcher conducted a linearity test of possible regression lines using the Statistical Package for the Social Sciences (SPSS) software package. According to Bambang (2018) the steps of regression analysis with SPSS: (1) test the data normality of each variable (especially dependent variables), use the Kolmogorov Smirnov or Shapiro-Wilk test, (2). calculate the values of the regression coefficients, so that the regression equation Y = aX + b, (3). regression equation significance test with ANOVA test. If $F_c > F_t$, then the regression equation "significant" on the selected α. If the opposite is "insignificant"or if sig. (p_{value}) < α, then the regression equation significant, otherwise the regression equation is "insignificant".

Furthermore, the regression significance test, if $t_{calculated} > t_{table}$, then the regression coefficient " significant" on the selected α. If on the other hand the regression coefficient is "significant" or otherwise sig. (p_{value}) < α, then the regression coefficient is" insignificant ".

3. Research Hypothesis

To see the correlation between the independent variable (X) and the dependent variable (Y), the hypothesis is formulated

Ho : $\beta = 0$ This means that there is no positive and significant correlation between the independent variable (X) and the dependent variable (Y)

Ha : $\beta \neq 0$ This means that there is a positive and significant relationship between the independent variable (X) and the dependent variable (Y).

4. Hypothesis Testing

Hypothesis testing is carried out using the t-test with the decision-making criteria, namely H_o is rejected, which means that H_a is accepted if sig. (p_{value}) < α with, α= 0.05 and degrees of freedom (db) = n-2 where n = the number of research samples. Furthermore, based on the results of data analysis, the linear regression equation Y = aX + b can be determined, and interpret the meaning of the equation.

IV. RESULTS AND DISCUSSION

A. Normality Test

Based on the results of the normality test of the two research data, the formal reasoning ability and mastery of physics concepts each have a sig. (p_{value})> 0.05, which means that the sample comes from a normally distributed population. The summary of the normality tests for the two variables is presented in Table 2.

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Table 2: Kolmogorov-Smirnov Normality Test of Research Data

One-Sample Kolmogorov-Smirnov Test

		KPF	PKF
N		40	40
Normal Parameters[a,]	Mean	5.5000	7.9500
	Std. Deviation	1.55250	.83051
Most Extreme Differences	Absolute	.126	.126
	Positive	.126	.126
	Negative	-.124	-.124
Kolmogorov-Smirnov Z		.799	.797
Asymp. Sig. (2-tailed)		**.546**	**.549**

a. Test distribution is Normal

Source: the results of SPSS data processing

B. Description of Formal Reasoning Abilities

The description of formal reasoning abilities is presented in Table 3.

Table 3: Description of Formal Reasoning Abilities

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3	5	12.5	12.5	12.5
	4	6	15.0	62.5	27.5
	5	9	22.5	22.5	50.0
	6	9	22.5	22.5	72.5
	7	6	15.0	15.0	87.5
	8	5	12.5	12.5	100.0
	Total	40	100.0	100.0	

Based on the data description in Table 2, the students' reasoning levels based on the TOLT score, transitional reasoning level, formal initial, were 5 (12.5%), 15 (37%), and 20 (50%) respectively.

C. Descripton of Physic Concepts Mastery

The description of Physic Concepts Mastery is presented in Table 4.

Table 4: Description of Physics Concepts Mastery

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	6.5	3	7.5	7.5	7.5
	7	6	15.0	15.0	22.5
	7.5	7	17.5	17.5	40.0
	8	10	25.0	25.0	65.0
	8.5	7	17.5	17.5	82.5
	9	4	10.0	10.0	92.5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	6.5	3	7.5	7.5	7.5
	7	6	15.0	15.0	22.5
	7.5	7	17.5	17.5	40.0
	9.5	3	7.5	7.5	100.0
	Total	40	100.0	100.0	

Source: the results of SPSS data processing

Based on the data description in Table 4, the mastery of physics concepts is high. This is indicated by a value ≥ 6.5. So it can be said that between students' formal reasoning abilities and their physics concepts mastery has a significant correlation.

D. Linear Regression

Based on the results of data analysis, the constant value (B) and the regression coefficient are 5.727 and 0.404, respectively, so that the linear regression equation is Y = 0.404X + 5,727 with the coefficients presented in Table 5

Table 5: Regression Test Results

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.727	.325		17.647	.000
	KPF	.134	.057	.756	7.113	.000

a. Dependent Variable: PK

Source: the results of SPSS data processing

E. Regression Linearity Test

Based on the ANOVA results, the sum of squares was obtained. The mean squares (mean square), and F, are presented in Table 6. As seen in Table 6, that F = 50,592 and sig. (p_{value}) < 0.05 of 0.000 which states that the correlation of the two variances of the variable is linear.

Table 6: Test Result F

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.362	1	15.362	50.592	.000[a]
	Residual	11.538	38	.304		
	Total	26.900	39			

a. Predictors: (Constant), KPF

b. Dependent Variable: PKF

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Source: the results of SPSS data processing

F. Correlation between Formal Reasoning Abilities and Physics Concepts Mastery

The results of the correlation analysis between formal reasoning abilities and physics concepts mastery are summarized in Table 7.

Table 7: Inter Variable Correlation Matrix

		KPF	PKF
KPF	Pearson Correlation	1	.756**
	Sig. (2-tailed)		.000
	N	40	40
PKF	Pearson Correlation	.756**	1
	Sig. (2-tailed)	.000	
	N	40	40

**. Correlation is significant at the 0.01 level (2-tailed).

Source: the results of SPSS data processing

As seen in Table 7, it is known that the correlation coefficient between X and Y is 0.756 which indicates a high correlation.

F. Hypothesis Testing Results

Based on the results of data analysis, as shown in Table 7, the correlation index between Formal Reasoning Abilities and Mastery of Physics Concepts was obtained as large as 0.756 and sig. (p_{value}) of 0.000 and this value is smaller than (α) = 0.05 two-tail test as shown in Table 7 which concludes that H_o is rejected and the opposite H_a accepted, which states that there is a significant correlation between formal reasoning abilities and physics concepts mastery.

V. DISCUSSION

Based on the data description in Table 3, the level of reasoning based on the TOLT score, the transitional, initial formal, and formal reasoning levels were obtained at 12.5%, 37% and 50%, respectively. When viewed from Piaget's cognitive development, 87% of students are at the level of formal reasoning. Furthermore, the description of mastery of physics concepts shows that all students have got a score of ≥ 6.5. So it can be said that between formal reasoning abilities and students' physics concepts mastery has a positive and significant correlation. This result is also reinforced by the $t_{calculate}$ of 7.113 and sig. (p_{value}) < 0.05, which proves that there is a significant correlation between the two variables.

VI. CONCLUSION AND SUGGESTIONS

A. CONCLUSION

1. The students' formal reasoning level consists of the transitional, initial formal, and formal reasoning levels of 12.5%, 37% and 50.0%, respectively. This indicates that students are able to reason well and result in physics concepts mastery that can achieve KKM completeness.
2. Students' formal reasoning power turned out to provide support for physics concepts mastery, making it easier for teachers to transfer a number of concepts
3. One way to improve students' reasoning power is to provide several examples of questions and a variety of homework after the lesson is complete.

B. SUGGESTIONS

1. Physics teachers should pay attention to and further improve the reasoning power of their students during the learning process. Because students' formal reasoning abilities are expected to improve Physics Concepts Mastery
2. The school management needs to fix and complete the facilities and infrastructure as a forum for students to develop their thinking power.

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