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## The Relationship Of Formal Reasoning Ability And Achievement Motivation With Student Learning Achievement

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### ABSTRACT

The purpose of this study was to determine the relationship between formal reasoning abilities and student achievement motivation. The method used is a quantitative research method with analysis using product moment correlation, assisted by SPSS version 16. Correlation research is a type of research used to explore the relationship between two or more variables. This study aims to determine whether there is a statistical relationship between these variables and to what extent this relationship is correlated. As for this study, researchers used the help of SPSS version 16 in analyzing the data. The sample selection in this study used a random sampling of 30 students. The independent variables in this study are formal reasoning (X1) and achievement motivation (X2), and the dependent variable is learning achievement (Y). Collecting data on formal reasoning, achievement motivation, and student achievement using a questionnaire. The results of this study indicate that formal reasoning and achievement motivation have a strong relationship with student achievement, with each sig. (2-tailed) 0.02 between formal reasoning and learning achievement, so that  $0.02 < 0.05$  is smaller than the r table, which means there is a correlation between formal reasoning and learning achievement. As for learning motivation and learning achievement, the sig. (2-tailed), namely  $0.02 < 0.05$ , means there is a correlation between learning motivation and learning achievement. From these results, formal reasoning allows individuals to think logically and systematically, while achievement motivation encourages academic success. The two mutually reinforce and enhance each other, creating a productive learning environment and enhancing overall individual achievement.

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### 1. INTRODUCTION

According to Abid (2019), "formal reasoning is a complex cognitive ability that allows a person to analyze, understand, and manipulate the concepts and logical rules that underlie them. This ability involves critical, deductive, inductive, and abstract thinking that is used to construct consistent and valid arguments. Therefore, formal reasoning is often associated with mathematics, philosophy, computer science, and other fields that use formal logic as an

analytical tool. Furthermore, formal reasoning basically involves the use of strict logical rules to produce correct and valid conclusions. This requires a solid understanding of basic concepts, including propositions, implications, inferences, and argument structure. Formal reasoning also involves an understanding of the relationships between these concepts and the ability to apply logical rules appropriately.

One important aspect of formal reasoning is deduction. Deduction is a process of drawing conclusions that uses known premises to produce unquestionable conclusions; this involves applying logical rules such as modus ponens, modus tollens, and syllogisms (Bronkhorst et al., 2020 m. The ability to deduce correctly is essential to building strong and consistent arguments. Besides deduction, formal reasoning also involves induction. According to Chimaka (2014), induction is a process of drawing conclusions that involve generalizations from specific examples to general rules. It involves gathering empirical evidence and drawing possible, but not entirely certain, conclusions. The ability to perform effective induction involves the ability to recognize patterns, make rational assumptions, and draw conclusions.

Besides that, formal reasoning also involves the ability to think abstractly. This ability allows one to understand concepts that have no direct physical representation and manipulate them in the mind. Abstract thinking allows one to think conceptually, recognize common patterns, and make strong generalizations. This is an important skill in mathematics and in understanding complex concepts in many fields. Formal reasoning also involves the ability to recognize and analyze errors in arguments. This involves understanding common logical fallacies such as inadequate generalizations, arguments involving shifting of responsibility, or errors in deductive reasoning. This ability allows one to criticize other people's arguments wisely and correct deficiencies in their own arguments (Jusman, 2018).

Weinberg et al. (2010) explained that the development of formal reasoning requires training and a deep understanding of the principles of logic and mathematics. This involves mastering basic concepts such as statements, predicates, quantifiers, and logical functions. Learning formal reasoning also enables one to develop strong analytical skills, critical thinking skills, and an acumen for analyzing complex problems. In addition, formal reasoning can be enhanced through the use of computational tools such as automated systems, formal modeling, and logical programming languages. The use of this technology allows one to harness computing power to perform complex calculations and check the correctness of arguments automatically. This can assist in the development of more effective and efficient formal reasoning. Meanwhile, according to Nawi (2012), in the academic and professional world, formal reasoning is important in various fields such as science, engineering, law, and business. The ability to solve complex problems, make sound decisions, and understand complex concepts often requires strong formal reasoning. Therefore, the development of this ability is very valuable in increasing one's competence in various fields.

According to Bertrand Russell, formal reasoning plays an important role in developing critical and analytical thinking skills as well as preparing individuals to deal with the complexities of the modern world. The following is a more detailed explanation of Russell's view of formal reasoning in education. It is further explained that education must emphasize the importance of the development of formal reasoning as an integral part of the curriculum. For Russell, formal reasoning is an essential cognitive ability that must be empowered through education. He argues that lessons about formal logic and methods of deductive and inductive reasoning should be taught to students from an early age. According to him, formal reasoning is not only relevant in mathematics and science but also in everyday life, critical thinking, and

wise decision-making (Patkos, 2010). In addition to academic interests, formal reasoning is an important tool in developing critical and independent thinking, which is very important in dealing with various complex problems in society. Through education that encourages formal reasoning, students can become more skilled in analyzing public issues, criticizing the arguments presented by leaders or the public, and making decisions based on evidence and solid reasoning (Tawil, 2008).

It can be concluded that formal reasoning is a complex and important cognitive ability that involves critical, deductive, inductive, and abstract thinking. This ability enables one to analyze, understand, and manipulate the concepts and logical rules that underlie various fields of knowledge. In developing formal reasoning, practice, understanding basic concepts, and the use of computational technology can be very helpful.

In the world of education, both at the middle and tertiary levels, it is undeniable that there are factors of achievement motivation in the academic and non-academic fields that are key factors that can influence the success of students in their education. Achievement motivation can be interpreted as an internal drive that encourages individuals to achieve high goals, try hard, and be committed to achieving success in everything they do (Darmawan, 2019). According to Boekaerts (2010), achievement motivation has several important elements. First, this motivation involves an intrinsic drive, namely the individual's inner desire to achieve personal and intellectual satisfaction. This means individuals feel happy and satisfied with their own accomplishments, regardless of external praise or rewards. In addition, achievement motivation also involves extrinsic encouragement, namely appreciation or reinforcement that comes from outside the individual, such as praise, recognition, or prizes. This extrinsic drive can play an important role in motivating individuals to achieve higher levels of achievement, especially when they feel rewarded or benefit from their achievements.

Besides that, Martin (2017) explained that achievement motivation also involves a strong goal orientation. Individuals who have high achievement motivation often have clear and specific goals, both in terms of academic and non-academic achievements. They set high standards for themselves and work hard to achieve them. This goal orientation gives them the focus and motivation needed to achieve high performance. Achievement motivation also involves a sense of self-responsibility. Individuals with high achievement motivation feel responsible for their own success or failure. They have a proactive attitude and take the initiative to overcome challenges and obstacles that may arise along the way. They see themselves as agents responsible for their accomplishments, and this gives them additional motivation to keep trying.

Achievement motivation also involves perseverance and mental resilience; individuals who have high achievement motivation do not easily give up in the face of obstacles or failures. They are able to keep their spirits up and keep fighting despite facing difficult challenges. They have a determined and persistent attitude toward pursuing their goals and are not swayed by temporary failures or obstacles. In addition, achievement motivation also involves self-confidence. Individuals who have high achievement motivation have a strong belief in their own ability to achieve the goals set. They have high self-confidence and believe that they can overcome obstacles and achieve great heights. This self-confidence gives them additional motivation to keep trying and exceeding their own limits (Tiara Ernita, 2016).

Meanwhile, in the context of education, achievement motivation is very important because it can affect the learning outcomes of students. Individuals who have high achievement motivation tend to be more involved in learning, participate actively in class, find out more information,

and use effective learning strategies. They also tend to achieve higher academic achievement and have the motivation to continue learning and developing (Syahrowiyah, 2016). In the academic field, achievement motivation can have a positive impact, such as in sports, art, or student or student organizations. Individuals who have high achievement motivation tend to have a strong commitment to their field of interest and strive to achieve high achievements. They develop self-discipline, dedication, hard work, and the ability to work together in teams (Banawi, 2019).

In an effort to increase the achievement motivation of students, education can play an important role. Educators can create an environment that encourages and supports achievement motivation by providing constructive feedback, providing challenges according to students' ability levels, and providing opportunities to participate in interesting projects or activities. It is also important to encourage fair rewards and build a culture that rewards effort and achievement (Andry, 2020). So it can be concluded that achievement motivation is an important factor in improving the academic and non-academic performance of students. This motivation involves intrinsic and extrinsic drives, a strong goal orientation, a sense of self-responsibility, persistence, mental resilience, and self-confidence. In the world of education, it is important for educators to create an environment that encourages and supports students' achievement motivation so that they can reach their full potential and achieve high achievements.

Based on the results of observations made by researchers, it can be seen that there is a trend of students lacking the enthusiasm to excel in academic and non-academic fields, as well as spending more time playing online games. This phenomenon can be caused by various factors that need to be understood and overcome in order to motivate students to achieve high achievements. Here are some factors that might contribute to this phenomenon: a. Lack of clear goals: Students may lose motivation because they don't have clear goals or haven't found interests that match their field of study. A curriculum that is too rigid or a lack of introduction to various career options can also be a contributing factor. Therefore, it is important to help students identify their goals and interests so that they can have stronger motivation to achieve achievements, b. Lack of connectedness between the subject matter and the real world: If students do not see the relevance of what they are learning in class to their real life or future career, they may lose motivation to study. It is important for educators to create clear connections between subject matter and the real world through practical examples, case studies, and direct experience. c. Lack of challenge or uninteresting curriculum: If the curriculum or assignments provided are not challenging or interesting for students, they may feel bored and lose the desire to achieve. It is important to design a challenging and interesting curriculum as well as provide opportunities for students to participate in practical projects, research, or relevant extracurricular activities. d. Technology distraction and online game overuse: College students may get caught up in online game overuse, which can interfere with the time and energy they should be spending on learning and developing themselves. It is important to raise awareness about the importance of balanced use of technology and provide information about the benefits of developing academic and non-academic skills. Lack of social support and encouragement: Students often need support and encouragement from their environment, including peers, family, and educators. Lack of positive social support and encouragement can make them feel isolated or demotivated. It is important to create a supportive environment, encourage collaboration, and provide students with constructive feedback.

Based on the explanation and findings above, the researcher is interested in conducting research entitled *The Relationship between Formal Reasoning Ability and Achievement*

Motivation with Student Learning Achievement with the hope of becoming a new finding in research with a similar theme.

**2. METHOD**

The research method used by researchers is a quantitative research method using correlation. According to Jannah, (2019) Correlation research is a type of research used to explore the relationship between two or more variables. This study aims to determine whether there is a statistical relationship between these variables, and to what extent this relationship is correlated . As for this study, researchers used the help of SPSS version 16 in analyzing the data. The sample selection in this study used random sampling of 30 students. The independent variables in this study are Formal Reasoning (X1), achievement motivation (X2), the dependent variable is learning achievement (Y). Collecting data on formal reasoning, achievement motivation and student achievement using a questionnaire.

**3. RESULTS AND DISCUSSION**

Based on the results of statistical tests with the help of SPSS version 16, the results are as follows:

Reliability Table	
Reliability Statistics	
Cronbach's Alpha	N of Items
.667	30

Information

If the alpha value is > 0.7, this means sufficient reliability, while if alpha is > 0.80, this means that all items are reliable and all tests consistently have strong reliability, and if alpha is > 0.90, then the reliability is perfect. If the alpha is between 0.70 and 0.90, then the reliability is high. If alpha is 0.50–0.70, then the reliability is moderate. If alpha is 0.50, then reliability is low. If the alpha is low, based on the results of the reliability test above, it is known that the score is 0.66, which means that the item is stated to have a moderate reliability value.

Validity Test Table				
Item-Total Statistics				
	Scale Mean if Deleted	Scale Variance if Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
<b>VAR00001</b>	687,000	44,700	.393	.679
<b>VAR00002</b>	687,667	43,840	.361	.671
<b>VAR00003</b>	686,333	43,344	.366	.668
<b>VAR00004</b>	685,333	44,533	.446	.679
<b>VAR00005</b>	684,667	44,051	.373	.675
<b>VAR00006</b>	687,000	43,183	.388	.666

<b>VAR00007</b>	685,333	45,292	.460	.685
<b>VAR00008</b>	686,333	43,344	.446	.668
<b>VAR00009</b>	685,333	44,051	.373	.675
<b>VAR00010</b>	687,000	43,183	.388	.666
<b>VAR00011</b>	688,000	36,166	.613	.614
<b>VAR00012</b>	686,333	36,516	.624	.615
<b>VAR00013</b>	689,667	36,654	.577	.619
<b>VAR00014</b>	686,000	43,352	.426	.682
<b>VAR00015</b>	686,667	40,713	.377	.653
<b>VAR00016</b>	679,333	39,375	.435	.658
<b>VAR00017</b>	686,000	43,352	.426	.682
<b>VAR00018</b>	680,000	42,276	.457	.675
<b>VAR00019</b>	675,000	38,879	.395	.640
<b>VAR00020</b>	689,000	37,955	.476	.631
<b>VAR00021</b>	689,000	45,955	.378	.696
<b>VAR00022</b>	683,333	41,540	.367	.655
<b>VAR00023</b>	686,333	40,723	.447	.655
<b>VAR00024</b>	688,667	40,740	.408	.651
<b>VAR00025</b>	686,333	40,723	.447	.655
<b>VAR00026</b>	683,333	41,540	.467	.655
<b>VAR00027</b>	686,333	40,723	.447	.655
<b>VAR00028</b>	675,000	38,879	.395	.640
<b>VAR00029</b>	686,667	40,713	.477	.653
<b>VAR00030</b>	688,000	36,166	.613	.614

Information

*Corrected Item-Total Correlation* score then all items are declared valid and can be used.

Correlation Test Table

Correlations				
		Formal Reasoning	Achievement motivation	Learning achievement
Formal Reasoning	Pearson Correlation	1	-.408 *	.102
	Sig. (2-tailed)		.002	.002
	N	30	30	30
Achievement motivation	Pearson Correlation	-.408 *	1	.149
	Sig. (2-tailed)	.002		.001
	N	30	30	30
Learning achievement	Pearson Correlation	.102	.149	1
	Sig. (2-tailed)	.002	.002	
	N	30	30	30

\*. Correlation is significant at the 0.05 level (2-tailed).

Information

Based on the significance value of Sig. (2-tailed) from the output table above, there is a known Sig. (2-tailed) 0.02 between formal reasoning and learning achievement, so that  $0.02 < 0.05$  is smaller than the r table, which means there is a correlation between formal reasoning and learning achievement. As for learning motivation and learning achievement, the sig. (2-tailed), namely  $0.02 < 0.05$ , means there is a correlation between learning motivation and learning achievement.

Based on the results of the analysis above, it can be explained that formal reasoning and achievement motivation are two factors that have been extensively studied in the context of education and learning achievement. The results of the analysis obtained show that these two factors have a strong relationship with learning achievement. Based on the understanding that has been explained previously, formal reasoning is an individual's ability to think logically, critically, and systematically. This involves the ability to understand and apply logical rules and solve complex problems. Formal reasoning develops with an individual's cognitive growth, especially during adolescence and early adulthood. Students with good formal reasoning skills tend to have a tendency to seek deeper understanding, explore more complex arguments, and question the information provided. They are also able to understand abstract concepts and think analytically.

Meanwhile, achievement motivation is an individual's internal drive to achieve high-quality achievements in the academic field. This involves a strong desire to achieve goals, challenge yourself, and continually improve performance. Individuals with high achievement motivation tend to have a strong task orientation, meaning they focus on self-improvement and material mastery, not just on the end result or comparison with others. They also have high self-confidence and take responsibility for their successes and failures.

The relationship between formal reasoning and motivation for academic achievement can be explained through several mechanisms. First, individuals with good formal reasoning are able to adopt a more analytical and systematic approach to learning. They tend to have better problem-solving skills, are able to identify complex patterns and relationships in subject matter, and integrate information more effectively. This enables them to better understand and remember information, as well as apply their knowledge in different contexts. Second, individuals with high achievement motivation have a strong orientation towards achieving academic success.

They may set ambitious goals, work hard to achieve them, and strive consistently to improve the quality of their performance. This motivation encourages them to face challenges with a positive attitude, persevere in the face of difficulties, and take initiative in the learning process. As a result, they achieve higher achievements in terms of knowledge, skills, and understanding (Nawi, 2012).

In addition, formal reasoning and achievement motivation influence and enhance each other. Individuals with good formal reasoning tend to have the ability to better plan their actions, motivate themselves effectively, and maintain persistence in the face of obstacles. On the other hand, individuals with high achievement motivation tend to seek challenges that require complex formal reasoning, and they develop their formal reasoning abilities through experience and constant effort.

The combination of formal reasoning and high achievement motivation in individuals significantly affects their academic achievement. Such individuals tend to achieve higher scores in exams, assignments, and other academic assessments and are also able to generate deeper understanding, think critically, and integrate knowledge in real-life situations. This high learning achievement in turn prepares students for success in education, careers, and life in general.

The results of this study are in accordance with the results of research (Rambega, 2016), which results in students' formal reasoning abilities in the physics learning process having a significant relationship with the motivation to learn physics in Class VIII students of SMPN 19 Bulukumba, Bulukumba district. For this reason, the results of this study reinforce the results of previous research with the theme of formal reasoning and achievement motivation in relation to academic or learning achievement, and the findings of this study are consistent with the findings of Rambega in 2016. There is a significant relationship between students' formal reasoning abilities in learning and learning motivation. So that emphasizes the importance of developing these two factors in an effort to improve academic achievement. By strengthening formal reasoning abilities and increasing learning motivation, individuals will have a stronger foundation for achieving high achievements.

#### **4. CONCLUSION**

Based on the results of the analysis and discussion above, formal reasoning and achievement motivation have a strong relationship with student achievement, with each sig. (2-tailed) 0.02 between formal reasoning and learning achievement, so that  $0.02 < 0.05$  is smaller than the  $r$  table, which means there is a correlation between formal reasoning and learning achievement. As for learning motivation and learning achievement, the sig. (2-tailed), namely  $0.02 < 0.05$ , means there is a correlation between learning motivation and learning achievement. From these results, formal reasoning allows individuals to think logically and systematically, while achievement motivation encourages academic success. The two mutually reinforce and enhance each other, creating a productive learning environment and enhancing overall individual achievement. Therefore, it is important for educators and parents to encourage the development of formal reasoning and achievement motivation in an effort to improve academic and non-academic learning achievement.



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