The Influence of Extracurricular Activities, Peer Tutoring, and Intensive Study Sessions on National Science Competition Achievement

Achmad Zaky Maulana [1], Osly Usman [2]

[1]Department of Digital Business, Universitas Negeri Jakarta, Indonesia

[2]Department of Digital Business, Universitas Negeri Jakarta, Indonesia

Abstract

The National Science Competition is a government program designed to facilitate academic competition among students at equivalent educational levels. This study investigates how extracurricular activities, peer tutoring, and intensive study sessions with teachers affect students' preparation for this competition. Using a qualitative approach, data from 100 students out of 965 enrolled at SMA N 99 Jakarta were analyzed with Structural Equation Modeling Partial Least Squares (SEM-PLS). The results reveal a positive and significant influence of extracurricular activities on intensive study sessions (p-value = 0.001) and of peer tutoring on intensive study sessions (p-value = 0.001). Intensive study sessions directly and significantly impact competition performance (p-value = 0.013). Extracurricular activities (p-value = 0.04) and peer tutoring (p-value = 0.044) also show significant direct effects on competition achievement. Additionally, peer tutoring has an indirect positive effect on competition performance through intensive study sessions (p-value = 0.031), while extracurricular activities do not have a significant indirect impact (p-value = 0.057). These findings suggest that extracurricular activities, peer tutoring, and intensive study sessions significantly contribute to students' success in national science competitions. However, extracurricular activities do not significantly affect performance through intensive study sessions. Schools are encouraged to enhance the quality of peer tutoring and intensive study sessions to better prepare students for the competition.

Keyword: competition; performance; peer tutoring; intensive study; extracurricular

1. Introduction

The National Science Competition (Kompetisi Sains Nasional, KSN) is a government-organized program that provides a platform for students to develop their academic potential in science. Through this competition, students are trained to think critically, analytically, and to solve complex problems, as the questions are designed to be at a Higher Order Thinking Skill (HOTS) level. However, achieving success in this competition requires effective learning methods and practice. Support from schools is also essential, allowing students to study the material thoroughly and comfortably.

There are many ways to help students succeed in this competition. Extracurricular activities, peer tutoring, and intensive study sessions are methods that can enhance students' skills in preparation for the National Science Competition (KSN) (Pranata, O. D., 2021). Extracurricular activities provide a space where students can develop creativity, engage socially, and build expertise in areas of interest (Rais, M. F., & Syafruddin, S., 2020). Such activities offer students opportunities to participate in competitions outside of school. Additionally, peer tutoring is a method that fosters critical thinking. Peer tutoring is a form of collaborative learning in which the tutor is a fellow student or peer. This approach helps students practice communication and critical thinking through discussions (Ramadhan, R., & Sabri, S., 2019).

Another form of support provided by schools is intensive study sessions. These are additional hours arranged by schools for students to delve deeper into the material (Fahrezi, I., & Taufiq, M., 2020). Intensive study sessions are often used as preparation for school exams or competitions, allowing students to gain a more comprehensive understanding of the subject matter.

2. Literature Review

2.1 Extracurricular

Extracurricular activities are a series of additional programs designed to enrich students' learning. These activities take place outside of regular class hours or formal class sessions (Kartika, 2023). Through these activities, students are expected to keep up with their peers in terms of understanding and skill development. Thus, extracurricular activities can be defined as supplementary programs conducted outside of the main academic schedule. They aim to enrich and expand students’ knowledge and skills, while also providing a means for them to express their talents and interests in activities that align with their individual potential (Wurdianto, 2020).

2.2 Peer Tutor

Peer tutoring is a cooperative learning method in which some students act as instructors (typically those with higher proficiency), while others are learners. These tutors can be of the same age or slightly older, with the goal of helping classmates better understand the material. Through this method, students are expected to improve their listening skills, concentration, and deepen their understanding of lessons, as explanations are provided in a more relatable

language (Melandri, 2024). For the tutors, this activity serves as an opportunity to expand their knowledge, increase learning motivation, and develop a sense of responsibility and confidence (Astuti et al., 2022).

2.3 Intensive Study

Intensive study sessions can involve training students in critical thinking and evaluating their learning methods. This strategy not only enhances students' understanding of the material but also encourages them to be more active in the learning process. By applying critical thinking, students are encouraged to question, analyze, and evaluate the information they receive, allowing them to develop strong analytical skills (Fahrezi et al., 2020). Additionally, this enables students to delve deeper into the subject matter and gain broader insights and knowledge about the lessons taught. Through assignments, students are also encouraged to develop courage, independence, responsibility, and initiative (Saraswati et al., 2023).

2.4 Achivement

Academic achievement in school reflects a student's ability to master and understand the material presented by the teacher. Various factors influence the level of student achievement, both internal and external. Internal factors include aspects from within the student, such as discipline in studying, physical condition, and psychological state. Meanwhile, external factors involve aspects outside the student, such as the environment, family, and educational instruments (e.g., curriculum, facilities, and learning resources) (Septiya Rini et al., 2020). During the teaching and learning process, students undergo various changes, transforming from initially not knowing to understanding and gaining new knowledge. Therefore, academic achievement can be defined as the outcome of a process of change and behavioral development within the student (Ningrum & Rahmawati, 2021).

3. Material and Method

3.1 Design Study

This research focuses on the influence of extracurricular variables, peer tutoring and material deepening to achieve achievement in national science competitions. The research uses qualitative methods because each variable does not have a specific measure and requires a direct approach or questionnaire. Questionnaire data totaling 100 people were collected from October to November 2024.

3.2 Operational Variable

In order for a concept to be researched empirically, the concept needs to be operationalized by turning it into a variable that has value. The following is an explanation of the operational definitions of these research variables:

1) Extracurricular activities are activities that can develop students' hobbies, interests and talents to prepare students for future competitions or abilities.

Variable	Indicator	Statement

Extracurricular	Hobby	1. Hobbies have become a means for me to express creativity and unwind after long activities. 2. Hobbies are activities that I do to fill my free time
	Interest	1. I have a great interest in a field, so I often take part in training related to that field. 2. Since childhood, I have shown a strong interest in a field, always interested in studying that field until now.
	Talent	1. My natural talent was visible from an early age, which made me want to continue to hone my talent. 2. Talent influences my ability to receive material at school so that I can understand the material more easily.
	Activity	1.Physical activity such as running every morning helps me maintain his health and increases energy throughout the day. 2.I do useful activities every day to improve my body fitness.
	Perseverance	1. I am diligent in studying material to prepare for exams or

		competitions 2. Perseverance is the most important factor for me to achieve achievement

2) Peer Tutoring is a learning activity together with peers. Peer tutors are able to improve communication, social relationships, motivation, teaching ability and responsibility.

Variable	Indicator	Statement
Peer Tutoring	Communication	1. Communication is very important to help strengthen relationships with peers. 2. I always try to practice communication even with new friends I don't know yet.
	Social relations	1. I always strengthen social relationships with my friends by studying together. 2. Social relationships can deepen communication and mutual understanding.
	Motivation	1. Motivation makes me want to achieve achievements with my peers. 2.I always increase my friends' motivation when participating in the same competition.
	Teaching ability	1. Teaching ability is very important when studying together.

		2. I always improve my teaching skills so that when studying with friends I can understand the material I present.
	Responsibility	1. I feel responsible when studying together so that the material presented is fully understood by my peers. 2. Responsibility is also an important value for achieving academic achievement

3) Intensive Study is a combination of strengthening analytical skills, critical thinking, feedback, self-reflection and evaluation of learning that has been carried out in class.

Variable	Indicator	Statement
Intensive Study	Analytical	1. I always practice my analytical skills when discussing in class. 2.Analyzing case studies and studying them is an effective way to prepare for competitions.
	Critical thinking	1. Critical thinking is very necessary to prepare for academic competitions 2. I always practice critical thinking by answering HOTS questions because it affects my abilities.
	Feedback	1.In discussions it is very important to provide feedback.

		2. Giving feedback is very important to open your horizons and accept other people's opinions
	Self reflection	1. After discussing and studying new material, it is very important to do self-reflection 2. Self-reflection is carried out to understand my level of self-understanding.
	Learning evaluation	1. Learning evaluation is important to deepen the material when preparing for competitions. 2. I always take the time to evaluate the material that I have studied and will deepen it.

4) Achievement is an achievement that a person gets after what he has worked for. Achievements are obtained from various kinds of training such as student creativity, non-academic skills, and consistency. Motivation and self-reflection also play an important role in supporting achievement.

Variable	Indicator	Statement
National Science Competition Achievements	Student creativity	1. I always train my creativity in art lessons 2. Creativity is very important for me to be able to train my imagination and put together better structures.
	Non-academic skills	1. I always train non-academic skills so that they are balanced with

		academic abilities. 2. I can achieve non-academic achievements by studying and practicing skills outside of academics.
	Consistency	1. I am always consistent in studying the material that will be prepared for the competition. 2. Consistency is very important so that the material we study continues to develop.
	Motivation	1.I am very motivated to achieve many academic achievements 2. My motivation can come from other people who support me.
	Self reflection	1. I always do self-reflection after receiving training from the teacher. 2. Self-reflection is very important to help me understand my shortcomings.

3.3 Data Analysis

After collecting data from respondents, the data was then processed using the SEM method with the Smartpls 4.0 application. This method allows for examining complex relationships between variables, assessing both direct and indirect effects, and exploring the role of extracurricular activities and peer tutoring in influencing the deepening of material and also the achievement of national science competitions

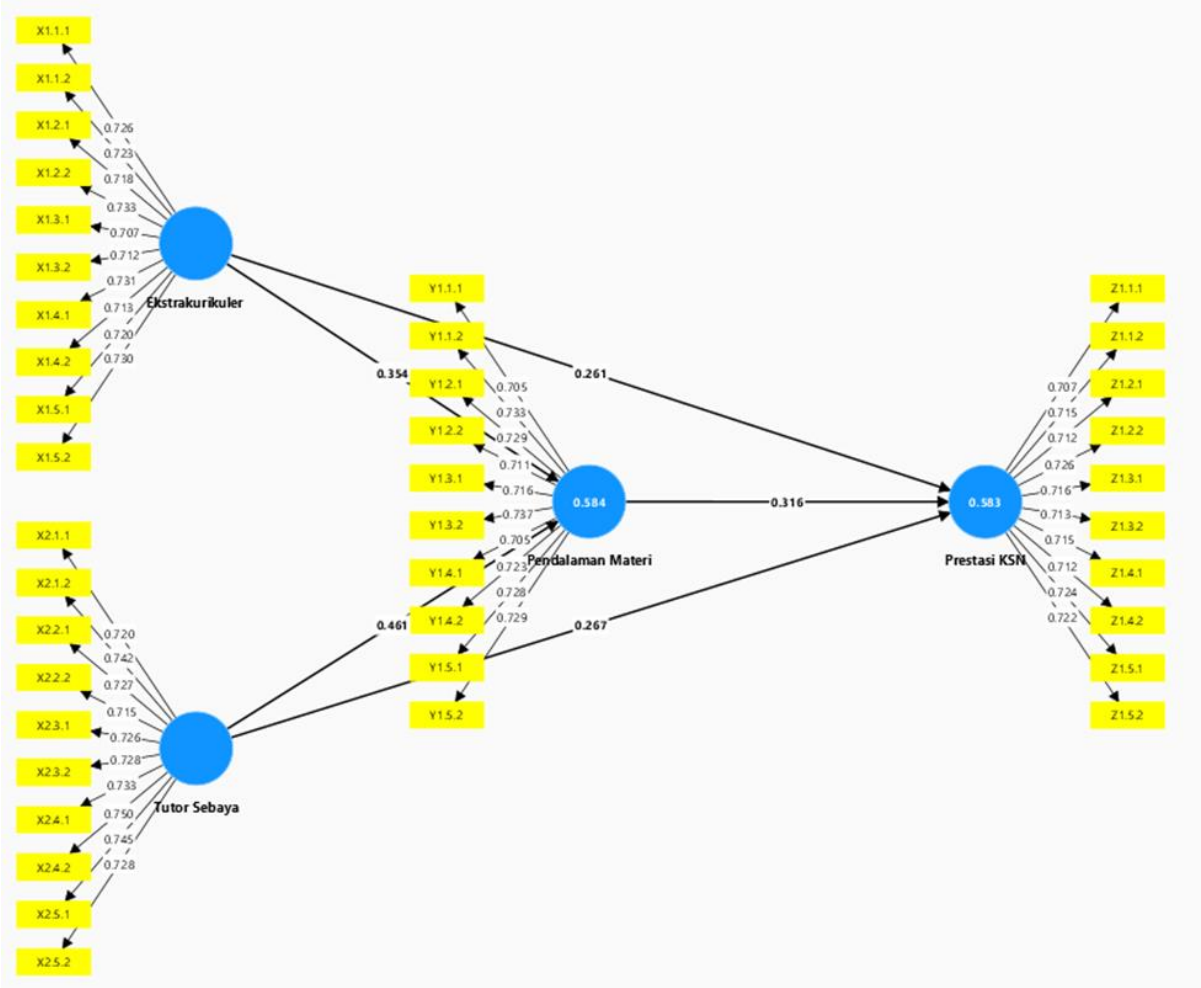


Figure 1. Research Model

4. Result

4.1 Respondent Descriptive

Respondent description is the process of describing respondents based on gender, age, education and number of responses for each variable. In the research, there were 100 respondents obtained from the results of distributing questionnaires.

Information	Amount
Questionnaires distributed	100
Returned questionnaire	100

Questionnaire is damaged/incomplete	-
Number of Respondents	100

In the calculations in the following table, a total of 100 research samples were determined. For this research, 100 questionnaires were distributed. From the results of distributing questionnaires, it shows that 100 questionnaires were returned without any damaged questionnaires.

To calculate the scale range and assign scores to the number of responses from respondents, it can be described as follows:

$$RS = \frac{m - n}{b}$$

Information:

RS = Scale Range

m = Number of highest scores on the scale

n = Number of lowest scores on the scale

b = Number of categories created

Calculation:

$$RS = \frac{5 - 1}{5} = 0.8$$

Based on the scale category results, the scale range can be determined as follows:

1.00 – 1.80 = Very Low

1.81 - 2.60 = Low

2.61 - 3.40 = Medium

3.41 - 4.20 = High

4.21 - 5.00 = Very high

The score given for the statement of each variable is:

1) STS or “Strongly Disagree” is given a score = 1

2) TS or "Disagree" is given a score = 2

3) N or “Neutral” is given a score = 3

4) S or “Agree” is given a score = 4

5) SS or “Strongly Agree” is given a score = 5

4.1.1 Respondent's Gender

Based on the table of number of respondents in 4.1, it can be seen that 54 respondents were men and 46 respondents were women. This shows that the majority of respondents are men. Based on research, the table description of the respondent's gender is as follows:

Gender	Amount	Percentage
Male	54	54
Female	46	46
Total	100	100

4.1.2 Respondent's Age

In this study, the ages of respondents were grouped into 3 parts. Based on the age grouping, it was found that the age range 17 – 19 dominated the respondents. Meanwhile, the minimum age range is 20 – 22. Based on the research results, the description of the respondents' ages is as follows:

Age	Amount	Percentage
14-16	13	13
17-19	78	78
20-22	9	9
Total	100	100

4.1.3 Respondent's Education

The respondents who had the most extracurricular activities or peer tutoring were at the high school level. Meanwhile, at least they are at junior high school level. In accordance with these data, the description of the respondents' education is as follows:

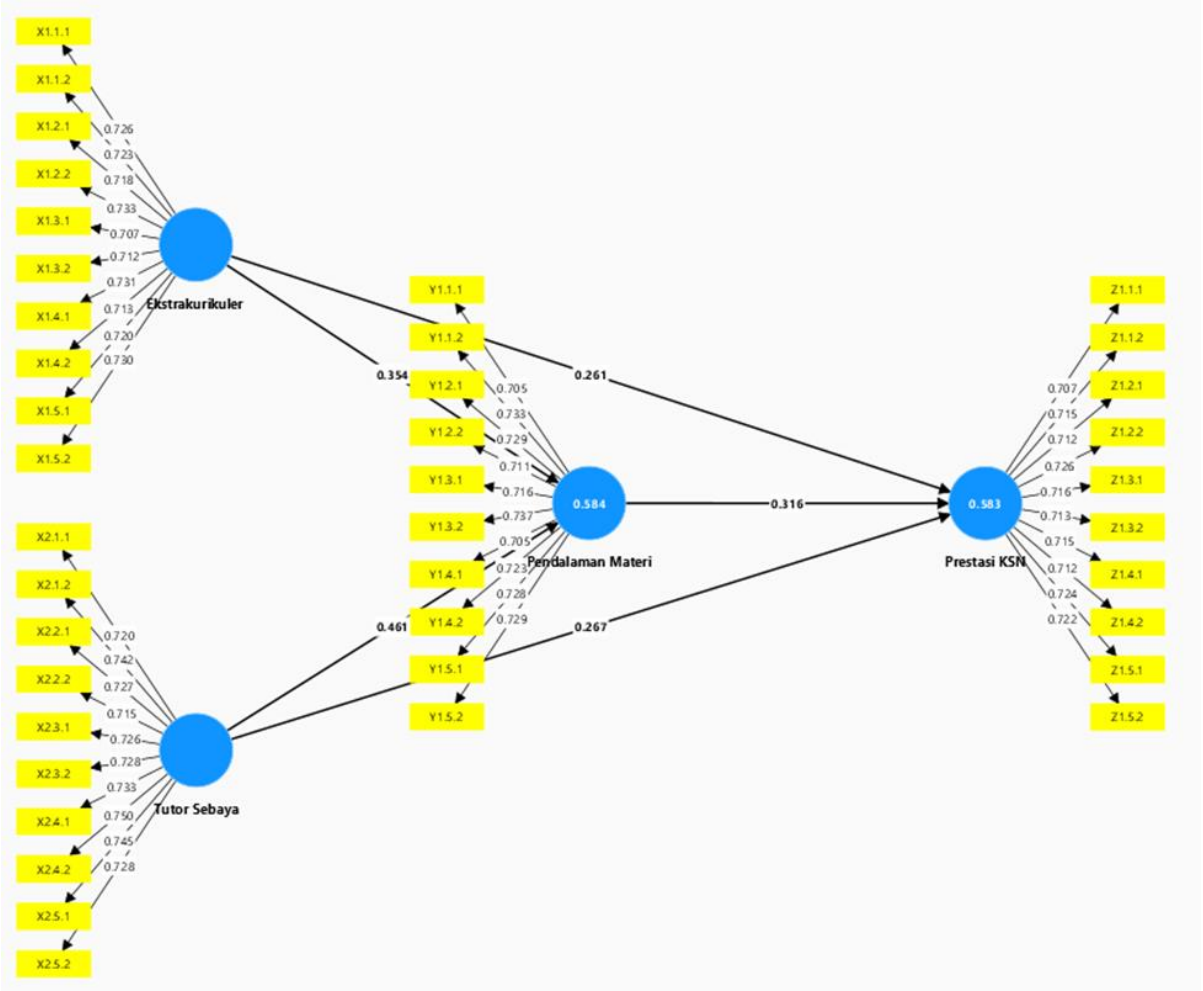
Education	Amount	Percentage

Elementary School/Equivalent	-	-
Middle School/Equivalent	6	6
High School/Equivalent	94	94
Total	100	100

4.2 Validity and Reliability

4.2.1 Measurement Model Test

1. **Convergent Validity**



Based on the picture above, it can be seen that the outer loading value of all variable indicators is greater than 0.7 so it is said to be valid.

2. Discriminant Validity

Judging from the AVE value and the AVE root value

1) AVE value

	Average variance extracted (AVE)
Ekstrakurikuler	0.520
Pendalaman Materi	0.521
Prestasi KSN	0.513
Tutor Sebaya	0.535

Average Variance Extracted (AVE) > 0.5

Based on the results above, it can be seen that the AVE value for each variable is greater than 0.5 so that discriminant validity is met.

2) AVE root value (Fornell Larcker Criterion)

Table 1. Fornell-Larcker Criterion

	Ekstrakurikuler	**Pendalaman Materi**	**Prestasi KSN**	**Tutor Sebaya**
Ekstrakurikuler	**0,721**			
Pendalaman Materi	0,702	**0,722**		
Prestasi KSN	0,684	0,693	**0,716**	
Tutor Sebaya	0,755	0,728	0,694	**0,732**

The AVE root value of each variable is greater than the AVE root of its correlation with other variables so that discriminant validity is fulfilled.

4.2.2 Model Collinearity Test

The value used to analyze it is by looking at the Variance Inflation Factor (VIF).

1) VIF value > 5.00: There is a collinearity problem.
2) VIF value < 5.00: No collinearity problems.

	VIF		VIF				
X1.1.1	1.920	X2.1.1	1.871	Y1.1.1	1.728	Z1.1.1	1.959
X1.1.2	1.792	X2.1.2	1.931	Y1.1.2	1.861	Z1.1.2	2.006
X1.2.1	1.878	X2.2.1	1.836	Y1.2.1	1.964	Z1.2.1	1.846
X1.2.2	1.891	X2.2.2	1.808	Y1.2.2	1.899	Z1.2.2	2.003
X1.3.1	1.788	X2.3.1	1.964	Y1.3.1	1.846	Z1.3.1	1.779
X1.3.2	1.779	X2.3.2	2.000	Y1.3.2	1.910	Z1.3.2	1.954
X1.4.1	1.861	X2.4.1	2.031	Y1.4.1	1.898	Z1.4.1	2.023
X1.4.2	1.880	X2.4.2	1.866	Y1.4.2	1.908	Z1.4.2	2.544
X1.5.1	1.972	X2.5.1	2.053	Y1.5.1	1.782	Z1.5.1	2.372
X1.5.2	1.822	X2.5.2	1.917	Y1.5.2	1.808	Z1.5.2	2.073

It can be seen that the VIF value of all variable indicators is <5, so there is no collinearity between each variable indicator being measured.

4.2.3 Reliability

1. Cronbach Alpha: > 0.7
2. Rho_A: > 0.7
3. Composite Reliability: > 0.6

Construct reliability and validity - Overview

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)
Ekstrakurikuler	0.898	0.898	0.916
Pendalaman Materi	0.898	0.899	0.916
Prestasi KSN	0.895	0.896	0.913
Tutor Sebaya	0.903	0.904	0.920

Based on the data above, it can be seen that the Cronbach Alpha, rho_A, and Composite reliability values for each variable have met the requirements to be said to be reliable.

4.2.4 Structural Model/Inner Model Test

1. **R-Square**

R-Square is a measure of the proportion of variation in the value of a variable that is influenced (endogenous) that can be explained by the variable that influences it (exogenous).

The criteria:

1) If the R2 value = 0.75, it means it is substantial (large/strong)
2) If the R2 value = 0.50 it means moderate (medium)
3) If the R2 value = 0.25, it means it is weak (small)

Table 2. R Square

	R Square	R Square Adjusted	Criteria
Pendalaman Materi	0,584	0,575	Moderate
Prestasi KSN	0,583	0,570	Moderate

R-Square Model path I = 0.584. This means that the ability of variables X1 and X2 to explain Y is 58.4% (Medium).

R-Square Model path II = 0.583. This means that the ability of variables X1 and X2 through Y to explain Z is 58.3% (Medium).

4.2.5 Hypothesis Testing

1. Direct Effect (Path Coefficient): Direct effect analysis is useful for testing the hypothesis of the direct influence of a variable that influences (exogenous) on the variable that is influenced (endogenous).

   The criteria:

   1) Path coefficient:

      If the value of the path coefficient (Path Coefficient) is positive, then the influence of a variable on it is in the same direction, if the value of an exogenous variable increases/rises, then the value of the endogenous variable also increases/rises.

      If the value of the path coefficient (Path Coefficient) is negative, then the influence of a variable on it is in the opposite direction, if the value of an exogenous variable increases/rises, then the value of the endogenous variable decreases.

   2) Probability/significance value (P-Value):
      - If the P – Value < 0.05, then it is significant
      - If the P – Value > 0.05, then it is not significant

Path Coefficient

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Ekstrakurikuler -> Pendalaman Materi	0.354	0.354	0.107	3.290	0.001
Ekstrakurikuler -> Prestasi KSN	0.261	0.266	0.127	2.056	0.040
Pendalaman Materi -> Prestasi KSN	0.316	0.310	0.127	2.487	0.013
Tutor Sebaya -> Pendalaman Materi	0.461	0.462	0.107	4.320	0.000
Tutor Sebaya -> Prestasi KSN	0.267	0.268	0.132	2.015	0.044

1) Based on the table above, it can be concluded as follows:
2) X1 –> Y = 0.354 (Positive), P-Value 0.001 < 0.05 (significant) (H1)
3) X1–> Z = 0.261 (Positive), P-Value 0.040 < 0.05 (significant) (H4)

4) Y –> Z = 0.316 (Positive), P-Value 0.013 < 0.05 (significant) (H3)
5) X2 –> Y = 0.461 (Positive), P-Value 0.001 < 0.05 (significant) (H2)
6) X2 –> Z = 0.267 (Positive), P-Value 0.044 > 0.05 (significant) (H5)

2. Indirect Effect: Indirect effect analysis is useful for testing the hypothesis of the indirect influence of an influencing variable (exogenous) on the influenced variable (endogenous) which is mediated/mediated by an intervening variable (mediator variable).
   The criteria:
   1) If the P - Value < 0.05, then it is significant (the influence is indirect), meaning that the intervening variable "plays a role" in mediating/mediating the relationship between an exogenous variable and an endogenous variable.
   2) If the P - Value > 0.05, then it is not significant (the influence is direct), meaning that the intervening variable "does not play a role" in mediating/mediating the relationship between an exogenous variable and an endogenous variable.

   Specific Indirect Effect

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Ekstrakurikuler -> Pendalaman Materi -> Prestasi KSN	0.112	0.110	0.059	1.904	0.057
Tutor Sebaya -> Pendalaman Materi -> Prestasi KSN	0.146	0.142	0.067	2.159	0.031

   Conclusion:

1) 1) The indirect effect of X1 –> Y –> Z is 0.112 (positive), with a P-Value of 0.057 > 0.05 (not significant)

   This means that the material deepening variable "does not play a role" in mediating the influence of extracurricular activities on achievement.

2) The indirect effect of X2 –> Y –> Z is 0.146 (positive), with a P-Value of 0.031 < 0.05 (significant)

   This means that the material deepening variable "plays a role" in mediating the influence of peer tutoring on achievement.

4.3 Hypothesis

1. Hypothesis 1 (H1): Extracurricular activities have a significant and positive influence on deepening the material
2. Hypothesis 2 (H2): Peer tutors have a significant and positive influence on material deepening

3. Hypothesis 3 (H3): Deepening the material can increase students' understanding in preparation for the National Science Competition (KSN) has a positive and significant relationship
4. Hypothesis 4 (H4): Extracurricular activities have a significant and positive effect on students' preparation for facing the National Science Competition (KSN).
5. Hypothesis 5 (H5): Peer tutoring activities have a significant and positive influence on students' preparation for facing the National Science Competition (KSN).
6. Hypothesis 6 (H0): Extracurricular activities have an indirect effect on students' preparation for the National Science Competition (KSN) through material deepening, which is positively related but not significant
7. Hypothesis 7 (H7): Peer tutoring activities have an indirect effect on students' preparation for the National Science Competition (KSN) through deepening the material. positively and significantly related

5. Discussion

Based on previous research, it is stated that each variable such as extracurriculars, peer tutoring and material deepening has a big influence on achievement. However, in this research, extracurricular activities indirectly affect achievement through deepening the material, which is not very significant because extracurriculars have different types of learning when it comes to deepening the material, so it is not so significant. However, in general all variables have a positive effect, which means that changes that occur in each variable will affect the final result as well.

6. Conclusion, Implication, and Recommendation

1. Conclusion

Based on the results of data analysis and discussion, researchers concluded that from research regarding the Influence of Extracurriculars, Peer Tutors and Material Deepening on National Science Competition Achievement, the following results were obtained:

1. The results show that the dependent variable KSN achievement can be directly and significantly influenced by independent variables. Meanwhile, peer tutoring indirectly has a significant effect on achievement through deepening the material, extracurricular activities do not have a significant effect on achievement through deepening the material.
2. The extracurricular variable regarding material deepening and achievement has a positive value, meaning that if extracurricular activities can be increased higher, then material deepening and achievement will also increase.
3. The peer tutoring variable for material deepening and achievement has a positive value, meaning that if peer tutoring is able to be increased higher, then material deepening and achievement will also increase.

4. The material deepening variable on achievement has a positive value, meaning that if material deepening can be increased higher, then achievement will also increase.
5. The variable extracurricular and peer tutoring on achievement through deepening the material has a positive value, meaning that if extracurricular and peer tutoring can be increased higher, then deepening the material and achievement will also increase.

2. Recommendation

The expected benefits from the results of this research are as follows:

1. For readers, it is hoped that the results of this research will help to increase knowledge regarding the influence of factors on achievement and their influence. Especially to find out the achievements of national science competitions and the variables that influence them. Apart from that, the results of this research can also help readers who want to conduct research by modifying independent variables, either adding variables or time series data from the research. So that the research can be more objective and varied in conducting research.
2. For education or schools, the results of this research can be a reference to help students achieve high achievements. The influence obtained can be a benchmark for how effective the activities held by the school are to equip students to take part in competitions and other competitions. So the school can determine the most effective way to help prepare students' material.
3. Apart from that, the government or schools can pay more attention to students who are preparing to take part in competitions. Students need an effective and good platform so that the knowledge they gain can help them achieve achievements. If students achieve achievements, education in Indonesia will be more secure in the future because students have good competencies.

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