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The Correlation between the Utilization of M3 Board Learning Media and Students' Learning Outcomes

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Abstract

This study aims to determine the correlation between the utilization of M3 board learning media and students' learning outcomes on the topic of measures of central tendency. This research employed a quantitative approach with a correlational design using the Pearson Product Moment method. The population consisted of two eighth-grade classes with a total of 34 students at SMP Swasta 17 Agustus Webalu, while the sample was class VIII A consisting of 15 students. Data were collected through a questionnaire to measure the utilization of M3 board learning media and a test to assess students' learning outcomes. The validity test results showed that all 12 questionnaire items were valid, with $r_{count} > r_{table}$, and the reliability test yielded a Cronbach's Alpha value of 0.776 (> 0.6), indicating that the instrument was reliable. The normality test indicated a significance value of 0.248 (> 0.05), confirming that the data were normally distributed. Pearson correlation analysis revealed a correlation coefficient of 0.2646, categorized as low, and 0.8591, categorized as very strong, indicating a positive correlation between the utilization of M3 board learning media and students' learning outcomes.

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Introduction

Learning is a process that involves various interrelated components, including learning objectives, learning materials, instructional strategies and methods, learning media, classroom management, learning evaluation, and learning outcomes. In schools, the learning process cannot be separated from five essential communication elements, namely teachers, students, instructional materials, learning media, and learning objectives. These components form an integrated system in the learning process and cannot be separated from one another. Since learning is inseparable from the communication process, teachers are required to create a pleasant and conducive learning atmosphere through effective communication. In this context, learning media occupy a crucial position within the instructional system. Without learning media, the learning process cannot be carried out optimally. Therefore, the use of instructional technology needs to receive serious attention from teachers, as it has implications for the utilization of varied learning media, which can create a contributive learning environment, facilitate the effective delivery of learning materials, and support the achievement of learning objectives.

Learning media are defined as instructional aids used to convey information or messages in the learning process in order to stimulate students' thoughts, feelings, attention, and learning interest,

thereby enabling the achievement of learning objectives (Boadu & Boateng, 2024; Simarmata et al., 2025; Uskono et al., 2023). The utilization of learning media in instructional activities aims to ensure that learning indicators are achieved. The success of the learning process can be observed through positive changes in students' behavior in the cognitive, affective, and psychomotor domains. Teachers are also expected to provide students with opportunities to fully actualize themselves in shaping the desired learning behaviors.

The M3 board is a learning medium designed to facilitate the teaching of statistical topics, particularly measures of central tendency mean, median, and mode in the form of single data sets ((Frossard & Renaud, 2021; Hajjar, 2018) 2022). The M3 board learning media serve as instructional tools used in learning activities to convey messages that can stimulate students' thinking, emotions, and interest, as well as promote smooth interaction between teachers and students.

Measures of central tendency are fundamental concepts in statistics and mathematics that help explain how data are distributed. Based on this condition, instructional approaches that train students to solve problems through the development of cooperative principles among students are necessary to enhance their understanding of measures of central tendency, namely mean, median, and mode. Measures of central tendency are basic materials within the topic of statistics taught in Grade VIII of junior high school. Learning statistics indirectly serves as a stepping stone that guides mathematics learning to a higher level (Chrisinta et al., 2023; Wang & Cai, 2024); therefore, it is important for students to study statistics.

Based on observations and interviews conducted by the researcher with a mathematics teacher at SMP Swasta 17 Agustus Webalu, it was found that the mathematical understanding of Grade VIII students was relatively low. Students experienced difficulties in learning mathematics due to monotonous classroom practices, as teachers predominantly applied conventional teaching methods and limited discussions. In this context, instruction relied mainly on textbooks as learning resources, and learning media that could support student engagement and learning interest were rarely used. As a result, students tended to feel bored and less active during mathematics lessons, which led to difficulties in understanding mathematical concepts. Evidence of students' low conceptual understanding of mathematics is also supported by previous research conducted by Satriawan, which reported that students faced difficulties in solving statistical problems, particularly in understanding the concepts of mean, median, and mode, as well as in applying the corresponding formulas to data presented in tabular form. These difficulties may be caused by several factors, such as teachers' limited mastery of the concepts, low student interest in learning mathematics, and the lack of variation in learning media used in mathematics instruction.

Methods

This study employed a quantitative approach with a correlational research design, specifically using the Pearson Product Moment correlation. The Product Moment correlation is a statistical technique used to determine the degree of relationship between two variables, namely the independent variable (X) and the dependent variable (Y) (Kennedy-Shaffer, 2024).

The research was conducted at SMP Swasta 17 Agustus Webalu during the 2024/2025 academic year. The population of the study consisted of two eighth-grade classes with a total of 34 students. The sample was selected representatively, considering that a sample is a subset of the population whose characteristics influence the accuracy of the research findings. Based on this consideration, class VIII A, consisting of 15 students, was chosen as the research sample.

Data collection techniques in this study included questionnaires, tests, and documentation. Questionnaires were used to collect data related to the utilization of the M3 board learning media and were administered in the form of written statements completed by the respondents. Tests were employed to measure students' learning outcomes on the topic of measures of central tendency and were administered after the learning process had been conducted. Documentation was used as supporting data in the form of records, photographs, and relevant research archives.

The data analysis technique applied in this study was descriptive analysis using a quantitative approach in the form of percentages. The use of percentages was intended to facilitate the measurement and interpretation of the research results. Descriptive statistics were employed to analyze the data by describing or summarizing the collected data without making generalizations to the population (Sugiyono, 2010). In addition, correlation analysis was used to determine the strength of the relationship between the research variables.

Result and Discussion

Result

Instrument Validity Test (X3)

The validity test was conducted to determine the appropriateness of the research instrument used in this study. The validity analysis was performed using SPSS version 26. Each item was considered valid if the value of $r_{calculated}$ was greater than r_{table} at a significance level of 0.05. The results of the validity test for the M3 board learning media utilization instrument are presented in Table 1.

Table 1. Results of Instrument Validity Test

Item	$r_{calculated}$	r_{table}	Description
1	0,879	0,515	Valid
2	0,892	0,514	Valid
3	0,867	0,514	Valid
4	0,665	0,514	Valid

5	0,687	0,514	Valid
6	0,854	0,514	Valid
7	0,901	0,514	Valid
8	0,766	0,514	Valid
9	0,684	0,514	Valid
10	0,801	0,514	Valid
11	0,853	0,514	Valid
12	0,731	0,514	Valid

All 12 questionnaire items showed values of $r_{calculated}$ exceeding r_{table}. Therefore, it can be concluded that all items in the instrument were valid and suitable for use in this study (Wahyuni, 2025).

Instrument Reliability Test (X3)

The reliability test was conducted to examine the consistency of the instrument in measuring the research variable. An instrument is considered reliable if the Cronbach's Alpha value is greater than or equal to 0.6. The results of the reliability test are presented in Table 2.

Table 2. Reliability Test Results

Case Processing Summary			
		N	%
Cases	Valid	15	100.0
	Excluded[a]	0	.0
	Total	15	100.0

a. Listwise deletion based on all

Table 3. Reliability Statistics

Cronbach's Alpha	N of Items
.776	13

The analysis indicated a Cronbach's Alpha value of 0.776, which exceeds the minimum threshold of 0.6. This result demonstrates that the M3 board learning media utilization instrument is reliable and has good internal consistency (Hajjar, 2018; Mertler et al., 2021).

Normality Test

The normality test was conducted to determine whether the research data followed a normal distribution, which is a prerequisite for parametric statistical analysis. The Kolmogorov–Smirnov test was employed, where data are considered normally distributed if the significance value is greater than

0.05 (Ghozali, 2006). The initial normality test showed a significance value of 0.000 (< 0.05), indicating that the data were not normally distributed. Therefore, data transformation was applied. After transformation, the normality test results showed a test statistic value of 0.248 with a significance value of 0.014 (> 0.05). This result indicates that the transformed data were normally distributed and suitable for further analysis.

Tabel 4. Normality Test

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		15
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	24.74673621
Most Extreme Differences	Absolute	.347
	Positive	.236
	Negative	-.347
Test Statistic		.347
Asymp. Sig. (2-tailed)		.000[c]

a. Test distribution is Normal

Tabel 5. Normality Test of Transformed Data

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		15
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	3.91906919
Most Extreme Differences	Absolute	.248
	Positive	.159
	Negative	-.248
Test Statistic		.248
Asymp. Sig. (2-tailed)		.014[c]

a. Test distribution is Normal

Correlation Analysis

Correlation analysis was conducted to determine the relationship between students' learning outcomes before the utilization of the M3 board learning media (X1), students' learning outcomes after the utilization of the M3 board learning media (X2), and the utilization of the M3 board learning media (X3). The Pearson Product Moment correlation method was applied.

Table 6. Correlation Analysis

Item	(X1)	(X2)	(X3)
1	46	20	56
2	76	80	37
3	87	93	60
4	78	86	28
5	86	93	57
6	80	83	51
7	85	93	49
8	46	26	32
9	75	73	54
10	84	90	50
11	85	90	60
12	84	90	52
13	57	40	55
14	85	90	60
15	75	80	29
Total	1129	1127	730

The correlation coefficient is calculated based on the data in the table below.

Table 7. Correlation Analysis between X_1 and X_3

NO	X_1	X_3	$X_1 . X_3$	X_1^2	X_3^2
1	46	56	2576	2116	3136
2	76	37	2812	5776	1369
3	87	60	5220	7569	3600
4	78	28	2184	6084	784
5	86	57	4902	7396	3249
6	80	51	4080	6400	2601
7	85	49	4165	7225	2401
8	46	32	1472	2116	1024
9	75	54	4050	5625	2916
10	84	50	4200	7056	2500
11	85	60	5100	7225	3600
12	84	52	4368	7056	2704
13	57	55	3135	3249	3025
14	85	60	5100	7225	3600
15	75	29	2175	5625	841
Total	1129	730	55539	87743	37350

$$r_{xy} = \frac{N.\sum XY - (\sum X).(\sum Y)}{\sqrt{\{N.\sum X^2 - (\sum X)^2\}.\{N.\sum Y^2 - (\sum Y)^2\}}}$$

$$= \frac{15(55539) - (1129)(730)}{\sqrt{(15.87743 - 1274641)(15.37350 - 532900)}}$$

$$= \frac{833085 - 824170}{\sqrt{(1316145 - 1274641)(560250 - 532900)}}$$

$$= \frac{8915}{\sqrt{(41504)(27350)}}$$

$$= \frac{8915}{\sqrt{1135134400}}$$

$= \frac{8915}{336917556681}$

$r_{xy} = 0{,}2646$

The results revealed that the correlation coefficient between X1 and X3 was $r_{xy} = 0.2646$, which falls into the low correlation category (0.20–0.39). This finding indicates a positive but weak relationship between students' learning outcomes prior to the use of the M3 board learning media and the utilization of the media.

Table 8. Correlation Analysis between X_2 and X_3

Item	X_2	X_3	$X_2 . X_3$	X_2^2	X_3^2
1	20	56	1120	400	3136
2	80	37	2960	6400	1369
3	93	60	5580	8649	3600
4	86	28	2408	7396	784
5	93	57	5301	8649	3249
6	83	51	4233	6889	2601
7	93	49	4557	8649	2401
8	26	32	832	676	1024
9	73	54	3942	5329	2916
10	90	50	4500	8100	2500
11	90	60	5400	8100	3600
12	90	52	4680	8100	2704
13	40	55	2200	1600	3025
14	90	60	5400	8100	3600
15	80	29	2320	6400	841
Total	1127	730	55433	93437	37350

$r_{xy} = \frac{N.\sum XY - (\sum X).(\sum Y)}{\sqrt{\{N.\sum X^2 - (\sum X)^2\}.\{N.\sum Y^2 - (\sum Y)^2\}}}$

$= \frac{15(55433) - (1127)(730)}{\sqrt{(15.93437 - 1270129)(15.532900 - 37350)}}$

$= \frac{831495 - 822710}{\sqrt{(1401555 - 1270129)(7993500 - 373550)}}$

$= \frac{8785}{\sqrt{(131429)(7956150)}}$

$= \frac{8785}{\sqrt{1045668838350}}$

$= \frac{8785}{102257950221}$

$r_{xy} = 0,\ 8591$

In contrast, the correlation between X2 and X3 yielded a correlation coefficient of $r_{xy} = 0.8591$, which falls into the very strong correlation category (0.80–1.00). This result indicates a very strong positive relationship between students' learning outcomes after the utilization of the M3 board learning media and the extent of media utilization.

Discussion

This study aimed to identify the correlation between the utilization of the M3 board learning media and students' learning outcomes on the topic of measures of central tendency among eighth-grade students at SMP Swasta 17 Agustus Webalu. Data were collected through questionnaires to measure the utilization of the M3 board learning media (X3) and tests to measure students' learning outcomes before (X1) and after (X2) the implementation of the learning media.

The results of the validity and reliability tests indicate that the research instrument met the required criteria, ensuring that the collected data were valid and reliable. Furthermore, the normality test results confirmed that the data satisfied the assumption of normal distribution, allowing the use of Pearson correlation analysis.

The correlation analysis results demonstrated that the relationship between students' learning outcomes before the use of the M3 board learning media and the utilization of the media was categorized as low. Conversely, the relationship between students' learning outcomes after the use of the M3 board learning media and the utilization of the media was categorized as very strong. These findings suggest that the use of the M3 board learning media contributes positively to the improvement of students' learning outcomes.

The use of instructional media in the form of manipulatives attracts students' attention, increases classroom engagement, and enhances students' motivation and enjoyment in learning. This finding is consistent with Shafira and Aimah (2018), who stated that learning media can improve the effectiveness of the learning process and have a positive impact on learning outcomes. Hamalik also emphasized that instructional media can stimulate students' interest, motivation, and learning activities, which subsequently influence learning outcomes.

Moreover, the use of the M3 board learning media enables abstract mathematical concepts to be represented concretely, allowing students to actively engage with the learning material rather than merely imagining the concepts (Septiyana, 2017). This result is also supported by previous research conducted by Novita Sari et al., which found that the use of the M3 board learning media improved students' understanding of mean, median, and mode.

Based on the results and discussion, it can be concluded that there is a significant positive correlation between the utilization of the M3 board learning media and the learning outcomes of eighth-grade students at SMP Swasta 17 Agustus Webalu on the topic of measures of central tendency.

Conclusion

This study demonstrates that the use of the M3 board learning media is positively associated with students' learning outcomes in the topic of measures of central tendency. The *Product Moment* correlation analysis reveals a low positive correlation for one utilization aspect ($r = 0.2646$)

and a very strong positive correlation for another aspect ($r = 0.8591$). These results indicate that increased and more effective utilization of the M3 board media tends to be accompanied by higher student achievement. Accordingly, the M3 board learning media can be considered an effective instructional support for enhancing students' understanding of mean, median, and mode in junior high school mathematics learning.

Recommendation

Based on the results of this study, mathematics teachers are encouraged to implement the M3 board learning media to enhance students' understanding of statistical concepts, as it demonstrates a positive correlation with learning outcomes. Future research should involve larger samples and adopt experimental designs to further investigate the effectiveness of this instructional media.

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