Manipulative-based Instruction, Academic Motivation, and Learning Engagement of Students in Mathematics

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ABSTRACT

This study investigated the relationship between students' perception of manipulative-based instruction, academic motivation, and learning engagement among Grade 7 students in Mathematics in a public high school in Negros Occidental during the School Year 2025–2026. A quantitative, non-experimental research design using a descriptive-correlational approach was employed. A total of 192 students were selected through simple random sampling using lottery method. Data were collected using a validated and reliable survey questionnaire. Academic motivation was measured in terms of intrinsic motivation, extrinsic motivation, and amotivation, while learning engagement included behavioral, emotional, and cognitive dimensions. Findings revealed that students demonstrated a very high level of perception of manipulative-based instruction, academic motivation, and learning engagement. Significant relationships were found between perception of manipulative-based instruction and both academic motivation and learning engagement. The study concludes that students' perceptions of manipulative-based instruction are positively associated with their academic motivation and learning engagement in Mathematics.

Keywords: Manipulative-Based Instruction, Academic Motivation, Learning Engagement, Mathematics Education, Grade 7 Students

INTRODUCTION

Mathematics remains one of the most challenging subjects for many students because of its abstract nature and the difficulty of relating mathematical concepts to real-life situations. Despite continuous efforts to improve mathematics education, many learners still struggle to understand complex mathematical concepts, resulting in low engagement and unsatisfactory academic outcomes. International assessment reports continue to highlight concerns regarding students' mathematics achievement, particularly in developing countries such as the Philippines. In response to these challenges, educators have increasingly explored instructional approaches that promote meaningful and active learning experiences.

One such approach is manipulative-based instruction, which has gained attention as an innovative and learner-centered strategy for teaching Mathematics. Manipulatives provide learners with concrete representations of abstract concepts, enabling them to explore, visualize, and construct mathematical ideas through hands-on experiences. Ponte et al. (2023) emphasized that manipulatives enhance conceptual understanding by allowing students to represent and visualize mathematical concepts more effectively. Similarly, Tjandra (2023) reported that manipulative-based activities improve students' problem-solving skills, participation, and interest in Mathematics. Furthermore, Ochugboju and Díez-Palomar (2025) found that both physical and virtual manipulatives contribute to deeper conceptual understanding and greater student engagement by creating interactive and meaningful learning experiences.

Another important factor influencing students' success in Mathematics is academic motivation. Academic motivation refers to the internal and external forces that encourage learners to participate in academic activities, persist despite challenges, and strive toward achieving educational goals. Students with higher levels of

motivation tend to exert greater effort, demonstrate resilience, and achieve better academic outcomes. Morgan (2022) found that engaging and interactive learning experiences enhance students' motivation and improve their performance in Mathematics. Likewise, Saadati and Celis (2023) reported that students with higher levels of motivation demonstrate stronger engagement in learning activities and more positive educational outcomes. In this regard, manipulative-based instruction may serve as an effective strategy for fostering both intrinsic motivation, such as interest and enjoyment, and extrinsic motivation, such as achievement and recognition.

Closely related to academic motivation is learning engagement, which refers to students' active involvement and participation in the learning process. Learning engagement encompasses behavioral, emotional, and cognitive dimensions that collectively contribute to academic success. According to Maamin et al. (2022), students who demonstrate higher levels of engagement are more likely to perform well in Mathematics. Their findings further revealed that behavioral, emotional, and cognitive engagement significantly influence learning outcomes. Within the Philippine context, Ramos et al. (2022) emphasized the importance of interactive classroom practices in encouraging student participation, while Guzman (2023) highlighted the positive effects of student-centered learning environments on learners' engagement and attitudes toward Mathematics.

Although numerous studies have examined the effects of manipulative-based instruction on students' achievement and conceptual understanding, limited research has explored its relationship with both academic motivation and learning engagement. Most existing studies focus primarily on cognitive outcomes, with less attention given to how students' perceptions of manipulative-based instruction influence their motivation and engagement in learning Mathematics. Understanding these relationships may provide valuable insights into improving instructional practices and creating more effective mathematics learning environments.

Therefore, this study aimed to determine the relationship between students' perceptions of manipulative-based instruction, academic motivation, and learning engagement among Grade 7 students in Mathematics. Specifically, it sought to examine whether students who perceive manipulative-based instruction more positively also demonstrate higher levels of motivation and engagement. The findings of the study may contribute to the development of more effective learner-centered instructional practices that enhance students' motivation, participation, and overall learning outcomes in Mathematics.

METHODOLOGY

Research Design

This study employed a descriptive-correlational research design, a non-experimental quantitative approach used to describe variables and examine the relationships among them without manipulating any conditions. The descriptive component determined the levels of students' perceptions of manipulative-based instruction, academic motivation, and learning engagement in Mathematics. Meanwhile, the correlational component examined whether significant relationships existed among these variables, specifically between manipulative-based instruction and academic motivation, and manipulative-based instruction and learning engagement. This design was considered appropriate because it enabled the researcher to systematically describe the variables and determine the degree of association among them as they naturally occurred (Siedlecki, 2020; Hassan, 2024; Bhandari, 2021).

Subject and Respondents of the Study

The respondents of the study were Grade 7 students enrolled in regular classes at a public high school in Negros Occidental during the School Year 2025–2026. They were selected because they were directly exposed to mathematics instruction that incorporated manipulative-based teaching strategies. Students enrolled in specialized programs, such as the Special Science Program and ARAL Program, were excluded to ensure consistency in academic background, learning environment, and instructional experiences. The respondents provided data regarding their perceptions of manipulative-based instruction, academic motivation, and learning engagement in Mathematics.

Population and Sample Size

The study population consisted of 368 Grade 7 students enrolled in regular classes at a public high school in Negros Occidental during the School Year 2025–2026. Students enrolled in specialized programs, such as the Special Science Program and ARAL Program, were excluded to ensure consistency in learning experiences and instructional exposure. A total of 192 students were selected as respondents, providing a representative sample of the target population.

Data Gathering Instrument

A structured survey questionnaire was used as the primary data-gathering instrument. The instrument consisted of 45 items designed to measure students' perceptions of manipulative-based instruction, academic motivation, and learning engagement, with 15 items allocated to each variable. The questionnaire was adapted from established and recent studies to ensure content validity and relevance.

The items measuring students' perceptions of manipulative-based instruction were adapted from Ahmad and Siller (2024), Al Farra et al. (2024), and Angeles et al. (2024). Academic motivation items, covering intrinsic motivation, extrinsic motivation, and amotivation, were adapted from Saadati and Celis (2023) and Valenzuela-Peñuñuri et al. (2024). Learning engagement items, which assessed behavioral, emotional, and cognitive engagement, were adapted from Awofala et al. (2024) and Gutierrez and Doronio (2024). All items were rated on a 5-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), allowing for the quantitative measurement and statistical analysis of the study variables.

The amotivation items were negatively worded and reverse-scored prior to statistical analysis. Consequently, higher scores indicated lower levels of actual amotivation and more positive motivational tendencies toward learning Mathematics.

Data Analyses

The data gathered in this study were carefully organized, coded, and analyzed using appropriate statistical tools to address each statement of the problem.

To determine the level of students' perception of manipulative-based instruction in Mathematics, the mean and standard deviation were used.

The formula for mean is presented below:

$$\bar{x} = \frac{\sum x}{n}$$

Where:

$\bar{x}$ = mean

$\sum x$ = sum of all data

n = total number of data

The formula for standard deviation is presented below:

$$\sigma = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$$

Where:

σ = sample standard deviation

x = score

$\bar{x}$ = sample mean

N = total number of observations

$\sum$ = summation symbol

For the interpretation of the result, the scale below was used.

Score	Description	Mean Score Range	Interpretation	Verbal Description
5	Strongly Agree	4.21 – 5.00	Very High	Students have a very positive perception and actively use manipulatives to understand mathematical concepts.
4	Agree	3.41 – 4.20	High	Students have a positive perception and use manipulatives to support their learning.
3	Neutral	2.61 – 3.40	Moderate	Students show moderate perception and occasionally use manipulatives in learning.
2	Disagree	1.81 – 2.60	Low	Students show low perception and rarely use manipulatives in learning.
1	Strongly Disagree	1.00 – 1.80	Very Low	Students have a very low perception and do not use manipulatives in learning.

To determine the level of students' academic motivation when taken as a whole and in terms of intrinsic motivation, extrinsic motivation, and amotivation, the mean and standard deviation were used.

For the interpretation of the result, the scale below was used.

Score	Description	Mean Score Range	Interpretation	Verbal Description
5	Strongly Agree	4.21 – 5.00	Very High	Students are highly motivated; they show strong interest, effort, and persistence in learning.
4	Agree	3.41 – 4.20	High	Students are motivated and actively participate in academic tasks.
3	Neutral	2.61 – 3.40	Moderate	Students show average or moderate motivation in learning.
2	Disagree	1.81 – 2.60	Low	Students show low motivation and limited effort in learning.
1	Strongly Disagree	1.00 – 1.80	Very Low	Students are minimally motivated and show little interest in learning.

To determine the level of students' learning engagement in terms of behavioral, emotional, and cognitive engagement, the mean and standard deviation were utilized.

For the interpretation of the result, the scale below was used.

Score	Description	Mean Score Range	Interpretation	Verbal Description
5	Strongly Agree	4.21 – 5.00	Very High	Students are highly engaged in learning in terms of behavior, emotions, and cognition.

4	Agree	3.41 – 4.20	High	Students are actively engaged in learning.
3	Neutral	2.61 – 3.40	Moderate	Students show average or moderate engagement.
2	Disagree	1.81 – 2.60	Low	Students show low engagement in learning.
1	Strongly Disagree	1.00 – 1.80	Very Low	Students are minimally engaged in learning.

To determine whether there is a significant relationship between manipulative-based instruction and academic motivation, the Spearman Rank-Order Correlation Coefficient (ρ) was used.

Formula for Spearman's Rho (ρ):

$$\rho = 1 - \frac{6 \sum d^2}{n(n^2 - 1)}$$

Where:

ρ = Spearman rank correlation coefficient

d = difference between the ranks of paired observations

Σd^2 = sum of squared rank differences

n = number of paired observations

The relationship between manipulative-based instruction and learning engagement was also determined using Spearman's Rank-Order Correlation Coefficient (ρ).

RESULTS AND DISCUSSION

This chapter presents, analyzes, and interprets the data gathered in the study. The information is arranged in an organized manner to clearly address the research questions and objectives, with the use of appropriate statistical methods and tools for accurate interpretation of the results.

Manipulative-based Instruction in Mathematics

The level of students' perception of manipulative-based instruction in Mathematics is presented below. It summarizes the respondents' overall assessment of the use of manipulatives in terms of usability, effectiveness, and engagement in facilitating their learning of mathematical concepts.

Table 1. Level of Students' Perception of Manipulative-based Instruction in Mathematics.

Statements	Mean	SD	Interpretation
1. Using manipulatives helps me understand abstract mathematical concepts better.	4.29	0.74	Very High
2. Manipulatives make difficult Math lessons easier to understand.	3.98	0.92	High
3. I learn Math concepts more clearly when I use concrete materials.	4.21	0.71	Very High
4. Manipulatives help me visualize Mathematical ideas.	4.26	0.81	Very High
5. Math lessons are more enjoyable when manipulatives are used.	4.24	0.80	Very High
6. Using manipulatives makes me more interested in learning Mathematics.	4.25	0.79	Very High
7. Manipulatives make Math lessons more engaging for me.	4.17	0.79	High
8. I feel less anxious about Math when manipulatives are used	4.01	0.92	High
9. Manipulatives encourage me to participate actively in Math class.	4.23	0.68	Very High

10. I feel more confident solving Math problems when I can use manipulatives.	4.15	0.84	High
11. Manipulatives make Math lessons more interactive.	4.17	0.82	High
12. I am more willing to share my ideas when manipulatives are used.	4.18	0.81	High
13. Manipulatives help me connect Math lessons to real-life situations.	4.28	0.70	Very High
14. Working with manipulatives helps improve my problem-solving skills.	4.36	0.71	Very High
15. Overall, the use of manipulatives improves my perception of Mathematics.	4.31	0.81	Very High
Perception of Manipulative-based Instruction as a Whole	**4.21**	**0.47**	**Very High**

Legend: (4.21 – 5.00)-Very High; (3.41 – 4.20)-High; (2.61 – 3.40)-Moderate; (1.81 – 2.60)-Low; (1.00 – 1.80)-Very Low

Table 1 shows that most of the respondents demonstrated a very high level of perception of manipulative-based instruction in Mathematics as indicated by the overall mean of 4.21 (SD = 0.47). This result suggests that Grade 7 students generally perceive manipulatives as effective tools that enhance their learning experiences and understanding of mathematical concepts. The relatively low standard deviation indicates that students shared similar positive perceptions regarding the use of manipulatives in Mathematics.

Among the indicators, the statement "Working with manipulatives helps improve my problem-solving skills" obtained the highest mean of 4.36 (SD = 0.71), while"Manipulatives make difficult Math lessons easier to understand" obtained the lowest mean of 3.98 (SD = 0.92), although it remained within the high level. These findings imply that students recognize the value of manipulatives in developing their problem-solving abilities and making mathematical concepts more concrete and meaningful.

The findings support the study of Ponte et al. (2023), who found that manipulatives play an important role in promoting students' understanding of mathematical concepts by allowing them to explore, construct, and represent mathematical ideas through active participation. Similarly, Angco and Angco (2024) reported that manipulatives enhance classroom engagement, participation, confidence, and conceptual understanding by creating interactive learning environments that encourage students' involvement in mathematical tasks.

The results suggest that students perceive manipulatives as valuable instructional tools that improve understanding, increase participation, and make Mathematics more engaging and meaningful.

Academic Motivation in Mathematics

The level of students' academic motivation in Mathematics is presented below. It summarizes the respondents' overall motivation in terms of intrinsic motivation, extrinsic motivation, and amotivation as they engage in learning mathematical concepts.

Table 2. Level of Students' Academic Motivation in Mathematics when taken as a whole and in terms of Intrinsic, Extrinsic and Amotivation.

Statements	Mean	SD	Interpretation
Intrinsic Motivation	**4.26**	**0.61**	**Very High**
1. I enjoy learning Mathematics, especially when manipulatives are used.	4.43	0.82	Very High
2. I find Math lessons interesting when I work with manipulatives.	4.26	0.72	Very High
3. I feel satisfied when I understand Math concepts using manipulatives.	4.27	0.86	Very High
4. Using manipulatives makes me curious about learning more Mathematics.	4.20	0.83	High
5. I feel interested in exploring Math ideas through hands-on materials.	4.15	0.81	High
Extrinsic Motivation	**4.22**	**0.63**	**Very High**

1. I am motivated to use manipulatives because they help me get better grades in math.	4.37	0.76	Very High
2. I participate in manipulative activities because they help me succeed academically.	4.16	0.80	High
3. I collaborate with my classmates when teachers use manipulatives in our Math class.	4.21	0.82	Very High
4. I use manipulatives because they help me prepare for future academic goals.	4.23	0.86	Very High
5. I participate more in math activities when manipulatives are used because I receive recognition.	4.13	0.89	High
Amotivation	**4.39**	**0.61**	**Very High**
1. Even with manipulatives, I do not feel interested in learning Math.	4.41	0.78	Very High
2. Using manipulatives does not help me see the value of Mathematics.	4.37	0.78	Very High
3. Manipulative-based instruction burdens me with additional learning tasks.	4.29	0.79	Very High
4. I do not understand the purpose of using manipulatives in math.	4.42	0.76	Very High
5. I do not put effort into manipulative activities in math class.	4.45	0.71	Very High
Academic Motivation in Mathematics as a Whole	**4.29**	**0.44**	**Very High**

Legend: (4.21 – 5.00)-Very High; (3.41 – 4.20)-High; (2.61 – 3.40)-Moderate; (1.81 – 2.60)-Low; (1.00 – 1.80)-Very Low

Table 2 shows that students exhibited a very high level of academic motivation in Mathematics, as reflected by the overall mean of 4.29 (SD = 0.44). This indicates that students generally possess strong motivation toward learning Mathematics when manipulatives are incorporated into instruction. The low standard deviation signifies consistency in students' responses regarding their motivation toward mathematics learning.

For intrinsic motivation, the overall mean of 4.26 (SD = 0.61) indicates that students enjoy learning Mathematics and find satisfaction in understanding mathematical concepts through manipulative-based activities. The relatively low standard deviation suggests that respondents' answers were fairly consistent, indicating a shared positive perception of manipulative-based instruction. The highest-rated statement was, "I enjoy learning Mathematics, especially when manipulatives are used" (M = 4.43), showing that students derive enjoyment and personal satisfaction from learning experiences involving hands-on materials.

Extrinsic motivation likewise obtained a very high mean of 4.22 (SD = 0.63), indicating that students are also motivated by external factors such as academic success, achievement, and future goals. The relatively small standard deviation demonstrates that students generally held similar views regarding the benefits of manipulatives in supporting academic performance. The statement "I am motivated to use manipulatives because they help me get better grades in Math" received the highest rating under this dimension, suggesting that students recognize the practical benefits of manipulatives in improving their achievement in Mathematics.

The amotivation dimension obtained a very high mean of 4.39 (SD = 0.61). However, it must be noted that the amotivation items were negatively worded and reverse-coded prior to analysis. Therefore, higher scores indicate lower levels of actual amotivation and more positive motivational tendencies. The relatively low standard deviation indicates consistency in respondents' answers, suggesting a common tendency among students to reject feelings of discouragement or disinterest in Mathematics. This finding implies that students generally remain interested in learning Mathematics, recognize the value of manipulative-based activities, and exert effort during mathematics lessons.

The findings are consistent with Valenzuela-Peñuñuri et al. (2024), who reported that motivated students tend to exhibit stronger self-efficacy, greater willingness to participate, and more positive attitudes toward mathematics learning. Likewise, Angco and Angco (2024) found that manipulative-based instruction contributes to increased motivation and confidence by providing interactive and meaningful learning experiences.

Overall, the findings indicate that manipulative-based instruction contributes to students' intrinsic and extrinsic motivation while minimizing amotivation, thereby fostering a more positive learning environment in Mathematics.

Learning Engagement in Mathematics

The level of students' learning engagement in Mathematics is presented below. It summarizes the respondents' level of engagement in terms of behavioral, emotional, and cognitive aspects during mathematics learning.

Table 3. Level of Students' Learning Engagement in Mathematics in terms of Behavioral engagement, Emotional engagement, and Cognitive engagement.

Statements	Mean	SD	Interpretation
Behavioral Engagement	**4.33**	**0.51**	**Very High**
1. I actively participate in Math activities when manipulatives are used.	4.39	0.78	Very High
2. I pay close attention during Math lessons that use manipulatives.	4.28	0.70	Very High
3. I complete Math tasks more consistently when manipulatives are included.	4.24	0.74	Very High
4. I follow instructions carefully during hands-on Math activities.	4.41	0.75	Very High
5. I take part in group work when manipulatives are used.	4.31	0.70	Very High
Emotional Engagement	**4.34**	**0.48**	**Very High**
1. I enjoy Math lessons that include manipulatives.	4.34	0.71	Very High
2. I feel interested and excited during manipulative-based Math lessons.	4.38	0.63	Very High
3. Using manipulatives makes Math classes more enjoyable for me.	4.36	0.70	Very High
4. I feel comfortable participating when manipulatives are part of the lesson.	4.34	0.71	Very High
5. Manipulatives make me feel more positive about learning Mathematics.	4.28	0.75	Very High
Cognitive Engagement	**4.26**	**0.51**	**Very High**
1. I try to understand Math concepts deeply when using manipulatives.	4.29	0.75	Very High
2. I think carefully about how manipulatives represent Math ideas.	4.35	0.66	Very High
3. I use different strategies when solving problems with manipulatives.	4.22	0.70	Very High
4. I can easily visualize challenging Math problems with the use of manipulatives.	4.26	0.71	Very High
5. I reflect on my mistakes and learn from them during hands-on Math activities.	4.18	0.83	High
Students' Classroom Engagement in Mathematics as a Whole	**4.31**	**0.44**	**Very High**

Legend: (4.21 – 5.00)-Very High; (3.41 – 4.20)-High; (2.61 – 3.40)-Moderate; (1.81 – 2.60)-Low; (1.00 – 1.80)-Very Low

Table 3 shows that respondents demonstrated a very high level of learning engagement in Mathematics, as evidenced by an overall mean of 4.31 (SD = 0.44). This indicates that students actively participate, invest effort, and show positive emotional and cognitive involvement in mathematics learning activities that incorporate

manipulatives. The small standard deviation further demonstrates consistency in students' responses regarding engagement.

Behavioral engagement obtained a mean of 4.33 (SD = 0.51), indicating that students consistently participate in classroom activities and complete mathematical tasks when manipulatives are used. The highest-rated statement,"I follow instructions carefully during hands-on Math activities" (M = 4.41), suggests that students demonstrate active participation and responsibility during manipulative-based lessons.

Emotional engagement registered the highest dimension mean of 4.34 (SD = 0.48), indicating that students experience enjoyment, interest, and enthusiasm during Mathematics classes involving manipulatives. Students particularly agreed that they feel interested and excited during manipulative-based lessons, emphasizing the positive emotions generated through hands-on learning experiences.

Cognitive engagement obtained a mean of 4.26 (SD = 0.51), indicating that students mentally invest effort in understanding mathematical concepts, applying strategies, and reflecting on their learning. This suggests that manipulatives help students think critically and connect mathematical ideas with problem-solving processes.

The findings support Ponte et al. (2023), who reported that manipulatives increase students' involvement in mathematical activities by encouraging exploration and the construction of mathematical representations. Similarly, Haji Ismail et al. (2023) found that students who used virtual manipulatives became more engaged, interactive, and confident because manipulatives enabled them to visualize abstract concepts and actively participate in learning activities. Angco and Angco (2024) further concluded that manipulatives activate classroom engagement and participation by creating inclusive and dynamic learning environments.

These findings demonstrate that manipulative-based instruction effectively promotes behavioral, emotional, and cognitive engagement among Grade 7 students.

Manipulative-based Instruction and Academic Motivation

The relationship between students' perception of manipulative-based instruction and their academic motivation in Mathematics is presented below. It shows the extent to which students' perceptions are associated with their levels of intrinsic motivation, extrinsic motivation, and amotivation.

Table 4. Relationship between Students' Perception of Manipulative-based Instruction and their Academic Motivation.

Variable	Test Statistics (r_s)	p-value	Decision for H_o	Interpretation
Level of Perception of Manipulative-based Instruction vs.	0.316	<0.001	Reject H_o	Significant
Level of Academic Motivation				

Table 4 shows that there is a significant relationship between students' perception of manipulative-based instruction and their academic motivation, as indicated by the computed Spearman rho (r_s) value of 0.316 and a p-value of less than 0.001. Therefore, the null hypothesis is rejected, and the relationship is interpreted as significant. The correlation coefficient of 0.316 indicates a positive relationship, suggesting that as students' perception of manipulative-based instruction becomes more favorable, their level of academic motivation also tends to increase.

This implies that when students perceive manipulatives as helpful, engaging, and effective in learning Mathematics, they become more interested, motivated, and willing to participate in classroom activities. Positive experiences with hands-on learning may enhance both intrinsic and extrinsic motivation while reducing feelings of amotivation. Therefore, manipulatives not only support students' understanding of mathematical concepts but also contribute to strengthening their motivation to learn.

This finding supports the studies of Ahmad and Siller (2024), Al Farra et al. (2024), Angeles et al. (2024), and Enuma and Ijeh (2024), which found that manipulative-based and interactive learning approaches promote greater student motivation, participation, and achievement in Mathematics. These results suggest that improving students' perceptions of manipulative-based instruction can positively influence their academic motivation.

Manipulative-based Instruction and Learning Engagement

The relationship between students' perception of manipulative-based instruction and their learning engagement in Mathematics is presented below. It shows the extent to which students' perceptions of manipulative-based instruction are associated with their level of learning engagement in terms of behavioral, emotional, and cognitive engagement.

Table 5. Relationship between Students' Perception of Manipulative-based Instruction and their Learning Engagement.

Variable	Test Statistics (r_s)	p-value	Decision for H_o	Interpretation
Level of Perception of Manipulative-based Instruction vs. Level of learning engagement	0.427	<0.001	Reject H_o	Significant

Table 5 shows a significant relationship between students' perception of manipulative-based instruction and their learning engagement, as indicated by the Spearman rho (r_s) value of 0.427 and a p-value of less than 0.001. Thus, the null hypothesis is rejected. The correlation coefficient indicates a moderate positive relationship, suggesting that students with more positive perceptions of manipulative-based instruction tend to exhibit higher levels of learning engagement.

This implies that students who view manipulatives as helpful and effective in learning Mathematics are more likely to participate actively, show interest in classroom activities, and engage more deeply in learning tasks. The use of manipulatives creates a meaningful and interactive learning environment that promotes behavioral, emotional, and cognitive engagement. Consequently, students become more attentive, enthusiastic, and involved in the learning process.

This finding supports the studies of Ahmad and Siller (2024), Al Farra et al. (2024), Angeles et al. (2024), Enuma and Ijeh (2024), and Byrne et al. (2023), which emphasize that manipulative-based instruction enhances students' participation, interest, and overall engagement in Mathematics learning. These findings suggest that fostering positive perceptions of manipulatives can contribute to greater student engagement in the classroom.

CONCLUSION

The study concludes that students' perceptions of manipulative-based instruction are positively associated with their academic motivation and learning engagement in Mathematics. The respondents likewise demonstrated very high levels of academic motivation, as reflected in strong intrinsic and extrinsic motivation and low levels of amotivation, suggesting that positive perceptions of manipulative-based instruction are associated with increased interest, enjoyment, and persistence in learning Mathematics.

Furthermore, students exhibited very high levels of behavioral, emotional, and cognitive engagement in mathematics learning. The findings revealed significant positive relationships between students' perceptions of manipulative-based instruction and their academic motivation and learning engagement. These results suggest that learners who perceive manipulative-based instruction more positively tend to be more motivated and actively engaged in Mathematics. Overall, the study affirms the value of manipulative-based instruction as a learner-centered approach that supports meaningful learning experiences while fostering students' motivation and engagement.

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