Interactive Teaching Strategies and Learning Engagement: Their Relationship to Academic Achievement in Mathematics in Lamba Yong Municipality

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ABSTRACT

In transformative and engaging pedagogical practices, this study examined the influence of interactive teaching strategies (ITS) on the relationship between Grade 10 students' learning engagement and academic achievement. A descriptive-correlational research design was employed, targeting secondary school clusters in Lambayong Municipality. A total of 598 students were randomly selected as participants. Data were gathered using a learning engagement survey, a perception scale on Interactive Teaching Strategies, and a 50-item achievement test in Mathematics. Descriptive statistics, specifically the mean and standard deviation, were utilized to determine the levels of students' learning engagement, perceptions of ITS, and academic performance. Additionally, Pearson correlation analysis was conducted to examine the relationship between students' learning engagement and academic achievement. The results revealed no significant relationship between students' perceptions of interactive teaching strategies and their academic achievement. Similarly, the correlation analysis indicated no significant relationship between learning engagement and academic achievement. However, the emotional component of learning engagement demonstrated a slight predictive value for academic performance. Therefore, the ITS employed in this study did not significantly predict higher academic achievement nor substantially enhance students' emotional, cognitive, and behavioral engagement. It is recommended that interactive teaching strategies be combined with other appropriate pedagogical approaches to effectively enhance academic achievement.

Keywords: Academic achievement, Interactive teaching strategies, Learning engagement

INTRODUCTION

The pursuit of quality education remains a cornerstone of global educational reforms, with emphasis placed on instructional strategies that foster meaningful learning. In mathematics education, this pursuit is often hindered by traditional pedagogies that emphasize rote memorization and procedural fluency over conceptual understanding. Such approaches have contributed to students' disengagement, anxiety, and underperformance in mathematics (Ayub et al., 2021). To address these challenges, educators are encouraged to adopt interactive teaching strategies (ITS), which emphasize student participation, collaboration, and hands-on learning.

Interactive teaching strategies—such as game-based learning and the use of manipulatives—are rooted in constructivist and inquiry-based learning theories. These strategies position learners at the center of the instructional process, promoting active engagement, critical thinking, and problem-solving (Senthamarai, 2018; Boctor, 2013). Game-based learning integrates elements of play and competition to enhance motivation and retention, while manipulatives allow learners to physically interact with mathematical concepts, bridging the gap between concrete and abstract understanding (Witzel & Allsopp, 2007; Teacher Vision, 2009). Such strategies not only support differentiated instruction but also cater to diverse learning preferences and developmental needs.

Although extensive literature supports the effectiveness of interactive strategies in science and language

education, their implementation in mathematics instruction, particularly at the secondary level, remains limited and under-researched (Vedamo, 2021; Kamran et al., 2023). There is a critical need to explore how these strategies impact students' engagement—emotionally, cognitively, and behaviorally—and their academic performance in mathematics.

This study, conducted in the Lambayong Secondary Schools Cluster in Sultan Kudarat, Philippines, seeks to fill this gap. It investigates the extent of students' perceptions toward interactive teaching strategies, their level of learning engagement, and academic achievement in mathematics. Moreover, it examines the relationship between the perceived use of ITS and students' academic performance, providing empirical data that may guide future instructional practices and educational policy.

By offering insights into the viability and influence of interactive strategies in mathematics education, this study contributes to ongoing efforts to enhance teaching effectiveness and student outcomes in a critical learning domain.

METHODOLOGY

Research Design

This study utilized a descriptive-correlational research design to determine the extent of the perceived instructional teaching strategies, learning engagement, and academic achievement among Grade 10 students at Lambayong Secondary School Cluster during the first and second quarters of the school year 2024-2025. Quantitative research methods are used to observe events affecting a particular group.

With this design, the researcher utilized questionnaires and highlighted the other teaching strategies, which supplement interactive teaching strategies to enhance student performance and learning engagement, and the mechanisms implemented to improve teachers' capabilities in teaching mathematics. This tool is particularly effective for measuring subject behavior, preferences, intentions, attitudes, and opinions (Petrat et al., 2022). Thus, this research design was suited to this study.

Research Locale

The study was conducted at Lambayong Secondary School Cluster, Municipality of Lambayong, Sultan Kudarat. It is approximately 20 kilometers from Sultan Kudarat State University ACCESS Campus, traversing the City of Tacurong. The schools under the cluster are Kapingkong National High School, Lambayong National High School, Madanding National High School, Maligaya National High School, Mamali National High School, and Pimbalayan National High School.

Research Participants

The study's respondents were the grade 10 students officially enrolled for the school year 2024-2025. The respondents were selected through simple random sampling. Based on simple random sampling, there are 218 students selected at Lambayong National High School, 99 students were from Kapingkong National High School, 72 students were from Mamali National High School, 71 students were from Maligaya National High School, 45 students were from Madanding National High School, and 93 students were from Pimbalayan National High School. Thus, there were 598 students served as respondents to the study. In addition, as prescribed by Accad (2016), inclusion criteria were used to determine the actual participants of the focus group discussions of this study.

Data Gathering Instrument

The following research instruments were used in the study:

Learning Engagement Survey. Standardized and modified survey tools adapted from Vizcayno (2023) and Montaño (2018) measured students' learning engagement in interactive teaching strategies. The scale below was used, interpreted, and patterned from the study of Manyange and Abuga (2015).

Scale	Mean Range	Interpretation
5	4.20 – 5.00	Strongly Agree
4	3.40 – 4.19	Agree
3	2.60 – 3.39	Undecided
2	1.80 – 2.59	Disagree
1	1.00 – 1.79	Strongly Disagree

Test Questionnaire. This questionnaire consists of questions designed to gather information from respondents through a survey or statistical study. It is typically a Multiple-Choice Test. The test questionnaire was used to determine the level of academic achievement of the grade 10 students. Based on DepEd Order No. 8, s. 2015, the following range of means and descriptive ratings were used. The interpretation was adapted from Gregorio (2024).

Grading Scale	Verbal Description	Interpretation
90 – 100	Outstanding	Very High
85 – 89	Very Satisfactory	High
80 – 84	Satisfactory	Moderate
75 – 79	Fairly Satisfactory	Low
Below 75	Did Not Meet Expectations	Very Low

Students' Perception Survey. This technique collects accurate information by asking questions to draw conclusions and make essential decisions by connecting with the situation. This survey method attests the perception of the students on Interactive Teaching Strategies. The scale below was used, interpreted, and patterned from the study of Manyange and Abuga (2015).

Scale	Mean Range	Interpretation
5	4.20 – 5.00	Strongly Agree
4	3.40 – 4.19	Agree
3	2.60 – 3.39	Undecided
2	1.80 – 2.59	Disagree
1	1.00 – 1.79	Strongly Disagree

Data Gathering Procedure

After the proposed study was approved, the researcher formulated the survey instruments. Three mathematics experts were validators who scrutinized, validated, and checked the instrument. Then, the researcher conducted a pilot test with Grade 11 students in the nearest secondary school clusters.

To ensure the reliability of the survey questionnaires, the Cronbach Alpha was used to compute whether the

questionnaire was suited for data gathering. Then, the revision, finalization, and reproduction of the materials needed for the study followed. The scale below shows the Cronbach Alpha Coefficient that measures the internal reliability of the survey items.

Cronbach's Alpha	Internal Consistency
$\boldsymbol{\alpha \geq 0.9}$	Excellent
$\boldsymbol{0.9 > \alpha \geq 0.8}$	Good
$\boldsymbol{0.8 > \alpha \geq 0.7}$	Acceptable
$\boldsymbol{0.7 > \alpha \geq 0.6}$	Questionable
$\boldsymbol{0.6 > \alpha \geq 0.5}$	Poor
$\boldsymbol{0.5 > \alpha}$	Unacceptable

Further, a letter was sent to the office of the graduate school dean to conduct the study. After the approval, a request letter was addressed to the Schools Division Superintendent of Sultan Kudarat to allow the researcher to use her official time during the data-gathering process. A similar letter was sent to the principal of Lambayong Secondary Schools Cluster to conduct the study among Grade 10 students.

The respondents received an orientation on using the Interactive Learning Approach, followed by distributing survey questionnaires. The data was gathered, tallied, and analyzed using appropriate statistical tools to reveal the results.

Statistical Treatment

After the study, the data was organized, tabulated, analyzed, and interpreted.

The following statistical tools were used in answering the statement of the problems.

Mean and standard deviation was used to determine the level of students' perception towards interactive teaching strategies and learning engagement in implementing interactive teaching strategies and the level of their academic performance. Meanwhile, Pearson r was used to determine the significant relationship between the perception of the grade 10 students towards interactive teaching strategies and mathematics achievement. It is also used to determine if there is a significant relationship between the level of learning engagement and academic achievements in mathematics of grade 10 students.

Ethical Considerations

This research study followed ethical guidelines. Ethical approval was obtained from the Department of Education Reasearch Ethics Board. All participants provided informed consent, and confidentiality was maintained in compliance with international research ethics standards.

RESULTS AND DISCUSSION

The Extent of Students' Perception Towards Interactive Teaching Strategies, Specifically Game-Based Learning and Using Manipulatives in Grade 10 Mathematics

As shown in Table 1, indicator 1 obtained the highest mean of 5.00 (SD = .00). Indicators 3 and 6 obtained a mean of 4.90 (SD = .31). Moreover, indicators 4, 8, and 10 have a mean of 4.93 (SD = .25). Indicators 5 and 7 obtained a mean of 4.97 (SD = .18), and indicator 2 and 9 had a mean of 4.83 (SD = .38), 4.87 (SD = .35), respectively. It garnered a section mean of 4.92 (SD = .25). The highlighted criteria were met with strong agreement from the respondents. It provides further evidence that using interactive teaching approaches

improves students' capacity to solve mathematical problems. It helps students become better at making connections between abstract mathematical concepts and their everyday lives.

Table 1. Extent of Students' Perception Towards Interactive Teaching Specifically Game-Based Learning and Using Manipulatives in Grade 10 Mathematics

Indicators	Mean	SD	Interpretation
1. ITS boosts students' skills in mathematics	5.00	.00	Strongly Agree
2. ITS develops students' higher-order thinking skills.	4.83	.38	Strongly Agree
3. ITS improves students' problem-solving and critical-thinking skills.	4.90	.31	Strongly Agree
4. ITS gives students an avenue to explore valuable learning experiences.	4.93	.25	Strongly Agree
5. ITS helps students to be engaged in different complex mathematical tasks.	4.97	.18	Strongly Agree
6. ITS helps students to be more enthusiastic in different learning tasks.	4.90	.31	Strongly Agree
7. ITS develops students' abilities to relate mathematical tasks to a real-world situation.	4.97	.18	Strongly Agree
8. ITS makes students ready to face another learning journey.	4.93	.25	Strongly Agree
9. ITS boosts students' motivation to learn more mathematical concepts and ideas.	4.87	.35	Strongly Agree
10. ITS helps students to understand the lesson and makes it easier than the usual classroom settings.	4.93	.25	Strongly Agree
Section Mean	4.92	.25	Strongly Agree

Additionally, when teachers use interactive teaching methods that enable students to engage in meaningful learning experiences, students are better equipped for their future academic pursuits. It also implies that the children are actively participating in the many learning exercises assigned to them. Lastly, it encourages critical thinking and improves students' reasoning ability at a higher level. Using interactive teaching strategies to involve students in various learning activities increases their enthusiasm and level of engagement.

The findings are corroborated by research conducted by Kamran et al. (2023), which demonstrates that interactive teaching strategies enhance students' learning outcomes. They encourage deeper learning, critical thinking, and higher-order cognitive skills. According to Rafiq et al. (2022), active participation, collaboration, and communication skills are essential for success in the twenty-first-century workforce. ITS improves certain attributes.

According to a study by Seidil and Tanner (2013), students who participated in interactive learning approaches demonstrated improved long-term material retention. According to Michael (2021), educators must have the right guidance and assistance to use interactive teaching methods successfully.

Level of Learning Engagement of Grade 10 Students in terms of Emotional, Cognitive, and Behavioral

Tables 2 to 4 show the level of emotional, cognitive, and behavioral learning engagement of grade 10 students.

Table 2. Level of Emotional Learning Engagement of Grade 10 Students

Indicators	Mean	SD	Interpretation
1. I feel motivated and eager to participate in mathematics lessons with interactive learning strategies.	4.72	.45	Strongly Agree
2. I enjoy solving mathematical problems and puzzles.	4.69	.46	Strongly Agree
3. I feel confident in understanding and applying mathematical concepts when using interactive learning strategies.	4.74	.44	Strongly Agree
4. I feel excited when I successfully solve a challenging mathematical problem.	4.96	.20	Strongly Agree
5. I feel supported and encouraged by my teacher and classmates during mathematics activities.	4.98	.16	Strongly Agree
6. I feel proud of my achievements in mathematics when interactive learning strategies are used.	4.75	.44	Strongly Agree
7. I feel frustrated when I encounter difficulties in understanding mathematical concepts.	4.74	.44	Strongly Agree
8. I feel anxious or nervous when faced with a complex mathematical task.	4.83	.38	Strongly Agree
9. I feel bored or disinterested during some parts of mathematics lessons.	4.77	.42	Strongly Agree
10. I feel satisfied when I make progress and improve my mathematical skills.	4.85	.36	Strongly Agree
Section Mean	4.80	.38	Strongly Agree

The result revealed that indicator 1 has a mean of 4.72 (SD = .45). For indicator 2, it obtained a mean of 4.69 (SD = .46). Indicators 3 and 7 revealed a mean of 4.74 (SD = .44). Indicator 4 obtained a mean of 4.96 (SD = .20). The data also shows that indicator 5 obtained the highest mean of 4.98 (SD = .16). The indicator 6 shows a mean of 4.75 (SD = .44). Lastly, indicators 8, 9, and 10 obtained a mean of 4.83 (SD = .38), 4.77 (SD = .42), and 4.85 (SD = .36), respectively. All the indicators are qualitatively described as strongly agree. The emotional learning engagement of the grade 10 students has a section mean of 4.80 (SD = .38) and is verbally described as strongly agree.

The data presented in the table indicates that when educators assist their students in resolving mathematical problems, the students experience a sense of support. They acquire self-assurance, particularly when they successfully surmount formidable challenges. The result also suggests that students are more inclined to experience feelings of satisfaction and pride in themselves when they engage in interactive learning methods and observe their progress.

D'Errico et al. (2016) explain that students' engagement in emotional learning significantly influences their interests and emotional states, reducing tedium, enhancing contentment, mitigating distress during class discussions, and decreasing anxiety levels. The existing data substantiate these findings.

Emotional engagement in the learning process significantly impacts classroom performance through behavioral modification (Geertshuis, 2019). Certain characteristics of emotional engagement, including attitude, self-

esteem, and self-recognition, exhibit a complex interplay with extrinsic and intrinsic motivation (Lee et al., 2022). According to Ganotice et al. (2022), a positive correlation exists between students' emotional investment in their learning and their motivation to learn.

Table 3. Level of Cognitive Learning Engagement of Grade 10 Students

Indicators	Mean	SD	Interpretation
1. I can effectively apply problem-solving strategies when working on interactive mathematics tasks	4.78	.42	Strongly Agree
2. I can describe how interactive learning strategies help me understand and retain mathematical concepts.	4.76	.43	Strongly Agree
3. I find myself thinking critically and analytically when engaged in interactive mathematics activities.	4.90	.31	Strongly Agree
4. I can integrate new mathematical knowledge with previously learned concepts during interactive learning sessions.	4.90	.32	Strongly Agree
5. I can make connections between mathematical concepts and real-world applications through interactive learning experiences	4.76	.45	Strongly Agree
6. I feel challenged to think creatively and explore different problem-solving approaches during interactive mathematics tasks.	4.82	.39	Strongly Agree
7. I use interactive learning strategies to enhance my ability to visualize and manipulate mathematical representations, such as graphs or diagrams.	4.82	.40	Strongly Agree
8. I can explain how interactive mathematics activities promote my active engagement and sustained attention to mathematical tasks.	4.79	.41	Strongly Agree
9. I can independently explore and investigate mathematical concepts further during interactive learning sessions.	4.78	.41	Strongly Agree
10. I use interactive learning strategies to support my development of metacognitive skills, such as self-monitoring and reflection, in mathematics.	4.84	.37	Strongly Agree
Section Mean	4.81	.39	Strongly Agree

In Table 3, indicators 1 and 9 have a mean of 4.78 (SD = .41 and .42). Indicators 2 and 5 obtained a mean of 4.76 (SD = .43 and .45). Indicators 3 and 4 received the highest mean of 4.90 (SD = .31 and .32). Indicators 6 and 7 have a mean of 4.82 (SD = .39 and .40). Lastly, indicators 8 and 10 obtained a mean of 4. 49 (SD = .41) and 4.84 (SD = .37). The level of cognitive learning engagement of grade 10 students garnered a section mean of 4.81 (SD = .39). All indicators were verbally described as strongly agree.

Students may connect their prior knowledge with the material they gained during interactive learning sessions. They have the opportunity to monitor and assess their development. Students are also encouraged to think creatively and experiment with new approaches to problem-solving.

Furthermore, when educators use interactive teaching methods in class, students show improved understanding

and recall of the subject. They also use these methods well in their interactions with their classmates. Consequently, it promotes the development of students' analytical and creative thinking abilities required to tackle mathematical problems.

Engagement in cognitive learning has a substantial impact on students' academic progress. Interactive teaching tactics in the classroom can inspire, engage, and actively involve students in their educational endeavors (Ingris, 2016).

Table 4. Level of Behavioral Learning Engagement of Grade 10 Students

Indicators	Mean	SD	Interpretation
1. I actively participate in group discussions and collaborative problem-solving activities during mathematics lessons.	4.77	.43	Strongly Agree
2. I eagerly volunteer to demonstrate mathematical concepts or solutions to the class during interactive learning sessions.	4.77	.43	Strongly Agree
3. I regularly seek assistance from my teacher or peers when encountering challenging mathematical problems.	4.82	.40	Strongly Agree
4. I demonstrate persistence and resilience when faced with difficult mathematical tasks, actively seeking solutions until I succeed.	4.84	.36	Strongly Agree
5. I utilize mathematical tools and technology effectively to enhance my understanding and performance during interactive learning activities.	4.82	.39	Strongly Agree
6. I engage in hands-on activities and manipulatives to explore mathematical concepts tangibly.	4.81	.40	Strongly Agree
7. I take the initiative to explore additional resources or supplementary materials to deepen my understanding of mathematical topics.	4.82	.39	Strongly Agree
8. I actively contribute to collaborative projects and group presentations on mathematical concepts and applications.	4.81	.39	Strongly Agree
9. I actively participate in peer tutoring or mentoring activities to support my classmates' understanding of mathematical concepts.	4.78	.42	Strongly Agree
10. I demonstrate responsible behavior by completing assigned mathematics tasks on time and following classroom rules and expectations during interactive learning sessions.	4.81	.39	Strongly Agree
Section Mean	4.81	.40	Strongly Agree

The data in the table shows the level of behavioral learning engagement of grade 10 students. It revealed that indicators 1 and 2 obtained a mean of 4.77 (SD = .43). Indicators 3, 5, and 7 received a mean of 4.82 (SD = .40 and SD = .39). Indicator 4 got the highest mean of 4.84 (SD = .36). For indicators 6, 8, and 10, it obtained a mean of 4.81 (SD = .40 and SD = .39), and for indicator 9, it has a mean of 4.78 (SD = .42). It implies that when pupils face challenging mathematics assignments, their perseverance and resilience improve. It was evident, as shown in the section mean of 4.81 (SD = .40) that it was interpreted as strongly agreeing.

The survey results show that students are taught to be responsible by routinely fulfilling class expectations and

completing projects on time. Also, when learners have difficulty grasping a subject, they collaborate to discuss it in class and seek clarification from the teacher. Furthermore, students demonstrate initiative in searching other materials to improve and extend their comprehension of the topic. Students used technology as an extra resource to help them understand mathematical issues better. Thus, using interactive teaching approaches, students acquire confidence and enhance their capacity to solve mathematical problems.

According to Francis et al. (2018), students' behavioral engagement, as measured by their involvement in various mathematics exercises within and outside the classroom, had little effect on their achievement.

Ozkal (2019) found that students' arithmetic learning and performance are connected with the amount of behavioral learning engagement they engage in. A positive approach towards completing numerous sets of mathematical homework might help make this a reality.

Overall Level of Learning Engagement of Grade 10 Students

Table 5 shows the list of grade 10 students' learning engagement level.

Table 5. Summary Table on the Level of Learning Engagement of Grade 10 Students

Dimensions	Mean	SD	Interpretation
Emotional	4.80	.38	Strongly Agree
Cognitive	4.81	.39	Strongly Agree
Behavioral	4.81	.40	Strongly Agree
Overall Mean	4.81	.39	Strongly Agree

The result revealed that the level of learning engagement of grade 10 students in terms of emotional has a mean of 4.80 (SD = .38). In terms of cognitive, the level of learning engagement of grade 10 students garnered a mean of 4.81 (SD = .39). In terms of behavioural, the level of learning engagement of grade 10 students obtained a mean of 4.81 (SD = .40). As shown in the table above, the overall level of learning engagement of grade 10 students was strongly agreed, as evidenced by the overall mean of 4.81 (SD = .39). This finding suggests that students who had been introduced to interactive teaching practices were more engaged and enthusiastic in class discussions.

According to Khan (2023), teachers who employ diverse strategies, such as interactive teaching, stimulate students' attention and increase their achievement levels. A clear link exists between students' engagement with their education and higher academic success. For this reason, it is critical to include students in their studies (Zeng et al., 2020; Gul et al., 2017).

Veríssimo et al. (2021) found that students interested in and dedicated to their studies exceed their less engaged colleagues on several tests. As a result, regardless of socioeconomic status, student participation predicts academic achievement and attitude toward learning.

Level of Academic Achievement of Grade 10 Students in Secondary Schools Cluster of Lambayong

The data presented in the Table 6 shows the academic achievement level of grade 10 students in the secondary schools in the municipality of Lamba Yong.

Table 6. Level of Academic Achievement of Grade 10 Students

Schools	N	Mean	SD	Interpretation
School A	99	85.74	7.25	Very Satisfactory

School B	218	83.52	7.97	Satisfactory
School C	45	84.89	7.49	Very Satisfactory
School D	71	85.27	7.26	Very Satisfactory
School E	72	84.24	7.57	Satisfactory
School F	93	85.90	7.21	Very Satisfactory
Total	598	84.66	7.61	Very Satisfactory

In School A grade 10 students' academic achievement has a mean of 85.74 (SD = 7.25) and is verbally described as very satisfactory. In School B, the level of academic achievement of grade 10 students got a mean of 83.52 (SD = 7.97) and was described as satisfactory. The level of academic achievement of grade 10 students in School C, l obtained a mean of 84.89 (SD = 7.49) and was interpreted as very satisfactory. In School D was very satisfactory in academic achievement, with a mean of 85.27 (SD = 7.26). In School E, the level of academic achievement of grade 10 students got a mean of 84.24 (SD = 7.57) and was described as satisfactory. Lastly, the level of academic achievement of grade 10 students in School F obtained a mean of 85.90 (SD = 7.21) and was interpreted as very satisfactory.

It revealed that the level of academic achievement in secondary schools in Lambayong has an overall mean of 84.66 (SD = 7.61). Students performed very satisfactorily.

Consistent with Sadiku and Sylaj's (2019) findings, the students' academic achievement reflects their learning ability. Students' favorable attitudes towards education, backgrounds, and tight interaction between family and school all influence their academic achievement.

According to Cabuquin and Abocejo (2023), high school students' mathematical proficiency has a "direct bearing" on their overall academic success. Those who succeed in mathematics in high school are more likely to get high scores and grow in other subjects, whereas those who struggle with arithmetic frequently struggle academically.

Correlation Analysis Between Grade 10 Students' Perception Towards Interactive Teaching Strategies (ITS) and Their Mathematics Achievement

The table below shows the correlation analysis between the students' perception of interactive teaching strategies and their mathematics achievement.

Table 7. Correlation Analysis Between Students' Perception Towards Interactive Teaching Strategies (ITS) and Their Mathematics Achievement

	Pearson r	p-value
Students' Perception of ITS vs. Students' Academic Achievement	.011	.789

The data in Table 7 shows that the extent of students' perception towards interactive teaching strategies is weakly positively correlated with student academic achievement in mathematics, with Pearson r = .011 and a p-value of. 789.The p-value is greater than the 0.05 significance level; hence, the extent of students' perception of interactive teaching strategies has no relationship with student academic achievement in mathematics.

Generally, the correlation between the extent of students' perception of interactive teaching strategies and students' academic achievement in mathematics is negligible and statistically insignificant. Hence, using interactive teaching strategies more frequently does not necessarily lead to higher academic achievement.

Giorgdze and Dgebuadze (2017) found that although interactive teaching techniques increase student involvement and participation, they do not ensure better academic outcomes in all circumstances.

This research examines the link between interactive teaching approaches and student learning outcomes and finds that although these methods encourage engagement and critical thinking, they do not necessarily improve academic achievement (Kamran et al., 2023).

Correlation Analysis Between the Level of Learning Engagement and Academic Achievements in Mathematics of The Grade 10 Students

Table 8 shows the correlation analysis between the level of learning engagement and academic achievements in mathematics of the grade 10 students.

Table 8. Correlation Analysis Between the Levels of Learning Engagement and Academic Achievements in Mathematics of The Grade 10 Students

	Pearson r	p-value
Emotional Learning Engagement vs Academic Achievement in Mathematics	– .080	.049*
Cognitive Learning Engagement vs Academic Achievement in Mathematics	– .029	.484
Behavioral Learning Engagement vs Academic Achievement in Mathematics	.002	.961
Overall Student Learning	– .060	.146

*Correlation is significant at the .05 level (2-tailed)

Table 8 shows that emotional learning engagement has a very weak negative correlation with academic achievement in mathematics, with a Pearson r = – .080 and a p-value of .049.

Further, cognitive learning engagement has a very weak negative correlation with academic achievement in mathematics, with a Pearson r = – .029 and a p-value of .484. Since the p-value is greater than the significance level, it shows that cognitive learning engagement and academic achievement in mathematics have no relationship. Regarding behavioral learning engagement and academic achievement in mathematics, it has a very weak positive correlation with a Pearson r = .002 and a p-value of .961. The p-value is greater than the significance level. Hence, there is no significant relationship between behavioral learning engagement and academic achievement in mathematics.

Generally, it suggests that students' emotional and cognitive involvement in learning decreases when interactive teaching techniques are used. As a result, it seems that students' cognitive and emotional involvement in education is minimal to nonexistent when ITS is implemented. However, the findings imply that the frequency of students' exercises with the ITS has little effect on their behavioral learning engagement.

Deslauriers et al. (2019) found that students engaged in active learning environments performed well but also reported a perception of having learned less. Some have posited that the disparity between students' perceptions of their engagement and the actual extent of their learning may be attributed to the increased cognitive effort required during active learning.

According to The Scholarly Teacher (n.d.), concerns about unfavorable impressions of interactive learning may influence student involvement and course evaluations. If students detest interactive approaches, their engagement levels may decrease.

CONCLUSION

Based on the summary of findings, several insightful conclusions were drawn. Grade 10 students strongly

perceived Interactive Teaching Strategies (ITS) as essential to learning mathematics, as these approaches significantly enhanced their motivation and engagement during lessons. The visual and interactive nature of ITS helped learners to better understand complex topics, fostered creativity, and developed their critical thinking skills.

In terms of emotional learning engagement, students demonstrated increased self-motivation, persistence in solving problems, and a growing awareness of their academic progress. For cognitive engagement, ITS played a crucial role in helping students connect prior knowledge with new concepts, deepening their understanding, and making recall easier. Moreover, ITS encouraged the development of analytical and creative abilities. Regarding behavioral engagement, students showed heightened responsibility and initiative, actively seeking resources, submitting work on time, and becoming more confident in tackling mathematical problems.

Notably, students' level of academic achievement was found to be very satisfactory, reflecting above-average performance and strong mathematical comprehension. This provides a valuable opportunity for teachers to offer constructive feedback that reinforces strengths and addresses learning gaps to further raise achievement levels.

Interestingly, correlation analysis revealed no significant relationship between the frequency of ITS use and overall academic achievement, suggesting that while ITS supports engagement, it may not directly influence grades. Additionally, cognitive and behavioral engagement did not show a significant link with the extent of ITS use, implying that excessive reliance on ITS could potentially limit these aspects of engagement. However, emotional engagement showed a significant positive correlation, highlighting that more frequent use of ITS enhances students' emotional connection to learning.

These findings emphasize the importance of a balanced and thoughtful integration of ITS, tailored to foster emotional engagement while complementing other pedagogical strategies to support comprehensive learning outcomes.

Conflict of Interests

The authors declared no conflict of interest.

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