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Learners' Mathematical Perspective and Cognitive Skills Through Interdisciplinary Integration Approach

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Abstract*—This study examined the correlation between the interdisciplinary integration approach and learners' mathematical perspective, and its effect on learners' mathematical cognitive skills, and the level of interdisciplinary integration, mathematical perspective, and cognitive skills. It used descriptive-predictive correlational research involving 68 Grade 8 students from Turbina National High School. Data were gathered through a research-made questionnaire and test questions. Data analysis involved the use of statistical techniques such as the mean, standard deviation, frequency, percentage, Pearson correlation analysis, and multiple regression analysis. Findings revealed that the interdisciplinary integration approach was implemented at a very high level across all dimensions. Learners also demonstrated a very high level of mathematical perspective, particularly in terms of learners' engagement and self-efficacy. However, learners' mathematical cognitive skills were noted to be at a satisfactory level. The interdisciplinary integration approach shows no significant relationship with learners' mathematical skills and no significant effect on learners' mathematical cognitive skills. The study found no significant relationship between the interdisciplinary integration approach and learners' mathematical perspective, nor any significant effect on cognitive skills, leading to the acceptance of both null hypotheses. Therefore, it can be concluded that the interdisciplinary integration approach alone may not automatically improve learners' perceptions unless it is implemented meaningfully, in ways relevant to learning needs, and that regular practice, mastery of basic mathematical concepts, and active participation remain important. Based on the findings, the study recommends continuing the interdisciplinary integration approach in mathematics to support better development and promote deeper understanding and higher-order thinking skills.*

***Keywords*—** *Mathematical perspective, cognitive skills, learner's engagement, reasoning, problem-solving.*

I. INTRODUCTION

Mathematics is considered one of the essential disciplines in education. It develops learners' reasoning, analytical thinking, and problem-solving abilities. It contributes not only in academic learning but also in understanding situations encountered in everyday life. As education evolves, teaching approaches also become more dynamic and learner-centered, focusing on meaningful learning experiences that connect knowledge across different disciplines.

One approach that has gained significance in modern education is interdisciplinary integration. This approach combines concepts, skills and learning experiences from various subject areas to promote a more holistic understanding of knowledge. Interdisciplinary integration allows learners to connect mathematical concepts with disciplines. Through these connections, learners are able to appreciate the practical applications of mathematics and recognize its value in different contexts. Scholars emphasized that interdisciplinary approach fosters deeper learning by bridging subject boundaries and encouraging holistic perspective (Oudenampsen et al. 2024). Problem-solving is enhanced when learners recognize connections to real-world applications and other disciplines.

Interdisciplinary integration also encourages active participation and meaningful engagement in the learning process. Exposing the learners to collaborative and context-based activities, the approach supports the development of cognitive skills such as critical thinking, reasoning, analysis, and decision-making. These cognitive skills are important in helping the learners' process information effectively, solve problems systematically, and apply learning in real-life situations.

The researcher aims to conduct a study on how blending mathematics with other disciplines can improve students' outlook toward the subject and strengthen their cognitive abilities. By integrating concepts and approaches across subjects, the study envisions equipping learners with broader perspectives, greater problem solving competence, and improved capacity for critical thinking. Additionally, it aims to provide knowledge and information on how linking mathematics with other disciplines can transform students' engagement, foster deeper understanding, and ultimately support their academic growth.

1.1 Statement of the Problem

Problem/s which were addressed by the research

This study aimed to determine the Learner's Mathematical Perspective and Cognitive Skills through Interdisciplinary Integration Approach.

Specifically, it sought to answer the following questions:

1. What is the level of Interdisciplinary Integration Approach in terms of:
   1.1. Technology Integration;
   1.2. curriculum Design;
   1.3. multidisciplinary Perspective; and
   1.4. relevance and connection?
2. What is the level of Learner's Mathematical Perspective in terms of:
   2.1. Attitudes towards Mathematics;
   2.2. self-efficacy; and
   2.3. learner's engagement?

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3. What is the level of Learner's Mathematical Cognitive Skills in terms of:
   3.1. Comprehension;
   3.2. Critical thinking;
   3.3. Problem-Solving Skills; and
   3.4. Mathematical Reasoning?
4. Is there a significant relationship between the Interdisciplinary Integration Approach and the Learner's Mathematical Perspective?
5. Is there a significant effect between the Interdisciplinary Integration Approach on the Learner's Mathematical Cognitive Skills?

II. Methodology

The study used descriptive-predictive correlational research involving 68 Grade 8 students from Turbina National High School. Data were gathered through a research-made questionnaire and test questions. Statistical tools such as mean, standard deviation, frequency, percentage, Pearson correlation analysis, and multiple regression analysis were used to analyze the data.

III. Results and Discussion

This part presents, analyzes, and interprets the data gathered that showed a significant relationship between the interdisciplinary integration approach and learner's mathematical perspective, and significant effect of interdisciplinary integration approach on the learner's mathematical cognitive skills

Level of Interdisciplinary Integration Approach

In this study, the level of Interdisciplinary Integration Approach refers to technology integration, curriculum design, multidisciplinary perspective, and relevance and connection.

The level of interdisciplinary integration approach in terms of technology integration, curriculum design, multidisciplinary perspective and relevance and connection, was treated statistically using mean and standard deviation.

Table 1 presents the level of interdisciplinary integration approach in terms of technology integration, including several indicators with their corresponding mean, standard deviation, and remarks.

The results demonstrate that teachers have shown a high level of effectiveness in using technology to facilitate student learning in mathematics. Using technology, students felt they were able to remember math concepts better and that they had improved their mathematical and digital literacy skills, whereas they also noticed that abstract ideas could be understood more clearly when using visual and interactive representations of those ideas. Technology-based activity was another way to increase students' problem-solving abilities as well as their ability to clearly visualize graphs, patterns, and relationships.

The majority of the respondents viewed technology integration through a weighted mean of 4.47 with a standard deviation of 0.84 as very high in providing meaningful learning experiences in the field of mathematics.

Table 1. Level of Interdisciplinary Integration Approach in Terms of Technology Integration

Statement When the teacher integrates technology…	MEAN	SD	REMARKS
…I can recall mathematical concepts better when technology is used in every lesson.	4.54	0.74	Strongly Agree
…I can develop both mathematical skills and digital literacy essential for problem-solving in modern contexts.	4.56	0.78	Strongly Agree
…mathematical concepts become more visual and interactive, which helps me understand abstract ideas.	4.49	0.84	Strongly Agree
…my problem-solving skills in mathematics have been enhanced through the use of technology-based activities.	4.22	1.02	Strongly Agree
…I can visualize graphs, patterns, and relationships clearly.	4.53	0.82	Strongly Agree
Weighted Mean	4.47		
SD	0.84		
Verbal Interpretation	Very High		

In summary, this implies that technology integration is an effective form of experiential learning and can help improve student engagement, understanding, and skill development in mathematics. The consistently high scores indicate that all teachers have the ability to effectively incorporate technology to create interactive, engaging, and innovative real world mathematics classrooms to support students with the concepts needed to improve their problem-solving capabilities.

Table 2. Level of Interdisciplinary Integration Approach in Terms of Curriculum Design

Statement When mathematics lessons are well-designed and well-organized…	MEAN	SD	REMARKS
…I am able to follow the procedures in solving mathematical problems.	4.04	0.76	Agree
…I can formulate and solves routine and non-routine problems.	3.88	0.82	Agree
…I clearly understand the objectives of the lesson needed to be attained.	4.18	0.85	Agree
…the sequence of activities helps me understand the lesson.	4.09	0.84	Agree
… I can create models, representations, or outputs using mathematical concepts.	4.34	0.68	Strongly Agree
Weighted Mean	4.11		
SD	0.79		
Verbal Interpretation	High		

Table 2 presents the level of interdisciplinary integration approach in terms of curriculum design, including several indicators with their corresponding mean, standard deviation, and remarks.

The results indicate that curriculum design is perceived to be effective in supporting students' learning in mathematics, as reflected by the consistently high ratings across all indicators. Students agreed that well-designed and organized mathematics lessons help them follow procedures in solving problems and understand the objectives that need to be achieved. They also recognized that the logical sequence of activities contributes to be better comprehension of the lesson. Moreover, students expressed confidence in their ability to formulate and solve both routine and non-routine problems, suggesting that the curriculum promotes critical thinking and problem-solving skills. Particularly, the highest mean score

(4.34) indicates that students strongly agree that they are able to create models, representations, or outputs using mathematical concepts, highlighting the effectiveness of the curriculum in fostering deeper understanding and application of knowledge.

Overall, the respondents rated curriculum design with a weighted mean of 4.11 and a standard deviation of 0.79, interpreted as high. This implies that the curriculum is well-structured and capable of facilitating meaningful learning experiences in mathematics.

In summary, the findings suggest that a well-planned and organized curriculum plays a significant role in enhancing students' understanding, procedural fluency, and ability to apply mathematical concepts. The positive responses indicate that effective curriculum design supports not only knowledge acquisition but also the development of higher-order thinking and practical skills in mathematics.

Table 3 presents the level of interdisciplinary integration approach in terms of multidisciplinary perspective, including several indicators with their corresponding mean, standard deviation, and remarks.

The results demonstrate that integrating mathematics with other subject areas contributes significantly to students' learning experiences. Students perceived that they are able to establish meaningful connections between mathematics and other disciplines, which allows them to apply mathematical knowledge in various academic contexts. They also recognized that such integration promotes a deeper understanding of lessons across disciplines and encourages them to think critically beyond a single subject area.

Table 3. Level of Interdisciplinary Integration Approach in Terms of Multidisciplinary Perspective

Statement When mathematics lessons are integrated with other subjects…	MEAN	SD	REMARKS
…I can identify connections between mathematics and other subjects.	4.54	0.76	Strongly Agree
…I can apply mathematical knowledge in different academic contexts.	4.49	0.70	Strongly Agree
…I develop a deeper understanding of the lessons across various disciplines	4.40	0.76	Strongly Agree
…I am encouraged to think critically across subject areas.	4.38	0.75	Strongly Agree
…I am able to use multiple strategies in solving problems.	4.26	0.98	Strongly Agree
Weighted Mean	4.41		
SD	0.78		
Verbal Interpretation	Very High		

Moreover, the use of a multidisciplinary perspective enables students to explore different strategies in solving problems, thereby enhancing their flexibility and adaptability in mathematical thinking. This approach supports the development of higher-order thinking skills as learners are exposed to diverse perspectives and applications of mathematical concepts.

The majority of the respondents viewed multidisciplinary perspective through a weighted mean of 4.41 with a standard deviation of 0.78 as very high in enhancing meaningful learning in mathematics.

In summary, this implies that a multidisciplinary perspective is an effective approach in fostering deeper understanding, critical thinking, and the ability to apply mathematical concepts across various disciplines.

Table 4. Level of Interdisciplinary Integration Approach in Terms of Relevance and Connection

Statement Seeing mathematics applied to real-life situations helps me to…	MEAN	SD	REMARKS
…retain the lesson more effectively.	4.35	0.69	Strongly Agree
…understand the value and importance of learning mathematics every day.	4.69	0.58	Strongly Agree
…develop a deeper understanding of mathematical concepts.	4.49	0.76	Strongly Agree
…relate and apply mathematical ideas beyond the classroom.	4.38	0.69	Strongly Agree
… appreciate the usefulness of mathematical problems in practical situations.	4.18	0.79	Agree
Weighted Mean	4.42		
SD	0.70		
Verbal Interpretation	Very High		

Table 4 presents the level of interdisciplinary integration approach in terms of relevance and connections, including several indicators with their corresponding mean, standard deviation, and remarks.

The results indicate that connecting mathematics to real-life situations plays a crucial role in enhancing students' learning experiences. Students perceived that when mathematical concepts are applied to everyday contexts, they are able to better retain the lessons and develop a deeper understanding of the subject. They also recognized the importance and value of mathematics in their daily lives, which increases their appreciation of the discipline.

Furthermore, real-life applications allow students to relate mathematical ideas beyond the classroom and see their practical use in solving real-world problems. This connection helps learners become more engaged and motivated, as they are able to see the relevance of what they are learning.

The majority of the respondents viewed relevance and connection through a weighted mean of 4.42 with a standard deviation of 0.70 as very high in promoting meaningful learning in mathematics.

In summary, this implies that establishing relevance and connection in mathematics instruction enhances students' understanding, retention, and appreciation of the subject by linking it to real-world experiences

Level of Learner's Mathematical Perspective

In this study, refers to the learners' view towards mathematics in terms of usefulness, application and personal interest. It also includes their appreciation and values towards academic and practical skills.

The level of learner's mathematical perspective in terms of attitudes towards mathematics, self-efficacy and learner's

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engagement was treated statistically using mean and standard deviation.

Table 5 presents the level of learner's mathematical perspective in terms of attitudes towards mathematics, including several indicators with their corresponding mean, standard deviation, and remarks.

Table 5. Level of Learner's Mathematical Perspective in Terms of Attitudes Towards Mathematics

Statement When learning mathematics, I…	MEAN	SD	REMARKS
…feel positive about participating in class activities.	4.18	0.85	Agree
…put effort into understanding challenging concepts.	4.53	0.74	Strongly Agree
…recognize the importance and application of mathematics real-life.	4.31	0.90	Strongly Agree
…value learning and mastering mathematical concepts.	4.10	0.79	Agree
…enjoy solving and analyzing mathematical problems.	4.06	0.90	Agree
Weighted Mean	4.24		
SD	0.84		
Verbal Interpretation	Very High		

The results show that students generally possess positive attitudes toward learning mathematics. They perceived that they are motivated to participate in class activities and are willing to exert effort in understanding challenging mathematical concepts. Students also recognized the importance and real-life applications of mathematics, which contributes to their appreciation of the subject.

Additionally, learners expressed that they value mastering mathematical concepts and experience enjoyment in solving and analyzing problems. These positive attitudes reflect their openness and willingness to engage in mathematical learning tasks.

The majority of the respondents viewed their attitudes toward mathematics through a weighted mean of 4.24 with a standard deviation of 0.84 as very high.

In summary, this implies that positive attitudes toward mathematics play a significant role in enhancing students' motivation, engagement, and overall learning outcomes in the subject.

Table 6. Level of Learner's Mathematical Perspective in Terms of Self-efficacy

Statement As a student, I feel capable of handling mathematics tasks…	MEAN	SD	REMARKS
…when I can develop strategies and use the skills I have learned to solve problems.	4.25	0.85	Strongly Agree
…when I apply what I've learned to solve problems independently.	4.66	0.77	Strongly Agree
…when I work persistently to improve my ability through practice and effort.	4.13	1.01	Agree
…when I can evaluate my ability to solve word problems correctly.	4.29	1.02	Strongly Agree
…If I am able to communicate or solve difficult mathematical problems.	4.76	0.58	Strongly Agree
Weighted Mean	4.42		
SD	0.84		
Verbal Interpretation	Very High		

Table 6 presents the level of learner's mathematical perspective in terms of self-efficacy, including several indicators with their corresponding mean, standard deviation, and remarks.

The results reveal that students have a strong sense of confidence in their ability to perform mathematical tasks. They perceived that they are capable of applying learned concepts to solve problems independently and are able to communicate solutions effectively, even when dealing with complex mathematical problems. This indicates a high level of belief in their own abilities.

Moreover, students recognized their capacity to develop strategies and utilize their skills in solving mathematical problems, as well as their ability to evaluate their own performance. They also demonstrated persistence in improving their abilities through continuous practice and effort.

The majority of the respondents viewed their self-efficacy through a weighted mean of 4.42 with a standard deviation of 0.84 as very high.

In summary, this implies that high self-efficacy enables students to approach mathematical tasks with confidence, persistence, and independence, which are essential for successful learning in mathematics.

Table 7 presents the level of learner's mathematical perspective in terms of learner's engagement, including several indicators with their corresponding mean, standard deviation, and remarks.

Table 7. Level of Learner's Mathematical Perspective in Terms of Learner's Engagement

Statement I actively engage in mathematics class by…	MEAN	SD	REMARKS
…asking questions during classroom discussions to clarify my understanding.	4.49	0.68	Strongly Agree
…participating in everyday discussions to understand the concept better.	4.56	0.66	Strongly Agree
…contributing ideas and information in problem-solving activities.	4.62	0.62	Strongly Agree
…trying to understand concepts deeply, even when challenging.	4.62	0.73	Strongly Agree
…acquiring further knowledge and information that will develop my critical thinking skills.	4.50	0.68	Strongly Agree
Weighted Mean	4.56		
SD	0.67		
Verbal Interpretation	Very High		

The results indicate that students are highly engaged in mathematics learning activities. They perceived that they actively participate in class discussions by asking questions, sharing ideas, and contributing to problem-solving activities. This active involvement helps them better understand mathematical concepts and enhances their learning experience. Furthermore, students demonstrated a willingness to deeply understand challenging concepts and to seek additional knowledge that can further develop their critical thinking skills. Their consistent participation and engagement reflect a strong interest in learning mathematics. The majority of the

respondents viewed their engagement through a weighted mean of 4.56 with a standard deviation of 0.67 as very high.

In summary, this implies that active learner engagement is a key factor in promoting deeper understanding, critical thinking, and sustained interest in mathematics learning.

Level of Learner's Mathematical Cognitive Skills

In this study, it refers to the process that involves understanding, applying and analyzing mathematical concepts that develop learner's comprehension, problem-solving, critical-thinking and reasoning.

The level of learner's mathematical cognitive skills in terms of comprehension, critical thinking, problem-solving skills and mathematical reasoning test was treated statistically using the frequency and percentage.

Table 8. Level of Learner's Mathematical Cognitive Skills in Terms of Comprehension

Scores	Frequency	Percentage	Description Equivalent
13-15	6	8.82%	Outstanding
10-12	17	25.00%	Very Satisfactory
7-9	19	27.94%	Satisfactory
4-6	18	26.47%	Fairly Satisfactory
0-3	8	11.76%	Needs Improvement
Total	68	100.00%	

Weighted Mean = 7.63
SD=3.17

Table 8 presents the level of learners' mathematical cognitive skills in terms of comprehension, including the distribution of scores with their corresponding frequency, percentage, and descriptive remarks.

The result revealed that majority of students scored within the satisfactory level range (27.94%) while there were nearly equal fractions in the Fairly Satisfactory level range (26.47%) and Very Satisfactory level range (25%). There were fewer students who scored at the outstanding level (8.82%) and some students scored within the Needs Improvement level (11.76%).

The weighted mean of 7.63 with a standard deviation of 3.17 indicates that in general the students scored at a satisfactory level on the comprehension of mathematics. However, the large standard deviation suggests that there is a large variance among the students, meaning some students understand mathematics well while other students experience difficulty in comprehending mathematics concepts.

In summary, this implies that students are at moderate levels of mathematics comprehension and the majority of students scored between satisfactory and fairly satisfactory comprehension levels. While there are higher order understanding students, there is a strong need for instructional support and interventions for students scoring in the lower range levels. By enhancing comprehension strategies and providing differentiated learning opportunities, student's overall mathematics performance can improve.

Table 9 presents the level of learners' mathematical cognitive skills in terms of critical thinking, including the distribution of scores with their corresponding frequency, percentage, and descriptive remarks.

The results revealed that the majority of students scored within the Very Satisfactory level range (51.47%), indicating that more than half of the respondents demonstrate strong critical thinking skills in mathematics. This is followed by students who fall under the Satisfactory level (30.88%), suggesting that a considerable number of learners possess adequate critical thinking abilities. A smaller proportion of students achieved Outstanding performance (7.35%), while only a few were classified under Fairly Satisfactory (5.88%) and Needs Improvement (4.41%).

Table 9. Level of Learner's Mathematical Cognitive Skills in Terms of Critical Thinking

Scores	Frequency	Percentage	Descriptive Equivalent
13-15	5	7.35%	Outstanding
10-12	35	51.47%	Very Satisfactory
7-9	21	30.88%	Satisfactory
4-6	4	5.88%	Fairly Satisfactory
0-3	3	4.41%	Needs Improvement
Total	68	100.00%	

Weighted Mean = 9.71
SD=2.47

The weighted mean of 9.71 with a standard deviation of 2.47 indicates that, in general, students performed at a Very Satisfactory level in terms of critical thinking. The relatively lower standard deviation suggests a more consistent performance among students compared to other skill areas.

In summary, this implies that most students have developed a strong level of critical thinking in mathematics, with the majority performing at satisfactory to very satisfactory levels. However, there is still a need to support students in the lower performance levels and to further enhance higher-order thinking skills among all learners.

Table 10 presents the level of learners' mathematical cognitive skills in terms of problem-solving skills, including the distribution of scores with their corresponding frequency, percentage, and descriptive remarks.

The results revealed that the majority of students scored within the Very Satisfactory level range (45.59%), indicating that a large proportion of learners demonstrate strong problem-solving skills in mathematics. This is followed by students in the Satisfactory level (27.94%), suggesting that many learners possess a sufficient ability to solve mathematical problems. Additionally, a notable percentage of students achieved Outstanding performance (13.24%), reflecting a group of learners with advanced problem-solving capabilities. Fewer students were classified under Fairly Satisfactory (11.76%), while only a minimal number fell under Needs Improvement (1.47%).

Table 10. Level of Learner's Mathematical Cognitive Skills in Terms of Problem-Solving Skills

Scores	Frequency	Percentage	Descriptive Equivalent
13-15	9	13.24%	Outstanding
10-12	31	45.59%	Very Satisfactory
7-9	19	27.94%	Satisfactory
4-6	8	11.76%	Fairly Satisfactory
0-3	1	1.47%	Needs Improvement
Total	68	100.00%	

Weighted Mean = 9.74
SD=2.77

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The weighted mean of 9.74 with a standard deviation of 2.77 indicates that, overall, students performed at a Very Satisfactory level in problem-solving skills. However, the relatively higher standard deviation suggests some variability in students' performance, indicating differences in their levels of problem-solving ability.

In summary, this implies that students generally exhibit strong problem-solving skills in mathematics, with most performing at satisfactory to very satisfactory levels. Nevertheless, there remains a need to provide targeted support for students with lower performance while continuing to challenge and develop those with higher-level skills.

As emphasized, effective problem-solving requires conceptual understanding, creativity, and persistence beyond procedural knowledge.

Table 11. Level of Learner's Mathematical Cognitive Skills in Terms of Mathematical Reasoning

Scores	Frequency	Percentage	Descriptive Equivalent
13-15	2	2.94%	Outstanding
10-12	16	23.53%	Very Satisfactory
7-9	9	13.24%	Satisfactory
4-6	24	35.29%	Fairly Satisfactory
0-3	17	25.00%	Needs Improvement
Total	68	100.00%	

Weighted Mean = 6.26
SD=3.53

Table 11 presents the level of learners' mathematical cognitive skills in terms of mathematical reasoning, including the distribution of scores with their corresponding frequency, percentage, and descriptive remarks.

The results revealed that the majority of students were classified under the Fairly Satisfactory level (35.29%), indicating that many learners demonstrate a basic level of mathematical reasoning but still require further development. This is followed by students in the Needs Improvement level (25.00%), suggesting that a significant proportion of learners experience difficulty in reasoning and justifying mathematical concepts. Meanwhile, 23.53% of the respondents achieved a Very Satisfactory level, and only a small percentage fell under the Satisfactory (13.24%) and Outstanding (2.94%) levels.

The weighted mean of 6.26 with a standard deviation of 3.53 indicates that, in general, students performed at a Fairly Satisfactory level in mathematical reasoning. The relatively high standard deviation suggests a wide variation in students' performance, implying that while some learners demonstrate strong reasoning skills, a considerable number struggle with this aspect of mathematics.

In summary, this implies that learners' mathematical reasoning skills are relatively lower compared to other cognitive domains, with many students performing at the fairly satisfactory to needs improvement levels. This highlights the need for targeted instructional strategies and interventions aimed at strengthening students' reasoning abilities, particularly in analyzing, justifying, and explaining mathematical ideas.

This shows a fairly satisfactory level of mathematical reasoning, support the findings of Segerby and Chronaki (2018). As emphasized, reasoning competence involves the ability to use mathematical concepts and methods to form solutions and model situations. This suggests that while some students demonstrate adequate reasoning skills, there is still a need to strengthen their ability to analyze and justify mathematical ideas.

Test of Significant Relationship between the Interdisciplinary Integration Approach and Learner's Mathematical Perspective

To test the significant relationship between the Interdisciplinary Integration Approach and Learner's Mathematical Perspective in terms of attitudes towards mathematics, self-efficacy and learner's engagement, was treated statistically using Jamovi 2.3.28 using the Pearson correlation coefficient.

Table 12 presents the relationship between the interdisciplinary integration approach and learners' mathematical perspective in terms of attitudes toward mathematics, self-efficacy, and learner engagement using the Pearson correlation coefficient.

Table 12. Interdisciplinary Integration Approach and Learner's Mathematical Perspective

Interdisciplinary Integration Approach		Learner's Mathematical Perspective		
		Attitudes towards Mathematics	SE	LE
Technology: Pearson Correlation		0.16	-0.15	0.07
Integration	Significance(2-Tailed)	0.319	0.230	0.584
	N	41	41	41
Curriculum: Pearson Correlation		0.29	0.12	-0.07
Design	Significance(2-Tailed)	0.066	0.900	0.574
	N	41	41	41
Multidisciplinary: Pearson Correlation		0.09	-0.17	0.18
		0.558	0161	0139
Perspective	Significance(2-Tailed)	41	41	41
	N			
Relevance: Pearson Correlation		0.38*	0.09	0.57***
and Connection	Significance(2-Tailed)	0.015	0.444	<.001
	N	41	41	41

Note: *p<.05, ** p<.01, ***p<.001

The results revealed that there is not a statistically significant relationship between the use of technology in instruction and math attitude (r = 0.16; p = 0.319), self-efficacy for math ability (r = -0.15; p = 0.230), or engagement in learning (r = 0.07; p = 0.584), despite its presence during instruction does not provide strong evidence for influencing students' math attitudes.

Likewise, curriculum design did not yield a statistically significant correlation with attitude towards math (r = 0.29; p = 0.066), self-efficacy (r = 0.12; p = 0.900) or engagement in learning (r = -0.07; p=0.574).

When looking at how interdisciplinary integration correlates to learners' attitude towards mathematics and how they engage with the subject matter, the results did not show a significant correlation in the areas of attitudes (r=0.09, p=0.558), self-efficacy (r=-0.17, p=0.161), or learner engagement (r=0.18, p=0.139) from an interdisciplinary perspective. Therefore, integrating interdisciplinary education by itself will not correlate how learners perceive mathematics or their level of engagement in learning about mathematics.

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Relevance and connection did demonstrate a weak positive correlation for learners' attitude towards mathematics (r=0.38, p=0.015), and showed a strong and significant correlation (r=0.57, p=0.001) with learner engagement. Relevance and connection did not demonstrate a significant correlation with self-efficacy (r=0.09, p=0.444). Thus, positively correlating learners' attitudes toward mathematics with real-world connections will contribute to learners developing a positive attitude toward the studying of mathematics and being actively engaged in learning mathematics.

In summary, only two aspects of interdisciplinary integration, relevance and connection, showed a significant relationship with learners' mathematical perspective as it relates to their attitude and engagement towards mathematics, while technological integration, curricular design, and multidisciplinary integration did not show a significant relationship. Therefore, it can be concluded that providing meaningful, real-world connections to the mathematics studied will promote students' interest and engagement in studying mathematics. However, other approaches to promoting engagement and interest in studying mathematics will require further refinement before they will produce a significant result.

The significant relationship between relevance, connection, and learners' perspectives is supported by Lucas Education Research (2021), which emphasized that real-life connections enhance student understanding and engagement. Likewise, Oudenampsen et al. (2024) highlighted that meaningful and authentic contexts are essential in strengthening interdisciplinary learning.

Test of Significant Effect of Interdisciplinary Integration Approach on the Learner's Mathematical Cognitive Skills

The significant effect of peer tutoring as an intervention strategy on the students' performance in mathematics in terms of summative test was treated statistically using Real Statistics Data Analysis Tools using multiple regression analysis.

A multiple regression analysis was conducted to determine whether the interdisciplinary integration approach, in terms of technology integration, curriculum design, multidisciplinary perspective, and relevance and connection, could significantly predict learners' mathematical cognitive skills.

ANOVA results did not reveal any statistically significant effect of the predictors of interdisciplinary integration variables on students' mathematical cognitive skills ($F(4,63)= 1.62$, $p = .180$). This indicates that the combination of predictors does not have a noteworthy effect on students' mathematical cognitive performance overall.

When considered separately, only the predictors of relevance and connection ($B = -0.52$, $t = -2.06$, $p = .043$) were statistically significant. This would imply that relevance and connection are associated with an increase in the development of students' mathematical cognitive skills, though, because of the negative relationship, it is reported to affect students in an inverse manner. However, predictors of technology integration ($B = .05$, $t = .24$, $p = .812$), curriculum design ($B = -0.47$, $t = -1.69$, $p = .096$), and multidisciplinary perspective ($B = -0.02$, $t = -.11$, $p = .916$) were all found to be statistically non-significant.

Table 13. Regression Analysis of Interdisciplinary Integration Approach on the Learner's Mathematical Cognitive Skills

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	6.11	4	1.53	1.62	0.180
	Residual	59.32	63	0.94		
	Total	65.43	67			

a. Dependent Variable: Learner's Mathematical Cognitive Skills_Overall

b. Predictors: Technology Integration, Curriculum Design, Multidisciplinary Perspective and Relevance and Connection

Coefficients[a]

Model	Unstandardized Coefficients B	Std. Error	T	Sig.
(Constant)	7.22	1.93	3.73	<.001
Technology Integration	0.05	0.22	0.24	0.812
Curriculum Design	-0.47	0.28	-1.69	0.096
Multidisciplinary Perspective	-0.02	0.23	-0.11	0.916
Relevance and Connection	-0.52	0.25	-2.06	0.043*

In summary, the predictors of interdisciplinary integration as an aggregate do not predict students' mathematical cognitive skills. Individual predictors only predict students' mathematical cognitive skills significantly, such as relevance and connection. This implies that providing students with educational experiences that are meaningful and tied to their life would enhance the development of their cognitive skills. On the contrary, the remaining predictors may need additional reinforcement to develop any discernible effect.

The findings shows that only selected components significantly affect cognitive skills are aligned with Kreijkes (2024), who noted that learning becomes effective when it is meaningful and structured. Similarly, Goos (2023) explained that integration in learning yields better cognitive outcomes when concepts are clearly connected and relevant.

IV. Conclusion and Recommendations

Interdisciplinary integration approach has no significantly relationship on learners' mathematical perspective, leading to the acceptance of the null hypothesis. This further implies that interdisciplinary integration alone may not automatically improve learners' perceptions and attitudes unless it is implemented consistently, meaningfully, and in ways that are relevant to students' experiences and learning needs.

Interdisciplinary integration approach has no significant effect on learners' mathematical cognitive skills, leading to the acceptance of the null hypothesis. Furthermore, it suggests that regular practice, mastery of basic mathematical concepts, and active learner participation remain important factors in developing mathematical cognitive skills.

In the formulated conclusions from the findings, the following recommendations are proposed:

Educational authorities may consider strengthening policies that promote interdisciplinary approaches in teaching mathematics to address learning gaps and improve overall student performance.

Administrators support professional development programs and training workshops that focus on interdisciplinary teaching strategies and innovative instructional approaches.

Curriculum planners design learning materials and activities that promote integration across disciplines while maintaining the rigor of mathematical concepts.

Teachers are encouraged to continuously incorporate interdisciplinary integration in their mathematics instruction. They should utilize technology, real-life applications, and connections to other subject areas to enhance student engagement and understanding.

Students may actively participate in interdisciplinary learning activities and develop a deeper appreciation of how mathematics applies to real-life situations and other subject areas.

Future studies may explore additional variables such as academic achievement, creativity, or the use of specific technological tools in interdisciplinary integration. They may also conduct experimental studies to further validate the effectiveness of this approach.

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