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Entity and Incremental Beliefs as Correlates of Mathematics Performance Among Junior High School Students

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Abstract: *This study examined the relationship between students' implicit theories of intelligence and their mathematics performance among junior high school learners in the Division of Malaybalay City, Bukidnon, Philippines. A total of 711 Grade 7 to 10 students enrolled during the school year 2022–2023 participated, representing schools of varying sizes across the division. Data were obtained simultaneously through secondary sources, namely students' officially recorded mathematics grades and responses to the Implicit Theory of Intelligence Scale (ITIS) developed by Abd-El-Fattah and Yates (2006), a 14-item, four-point Likert-type instrument with established reliability. Descriptive statistics including frequency counts, percentages, means, and standard deviations were computed to summarize performance levels and mindset orientations. Pearson product-moment correlation was employed to determine the influence of entity and incremental beliefs on mathematics performance, with assumptions of normality, linearity, and homoscedasticity verified prior to analysis. Results showed that most students performed within the satisfactory to very satisfactory levels, with relatively few attaining outstanding proficiency and only a small proportion failing to meet expectations. Analysis of the ITIS revealed that students leaned more toward incremental beliefs, endorsing effort and learning as means to develop intelligence, though traces of entity thinking remained, particularly the view that innate ability influences performance. Correlation analysis indicated that neither entity ($r = 0.067$, $p = 0.075$) nor incremental ($r = –0.052$, $p = 0.164$) beliefs exerted a significant influence on mathematics grades. These findings suggest that while mindset shapes students' attitudes and approaches to learning, mathematics achievement is likely influenced by a broader set of academic and contextual factors beyond implicit theories of intelligence.*

Keywords: Implicit Theory of Intelligence, Mathematics Performance, Correlation

1. INTRODUCTION

Mathematics has long been regarded as one of the core subjects essential to students' academic success and future opportunities, yet it continues to pose persistent challenges for many learners. The ability to perform well in mathematics is not only shaped by cognitive skills but also by motivational, affective, and belief systems that students bring into the learning process (Semeraro *et al.*, 2020; Svraka & Ádám, 2022; Silver *et al.*,2022). Among these belief systems, implicit theories of intelligence—commonly referred to as students' "mindsets"—have gained increasing attention in educational psychology. According to Dweck (2014), individuals differ in the extent to which they believe intelligence is a fixed trait (entity theory) or a malleable quality that can be developed through effort and learning (incremental theory). These orientations influence how students respond to challenges, setbacks, and effort, which in turn may shape their academic engagement and achievement.

Research has suggested that students who hold an incremental view of intelligence are more likely to embrace challenges, persist after failure, and adopt adaptive learning strategies, thereby increasing their likelihood of academic success (Blackwell, Trzesniewski, & Dweck, 2007). Conversely, students who endorse an entity perspective often avoid difficult tasks, interpret effort as a sign of low ability, and are more vulnerable to discouragement after failure, which can undermine performance. Despite this theoretical linkage, empirical studies have shown mixed results, with some confirming the influence of mindset on achievement and others reporting weak or nonsignificant associations (Burnette *et al.*, 2023; Macnamara & Burgoyne, 2023). This indicates the need for more context-specific investigations, particularly in mathematics, a subject often perceived as difficult and anxiety-inducing for learners (Bascones *et al.*, 2024).

In the Philippine context, mathematics performance has been a concern, as national and international assessments consistently highlight gaps in achievement across grade levels (Acido & Caballes, 2024; Bernardo *et al.*, 2022; Callaman & Itaas, 2020). At the same time, limited attention has been given to the role of students' psychological beliefs, such as implicit theories of intelligence, in shaping academic outcomes (Valdez, 2024; Montano, 2024). Understanding this relationship within local settings is essential, as it can inform both instructional strategies and policy interventions aimed at improving performance.

This study was conducted among high school students in the Division of Malaybalay City, Bukidnon, Philippines, to explore the relationship between students' implicit theories of intelligence and their mathematics performance. Using the Implicit Theory of Intelligence Scale (ITIS) developed by Abd-El-Fattah and Yates (2006) and secondary data on students' mathematics grades, the

research employed descriptive statistics to profile performance levels and mindset orientations, and Pearson correlation to examine possible associations between these variables. By doing so, the study sought to provide empirical evidence on whether students' beliefs about the nature of intelligence exert an influence on their achievement in mathematics. Ultimately, the findings aim to contribute to the growing body of knowledge on mindsets and learning while offering insights that can support teachers, curriculum planners, and policymakers in enhancing mathematics education.

2. METHODS

2.1 Research Design

This study employed a correlational research design to examine the relationship between students' implicit theories of intelligence and their mathematics performance. The design was appropriate because the goal was not to manipulate variables or establish causality, but rather to determine whether and to what extent students' beliefs about intelligence are associated with their academic outcomes in mathematics. This design allowed for the identification of patterns and directions of relationships—whether positive, negative, or absent—between mindset factors and achievement. However, while effective in establishing associations, correlational design does not capture causal mechanisms, meaning that other variables such as teaching methods, motivation, or learning strategies may also play a role in mathematics performance. Despite this limitation, the design was suitable for addressing the study's main objective, as it provided a systematic way to explore the influence of implicit theories of intelligence on students' mathematics outcomes.

2.2 Participants and Sampling

The participants of the study were high school students from Grades 7 to 10 enrolled during the school year 2022–2023 under the Division of Malaybalay City, Bukidnon, Philippines. A total of 711 students took part in the research, representing learners from schools of varying sizes within the division, ranging from mega schools with populations of about 10,000 to small schools with fewer than 500 students. This diversity in school size ensured that the sample reflected a wide range of educational environments and student backgrounds, providing a more comprehensive view of mathematics performance and implicit theories of intelligence. The sampling procedure employed was purposive, as the study specifically targeted students currently enrolled in mathematics subjects, making them directly relevant to the objectives of the research. While purposive sampling does not allow for full generalization to all learners outside the division, the substantial number of participants and the representation across different school categories strengthened the reliability of the findings and ensured that the data captured the breadth of student performance and mindset orientations within the Division of Malaybalay City.

2.3 Instrumentation

The study employed both a standardized instrument and official academic records to gather data on students' beliefs and performance. To measure students' implicit theories of intelligence, the Implicit Theory of Intelligence Scale (ITIS) developed by Abd-El-Fattah and Yates (2006) was used. The ITIS is a four-point Likert-type scale, ranging from 1 (strongly disagree) to 4 (strongly agree), consisting of 14 items, with half reflecting entity theory and the other half reflecting incremental theory. The reliability of the scale is well-established, with reported Cronbach alpha coefficients ranging from .78 to .83 for the two components, ensuring internal consistency and validity in measuring students' beliefs about intelligence. In addition to the ITIS, a brief profile of the participants was collected to capture their basic demographic and academic background. Students' mathematics performance was measured using their officially recorded grades, which provided an objective and standardized indicator for this study.

2.4 Data Gathering Procedure

The data for this study were obtained through secondary sources that had been collected simultaneously by the schools. Students' mathematics grades for the school year 2022–2023 were gathered at the same time that they completed the Implicit Theory of Intelligence Scale (ITIS), ensuring that performance records and mindset measures reflected the same academic period. The grades served as an objective indicator of mathematics achievement, while the ITIS responses provided insight into students' beliefs about the nature of intelligence. Since both sets of data were already available from school records and survey responses, the researcher did not administer new instruments but instead made use of existing information. This approach allowed for efficiency in data collection and minimized classroom disruptions, while also ensuring that the data reflected authentic student outcomes. Care was taken to uphold confidentiality and ethical handling of records, with only the information directly relevant to the study included in the analysis.

2.5 Statistical Treatment

The data gathered in this study were analyzed using both descriptive and inferential statistics. To describe the students' mathematics performance, frequency counts, percentages, means, and standard deviations were computed, which allowed the researcher to classify students into proficiency levels and determine the overall level of achievement. Similarly, descriptive statistics were applied to the Implicit Theory of Intelligence Scale (ITIS) to summarize students' responses to entity and incremental belief

items, providing a profile of their dominant mindset orientation. For inferential analysis, the Pearson product-moment correlation coefficient was used to examine the relationship between students' implicit theories of intelligence and their mathematics performance. This statistical test was appropriate because both variables were measured at the interval level, and the assumptions of normality, linearity, and homoscedasticity were satisfied. The correlation analysis determined the direction and strength of association between mindset factors and performance, with a significance level set at 0.05. Through this combination of descriptive and inferential procedures, the study was able to provide a comprehensive analysis of both the distribution of performance and beliefs as well as the possible influence of these beliefs on academic achievement in mathematics.

3. RESULTS AND DICUSSIONS

The table presents the descriptive summary of students' mathematics performance across five proficiency levels, covering a total of 711 learners. Their scores were grouped into categories ranging from "Outstanding" (90–100) to "Did Not Meet Expectations" (0–74). The distribution shows that most students performed in the middle ranges, with the overall mean score of 83.7 and a standard deviation of 8.79, suggesting that students' performance centers around the satisfactory level but still shows noticeable variation.

The largest proportion of students fell in the "Very Satisfactory" category (31.79%), followed closely by those in the "Satisfactory" level (28.27%). Together, these groups comprise about 60% of the population, reflecting that most students perform consistently above the minimum standard but not quite at the highest level. A substantial number of students, 18.28%, achieved "Outstanding" scores, showing that high excellence is possible and evident among a notable segment. Meanwhile, 20.25% were in the "Fairly Satisfactory" group, which indicates they are just at the passing threshold and may require additional support. Encouragingly, only a small fraction of students, 1.41%, did not meet expectations, suggesting that failure in mathematics is relatively uncommon in this sample.

The mean score of 83.7 places the average student in the satisfactory range, close to the "Very Satisfactory" threshold, meaning overall performance in mathematics is strong. However, the standard deviation of 8.79 indicates that there is a meaningful spread in achievement, with students distributed across different performance levels, from those excelling at the top to a handful struggling at the bottom. This spread suggests the presence of both advanced learners who may need enrichment and weaker learners who require intervention (Valenzuela & Gorosin, 2025; Lacio, 2025; Fuentes, 2025; Pedersen *et al.*, 2023).

Interpreting the results further, the dominance of the satisfactory-to-very-satisfactory range implies that mathematics learning outcomes are generally positive, though many students remain below the outstanding level. This pattern highlights the potential for improvement if instructional strategies are adjusted to help students push beyond proficiency into higher achievement. The low failure rate, meanwhile, is encouraging but signals that the small group of struggling learners should not be overlooked.

Table 1. Summary of the Descriptive Statistical Results of Students Mathematics Performance

Range	Level of Proficiency	Frequency	%	Mean	SD
90 – 100	Outstanding	130	18.28	83.7	8.79
85 – 89	Very Satisfactory	226	31.79		
80 – 84	Satisfactory	201	28.27		
75 – 79	Fairly Satisfactory	144	20.25		
0-74	Did Not Meet the Expectations	10	1.41		
	Total	711	100		

Table 2 presents the mean and standard deviation of students' implicit theories of intelligence, divided into two factors: entity beliefs, which consider intelligence to be fixed and unchangeable, and incremental beliefs, which see intelligence as malleable and capable of development. The values provide insights into how strongly students endorse each type of belief and where their perceptions of intelligence tend to lean.

Table 2. Mean and Standard Deviation of Students Implicit Theory of Intelligence

Statements	Mean	SD
Entity		
When I'm doing my work as a student, I feel bursting with energy.	2.52	0.673
Difficulties and challenges prevent you from developing your intelligence.	2.54	0.762
If you fail in a task, you question your intelligence.	2.85	0.710
When you exert a lot of effort, you show that you are not intelligent.	2.79	0.945
Your abilities are determined by how intelligent you are.	3.36	0.755
You are born with a fixed amount of intelligence.	2.15	0.943
Mean	2.70	0.886
Incremental		
The effort you exert improves your intelligence.	3.10	0.758
You can develop your intelligence if you really try.	2.79	0.735
When you learn new things, your basic intelligence improves.	3.20	0.765
If you fail in a task, you still trust your intelligence.	2.72	0.861
Performing a task successfully can help develop your intelligence.	2.79	0.895
Good preparation before performing task is a way to develop your intelligence.	2.83	0.815
Mean	2.90	0.827

For the entity theory items, the highest mean score was observed in the statement "Your abilities are determined by how intelligent you are" (M = 3.36, SD = 0.755), showing that many students still believe intelligence plays a determining role in their abilities. The items "If you fail in a task, you question your intelligence" (M = 2.85, SD = 0.710) and "When you exert a lot of effort, you show that you are not intelligent" (M = 2.79, SD = 0.945) reflect a moderate tendency to equate failure or exertion with lower ability. Meanwhile, weaker endorsement was given to "When I'm doing my work as a student, I feel bursting with energy" (M = 2.52, SD = 0.673) and "Difficulties and challenges prevent you from developing your intelligence" (M = 2.54, SD = 0.762), suggesting that most students do not strongly connect obstacles with intellectual limits. The lowest endorsement came from "You are born with a fixed amount of intelligence" (M = 2.15, SD = 0.943), indicating that students largely reject the strictest form of fixed-mindset belief. Considering all six statements, the overall mean for entity theory was 2.70 with a standard deviation of 0.886, pointing to a moderately low level of fixed thinking among students. While some fixed beliefs remain, particularly the idea that ability is shaped by intelligence, students generally do not fully embrace entity perspectives (de Kraker-Pauw *et al,* 2022; Scherer *et al.,* 2022; Limeri *et al,* 2020).

For the incremental theory items, higher means were observed across most statements compared to the entity factor. The highest endorsement was for the statement "When you learn new things, your basic intelligence improves" (M = 3.20, SD = 0.765), followed closely by "The effort you exert improves your intelligence" (M = 3.10, SD = 0.758). These results show that students generally recognize the role of learning and effort in strengthening their intelligence. Moderate agreement was also seen for "Good preparation before performing a task is a way to develop your intelligence" (M = 2.83, SD = 0.815), "Performing a task successfully can help develop your intelligence" (M = 2.79, SD = 0.895), and "You can develop your intelligence if you really try" (M = 2.79, SD = 0.735). The lowest mean in this set came from "If you fail in a task, you still trust your intelligence" (M = 2.72, SD = 0.861), suggesting that although students value effort and preparation, failure can still undermine their confidence in their intelligence. Taken together, the overall mean for incremental theory was 2.90 with a standard deviation of 0.827, reflecting a stronger endorsement of growth-oriented beliefs compared to fixed ones. This indicates that students lean toward the view that intelligence can be developed, though their incremental orientation is not absolute (Blackwell *et al.,* 2007; Rattan *et al.,* 2012).

Table 3 presents the bivariate correlations between students' implicit theory of intelligence (entity and incremental factors) and their mathematics performance. Before performing the correlation analysis, the assumptions of normality, linearity, and homoscedasticity were examined and found to be sufficiently met, allowing the Pearson correlation test to be appropriately applied. This ensures that the results can be interpreted with confidence regarding the relationships between the variables.

The results show that the correlation between entity beliefs and mathematics performance was positive but very weak (r = 0.067, p = 0.075). Since the p-value is greater than the 0.05 level of significance, this relationship is not statistically significant. This indicates that holding stronger entity beliefs, such as the idea that intelligence is fixed, does not have a meaningful influence on students' mathematics grades in this sample. In practical terms, whether students believe intelligence is innate or limited does not significantly affect their performance in mathematics.

Table 3. Bivariate Correlation Between Students' Implicit Theory of Intelligence Factors and Mathematics Performance

Variables		Person r	p-value
Entity	-Grades	0.067	0.075
Incremental	-Grades	-0.052	0.164

*Correlation is significant at alpha 0.05

Meanwhile, the correlation between incremental beliefs and mathematics performance was slightly negative ($r = –0.052$, $p = 0.164$). Again, this relationship is very weak and statistically non-significant, as the p-value is above 0.05. This finding suggests that endorsing growth-oriented beliefs, such as effort and preparation improving intelligence, does not exert a direct influence on mathematics grades in this dataset. Although students generally lean more toward incremental beliefs than entity beliefs, these views do not appear to translate into measurable differences in mathematics achievement when analyzed statistically.

Overall, the results of the correlation analysis indicate that neither entity nor incremental beliefs exert a significant influence on students' mathematics performance in this study. This suggests that while implicit theories of intelligence may shape how students approach learning tasks and challenges, their direct effect on grades may be overshadowed by other academic and contextual factors such as prior knowledge, study habits, classroom instruction, and assessment conditions (Costa & Faria, 2018; Bonne & Johnston, 2016; Flanigan *et al*, 2017; Blackwell, 2007; Bonne & Johnston, 2016). The non-significant findings emphasize the complexity of academic performance and imply that implicit theories may interact with, rather than independently determine, students' outcomes in mathematics.

4. CONCLUSION AND RECOMMENDATION

The results of the study reveal that students' mathematics performance is generally satisfactory, with the majority falling within the satisfactory and very satisfactory levels and only a small proportion failing to meet expectations. This indicates that, as a group, students demonstrate adequate competency in mathematics, though there remains room for improvement in lifting more learners into the outstanding category. In terms of mindset, students lean more toward an incremental theory of intelligence, recognizing that effort, preparation, and learning can enhance their intellectual capacity. However, traces of entity thinking remain, particularly the belief that innate ability influences outcomes, and these views may contribute to differences in confidence when facing challenges or failures. Despite these tendencies, the correlation analysis shows that neither entity nor incremental beliefs exert a significant influence on mathematics performance, suggesting that while mindset shapes students' attitudes toward learning, it does not directly determine academic outcomes in this context. Instead, mathematics achievement likely arises from the combined effects of multiple factors such as instructional quality, study strategies, and prior knowledge. Overall, the findings underscore the importance of fostering growth-oriented beliefs while also addressing other academic supports, as implicit theories of intelligence alone are not sufficient to drive measurable differences in mathematics achievement.

Based on the findings, several recommendations may be drawn for practice, policy, and future research. Since most students perform at satisfactory and very satisfactory levels, teachers should provide enrichment activities and higher-order problem-solving tasks to help more learners move toward the outstanding category, while also giving targeted support to those who are only fairly satisfactory or did not meet expectations. Given that students lean toward incremental beliefs but still retain traces of entity thinking, schools should promote growth mindset interventions, such as classroom discussions that frame mistakes as opportunities for learning and feedback that emphasizes effort, strategies, and persistence over innate ability. This can help students sustain confidence, especially when they encounter difficulties in mathematics. Although implicit theories of intelligence did not show a significant direct influence on mathematics performance, they remain valuable in shaping students' motivation and resilience; therefore, programs that integrate study skills training, collaborative learning, and metacognitive strategies should be implemented alongside mindset development. At the policy level, curriculum planners may consider embedding activities that highlight the connection between effort and achievement, ensuring that assessment practices encourage perseverance and problem-solving rather than rote performance alone. Finally, future research could examine how implicit theories interact with other variables such as self-efficacy, learning strategies, or teaching methods, to better understand the complex factors influencing mathematics performance.

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