Finding the Mathematical Connectivity of the Emotional Intelligence Skills through Numeracy Capability

RESEARCH ARTICLE

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This article is part of a special issue titled Sustainability, Innovation, and Development: A Festschrift in honour of Rt. Rev. Prof. Obeka Samuel Sunday.

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ABSTRACT

This study investigated the relationship between emotional intelligence (EI) and numeracy capability among students with Basic School Leaving Certificates in the Central Senatorial District of Ondo State, Nigeria. Aligned with educational policies promoting foundational numeracy for holistic development, the study examined whether EI is mathematically connected to numeracy skills. A correlational survey design was adopted, involving 385 students selected through multi-stage sampling. The research drew on Sternberg's Triarchic Theory of Intelligence, Mayer and Salovey's Ability Model, and Goleman's Emotional Intelligence Theory. Data were collected using a researcher-adapted Emotional Intelligence Scale and a numeracy test focussed on foundational number concepts. Pearson's Product-Moment Correlation showed a statistically significant but weak positive relationship between EI and numeracy ($r = 0.118$, $p = 0.044$). The effect size (Cohen's $d = 0.238$) indicated a small yet educationally meaningful impact. Contextual factors such as school location and educational background potentially moderated the relationship, with urban and private school students performing better overall. The findings align with existing literature linking emotional regulation, motivation, and self-awareness to academic achievement. The study concludes that EI contributes modestly to numeracy development, supporting the integration of Social-Emotional Learning (SEL) into mathematics education. Recommendations include SEL-focussed policy, teacher training, and further research on moderating variables.

Methodology

Correlational survey design using multi-stage sampling with 385 students from the Central Senatorial District of Ondo State

Key Variables

Emotional intelligence and numeracy capability among Basic School Leaving Certificate holders

Main Finding

Weak but significant positive relationship ($r = 0.118$, $p = 0.044$) with small effect size ($d = 0.238$)

Keywords: Emotional Intelligence, Numeracy Capability, Foundational Mathematics, Social-Emotional Learning, Educational Psychology.

INTRODUCTION

The goal of Nigeria's educational policy is to advance the academic framework. This is among the justifications for providing universal education to all citizens. Various approaches must be used based on the requirements and opportunities for these persons. Every child should be taught the fundamentals of numbers starting in pre-primary school as part of the goals and objectives of Nigerian education (Odimayo, 2020). Every child benefits from this as they prepare for their foundational education. A child engaged in basic education usually finishes three years of junior secondary (also known as upper basic) school and six years of primary (also known as lower basic) school. Every pupil is supposed to acquire fundamental numeracy abilities during these nine years.

Natural numbers, like 1, 2, 3, and so forth, are some of the fundamentals of numbers. They support numeracy capability by forming the foundation for counting, ordering, and performing basic arithmetic operations. Understanding natural numbers helps learners develop key skills such as recognising quantity, comparing values, and identifying number patterns. These are necessary for resolving common issues, such as managing finances, counting objects, and comprehending time. By mastering natural numbers, individuals build confidence and accuracy in mathematical thinking, which strengthens their overall numeracy (Mathematicshub, 2024). Numerals are the human-created symbols used to represent numbers, while numbers themselves are the quantity. The numeral "4" represents the number four. The number four is also denoted by the Roman numeral "IV" (Burnstein, 2023). Cardinal numbers express quantity, such as 30 bags, while ordinal numbers indicate position, such as 1st place. Integers include positive and negative whole numbers; prime numbers have exactly two factors, whereas composite numbers have more. Numbers may also be classified as even or odd, or as belonging to finite, infinite, countable, or uncountable sets–concepts foundational to elementary number theory (Burton, 2011).

01

Pre-Primary Foundation

Introduction to basic number concepts and counting skills as foundational preparation for formal education.

02

Nine-Year Basic Education

Six years of primary (lower basic) and three years of junior secondary (upper basic) focused on developing numeracy skills.

03

Mathematical Thinking Development

Building confidence and accuracy through mastery of natural numbers, numerals, and arithmetic operations.

These statements by Odimayo (2020) align with current research showing that education plays a crucial role in developing emotional intelligence (EI) by fostering self-awareness, empathy, responsible decision-making, and moral reasoning. Social and Emotional Learning (SEL) programmes in schools help students recognise right from wrong and cultivate positive mindsets, contributing to their emotional, social, and psychological growth (Martínez et al., 2021; CASEL, 2024).

Programmes supporting the holistic development outlined by Odimayo (2020) prepare students for personal well-being and academic success. This development relies on engaging with educational processes and acquiring fundamental mathematical skills. The level of support required varies based on a student's grasp of mathematical foundations like number sense and basic operations. Mathematical comprehension can influence the pace of emotional development. Findings suggest a strong grasp of basic mathematics accelerates emotional development by fostering confidence, reducing negative emotions, and promoting intrinsic motivation. This cognitive-emotional link, observable from early childhood through primary school, aligns with frameworks like Control-Value Theory (Putwain et al., 2020).

CONCEPTUAL REVIEW

Emotional Intelligence

"Emotional" refers to a person's feelings, typically defined by strong emotions, or having emotions easily aroused and expressed (Oxford Dictionary, n.d.). Being emotional means being overly influenced by feelings. Emotion can incite actions or experiences leading to pleasant or unpleasant states, akin to excitement. Intelligence is the capacity to acquire and use knowledge and skills.

Intelligence involves the ability to reason, learn and effectively apply knowledge to solve problems and understand complex ideas (APA, 2023), reflecting both cognitive ability and subject comprehension. Emotional Intelligence (EI) is the ability to perceive, regulate, and express emotions, whilst thoughtfully managing social relationships (Cherry, 2025). Goleman's model highlights five core EI traits: self-awareness, self-regulation, motivation, empathy, and social skills, which are crucial for personal and professional success (Goleman, 2023; Cherry, 2025). To ascertain means to discover, identify, or understand something with certainty, often through research or enquiry (Cambridge, n.d.; Google, 2024).

Numeracy Capability

Emotional demands are universal, but individuals differ in how they perceive and manage emotions, as explained by Goleman's trait-based model and Mayer & Salovey's ability-based theory. These foundational models highlight that emotional intelligence involves recognising, understanding, and regulating emotions in oneself and others (Goleman, 2023; Mayer et al., 2024). Rather than classifying people by shared emotional traits, it is more accurate to gauge variations in emotional demands based on an individual's level of occurrence (or degree). These demands might also be more essential and fundamental than often considered (LumenLearning, n.d.). Similarly, a person's social, mental, physical, emotional, moral, and psychological growth depends on comprehending mathematical fundamentals throughout their educational process (Odimayo, 2020).

Emotional Intelligence Components

Self-awareness, self-regulation, motivation, empathy, and social skills essential for personal development.

Numeracy Foundation

Understanding of basic number concepts, counting, arithmetic operations, and mathematical reasoning skills.

Educational Integration

Holistic development through a combination of cognitive skills and emotional competencies in learning.

THEORETICAL REVIEW

Three prominent theories of intelligence will serve as the foundation for this research: Howard Gardner's theory of multiple intelligences, Robert Sternberg's triarchic theory, and Charles Spearman's g-factor theory. British psychologist Charles Spearman proposed that intelligence comprises a generic component, denoted as "g," which represents the common underlying factor among individuals that can be measured and compared (Cianciolo & Sternberg, as cited in LumenLearning, n.d.). From this perspective, the "g" factor provides a basis for understanding how a person's numeracy skills might reflect or correlate with their emotional intelligence, suggesting a shared cognitive foundation. Recent meta-analytic evidence further reinforces the importance of emotional intelligence in academic contexts: MacCann et al. (2020) in Psychological Bulletin found that EI significantly predicts academic performance ($\rho = .20$, $N = 42{,}529$). Specifically, ability EI emerged as the strongest predictor ($\rho = .24$), explaining additional variance beyond intelligence and personality, with the understanding and management branches of EI contributing 3.9% and 3.6% additional variance, respectively, to academic outcomes.

Later on, intellect was refined into two categories: fluid and crystallised. While fluid intelligence aids in navigating complex, abstract daily challenges, crystallised intelligence is applied to solve clear, straightforward problems (Cattell, 1963). Subsequently, Robert Sternberg formulated the triarchic theory of intelligence, which divides intelligence into three categories: analytical, creative, and practical (Figure 1).

Triarchic Intelligence by Robert Sternberg

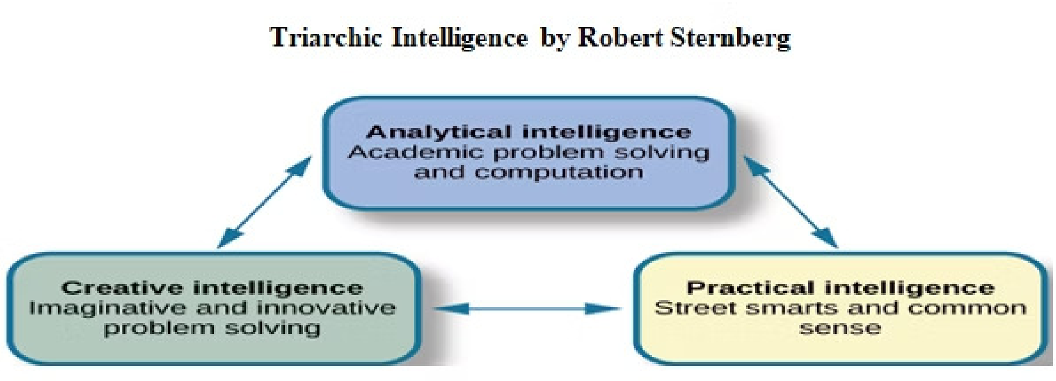

Figure 1: Triarchic Intelligence by Robert Sternberg

Source: LumenLearning, n.d.

Practical intelligence encompasses street smarts and common sense, while creative intelligence involves imaginative and inventive problem-solving skills. Analytical intelligence, on the other hand, deals with academic computation and problem-solving (LumenLearning, n.d.). As indicated by the arrows in Figure 1, these three forms of intelligence are intertwined and mutually influential. This interconnectedness suggests that numeracy, as a core component of analytical intelligence, can interact with and be influenced by practical and creative aspects of intelligence, which also involve emotional regulation and understanding. For instance, practical intelligence may involve the emotional wisdom to apply numerical knowledge effectively in real-world scenarios, while creative intelligence might leverage emotional insights to devise novel approaches to mathematical problems. Therefore, Sternberg's theory provides a framework for understanding how emotional and numerical abilities are not isolated but rather contribute synergistically to overall intelligent functioning.

Neuropsychological evidence further highlights the intricate link between emotional regulation and mathematical cognition. Research indicates that emotional regulation strategies directly impact working memory capacity during mathematical tasks, suggesting that individuals who can effectively manage their emotions are better equipped to allocate cognitive resources to numerical processing. Conversely, phenomena such as maths anxiety are known to interfere significantly with the cognitive resources needed for numerical processing, thereby impairing performance. This underscores that emotional states and regulatory capacities are not peripheral but central to how individuals engage with and succeed in numeracy tasks.

Howard Gardner proposed the theory of multiple intelligences, a relatively recent notion positing that each human possesses at least eight distinct intelligences, with emotional intellect being one of them. Emotional intelligence, within Gardner's framework, is formed by a combination of interpersonal (understanding and interacting with others) and intrapersonal (understanding oneself) intelligences. Gardner's theory suggests that individuals typically excel in some intelligences while encountering challenges in others (Gardner, as cited in LumenLearning, n.d.). This implies that, while some individuals may possess high logical-mathematical intelligence (directly relevant to numeracy), their emotional intelligence (interpersonal and intrapersonal) could play a crucial role in how they apply, adapt, and even overcome difficulties in numerical tasks. For example, strong intrapersonal intelligence might enable better self-regulation of maths anxiety, while interpersonal intelligence could facilitate collaborative problem-solving in numeracy. Thus, Gardner's theory supports the idea that different forms of intelligence, including emotional and numerical, are interconnected and contribute to an individual's overall cognitive profile, rather than existing in isolation.

Moreover, the relationship between emotional intelligence and numeracy performance is often mediated by several key psychological variables. Anxiety, particularly maths anxiety, can significantly impair cognitive resources necessary for numerical tasks, acting as a negative mediator. Conversely, motivation can positively influence persistence and engagement with mathematical challenges, enhancing numeracy outcomes. Self-efficacy, or an individual's belief in their capacity to succeed in mathematical tasks, also plays a critical mediating role, impacting effort and resilience. Finally, working memory, which is influenced by emotional regulation, is a direct cognitive mediator, as it underpins the ability to hold and manipulate numerical information. Understanding these mediating variables is essential for a comprehensive theoretical framework linking emotional intelligence and numeracy.

Spearman's g-Factor Theory

Intelligence as a general component (g) that can be measured and compared across individuals, providing a foundational link between numeracy and emotional intelligence assessment.

Sternberg's Triarchic Theory

Three interconnected categories: analytical (academic computation), creative (innovative problem-solving), and practical (street smarts and common sense), illustrating how emotional wisdom impacts the application of numerical abilities.

Gardner's Multiple Intelligences

Eight different intelligences including emotional intelligence (interpersonal and intrapersonal), indicating varying strengths that influence how individuals engage with and succeed in numerical tasks.

The Hypothetical Theoretical Framework

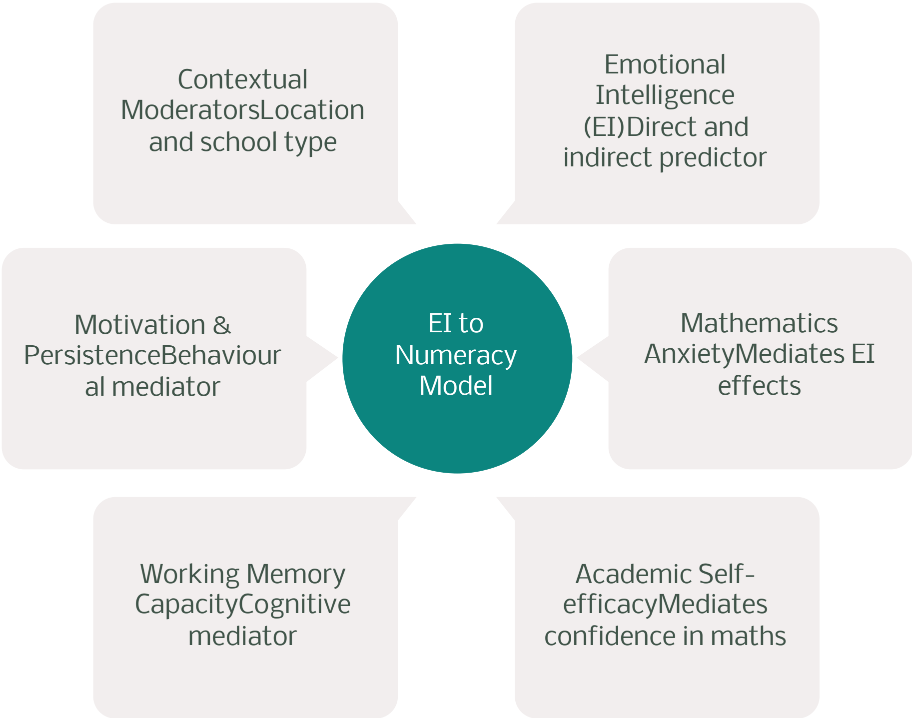

Figure 2: Conceptual Framework of the Study

Since emotional intelligence can be measured and compared amongst people, it may be determined to be either high or low. Similarly, mathematical connections can indicate a person has a high or low numeracy ability. Additionally, this study measured some categorical characteristics that might explain why individuals fall into the high or low group. Thus, the study's conceptual theoretical framework, incorporating direct and indirect pathways and moderating factors, was depicted in Figure 2.

A theoretical framework for applying numeracy ability to understand the mathematical connection of emotional intelligence skills shows that the numeracy ability level of people with primary school leaving certificates may impact the mathematical connection of emotional intelligence skills. Learning the fundamentals of numbers, such as natural numbers, numerals, cardinal and ordinal numbers, integers, prime and composite numbers, and distinctions between finite, infinite, odd, and even sets, does more than build numeracy skills; it also supports emotional intelligence. As learners engage with these concepts, they develop cognitive abilities like logical reasoning, pattern recognition, and problem-solving, which are closely linked to emotional regulation (Schoenherr et al., 2025; Caballero-Carrasco et al., 2021).

Moreover, the relationship between emotional intelligence and numeracy performance is often mediated by several key psychological variables. For instance, emotional regulation strategies directly impact working memory capacity during mathematical tasks, suggesting that individuals who can effectively manage their emotions are better equipped to allocate cognitive resources to numerical processing. Conversely, phenomena such as maths anxiety are known to interfere significantly with the cognitive resources needed for numerical processing, thereby impairing performance, serving as a key mediator where high EI can lead to lower maths anxiety and, consequently, better numeracy. Academic self-efficacy, or an individual's belief in their capacity to succeed in mathematical tasks, also plays a critical mediating role: stronger EI can lead to higher self-efficacy, which in turn improves numeracy performance. Furthermore, EI fosters better emotional regulation, contributing to increased motivation and persistence, sustaining effort in challenging maths tasks. This underscores that emotional states and regulatory capacities are not peripheral but central to how individuals engage with and succeed in numeracy tasks (Pekrun et al., 2007). This also links to Sternberg's practical intelligence, where EI facilitates adaptive responses to academic challenges, allowing individuals to apply numerical knowledge effectively in real-world scenarios.

Mastery of foundational mathematics often builds confidence and reduces anxiety, enhancing a learner's capacity for perseverance, self-control, and adaptive coping in challenging academic situations. Developing number fundamentals strengthens more than academic skills. It also supports cognitive processes that are essential for emotional regulation, helping learners manage frustration, persist through mistakes, and feel secure in learning environments. In this way, numeracy contributes to both cognitive development and emotional self-regulation (Blair & Razza, 2007; Duncan et al., 2007). Individuals may have a high or low level of numeracy ability, depending on their region, area of expertise, and educational background. These contextual factors, such as location and school type, can also moderate the strength of the relationship between emotional intelligence and numeracy capabilities, influencing how effectively EI translates into numerical proficiency. Similar to how specific situations may impact an individual's mathematical aptitude, so too may the performance level of emotional intelligence skills in such persons. These people's intrapersonal and interpersonal intelligence can be used to gauge their emotional intelligence levels. The degree to which a person demonstrates the two forms of emotional intelligence and the outcome of the instruction they received while learning the fundamentals of mathematics in elementary school, may determine how practical their emotional intelligence skills are. Thus, this study aims to determine the mathematical connectedness of emotional intelligence skills by examining these direct, indirect, and moderated pathways.

Table 1: Cognitive and Emotional Intelligence Links in Foundational Mathematics

Mathematical Concept	Cognitive Skill	Emotional Intelligence Link	Supporting Citation
Natural/Cardinal Numbers	Counting, comparison	Promotes confidence, reduces uncertainty	Baroody et al., 2020; Pekrun et al., 2023
Ordinal Numbers	Sequencing, logic	Enhances self-regulation through structured thinking	Limone & Toto, 2021
Prime/Composite Numbers	Problem-solving, reasoning	Encourages resilience when tackling complex challenges	Fernández-Castillo & Gutiérrez-Santuiste, 2021
Finite/Infinite Concepts	Abstract thinking	Supports emotional flexibility and tolerance of ambiguity	Valle et al., 2023
Odd/Even Numbers	Categorization	Builds self-efficacy through pattern recognition	Baroody et al., 2020; Pekrun, 2022

The independent variable for this study was Numeracy Capability (Continuous), while the dependent variable was Emotional Intelligence Skills (Ordinal) (see Table 1).

The Moderating (Categorical) Variables were Location (Nominal), Subject Specialisation (Nominal), and Highest Educational Qualification (Nominal).

STATEMENT OF THE PROBLEM

Nigeria's educational policy emphasises foundational numeracy as essential for learners' academic and holistic development. However, students' ability to acquire numeracy skills may be influenced by their emotional intelligence (EI), the capacity to recognise, regulate, and manage emotions. Emotional challenges like anxiety or low self-efficacy can hinder mathematical learning, while strong EI may enhance persistence and problem-solving.

Although theory suggests a connection between numeracy and EI, empirical evidence, particularly among Nigerian students, remains limited.

Contextual factors such as school location and educational background may further affect this relationship.

This study, therefore, sought to determine the statistically significant relationship between emotional intelligence and numeracy capability.

Core Problem

- Limited empirical evidence on EI-numeracy relationship.
- Influence of contextual factors unclear.
- Gap in understanding among Nigerian students.

Research Need

- Examine the statistical relationship between EI and numeracy.
- Consider moderating factors like location and educational background.
- Provide evidence for educational policy development.

Research Objective

The study's objective was to determine the relationship between emotional intelligence and numeracy capability, specifically exploring their mathematical connectivity.

Research Questions:

1. Is there any mathematical connectivity between students' emotional intelligence and numeracy capability?

2. Is there any relationship between students' emotional intelligence and numeracy capability?

METHODOLOGY

This study utilised a correlational survey research design. This design was chosen to explore the statistical relationship between students' emotional intelligence and numeracy capability, and to identify any mathematical connectivity between these factors in students with Basic School Leaving Certificates in Ondo State, Nigeria, without manipulating variables.

Population and Sampling

The target population consisted of students in the Central Senatorial Districts of Ondo State, Nigeria, who hold Basic School Leaving Certificates (having completed nine years of basic education), having been exposed to foundational numeracy and possessing varying levels of emotional intelligence. A multi-stage sampling procedure was employed: Stage 1 involved stratified sampling of schools by location (urban/rural). Stage 2 used purposive sampling to select schools offering mathematics-based subjects to students who had completed basic education. Stage 3 drew a random sample of 385 students from these selected schools to ensure statistical power and generalisability.

Power Analysis and Sample Size Justification

A power analysis determined the sample size of 385 students. This was based on detecting a moderate effect size ($r = 0.3$) with 80% power at a 0.05 significance level. This size ensures statistical power and generalisability within the specified population, allowing detection of meaningful relationships between emotional intelligence and numeracy. The minimum detectable effect size under these constraints is approximately $r = 0.15$, providing reasonable sensitivity.

Instrumentation

Emotional Intelligence (EI), the dependent variable, was operationalised using a researcher-developed self-report scale. This scale, adapted from Schutte et al.'s (1998) Emotional Intelligence Scale (EIS) based on Salovey and Mayer's ability model, comprises 11 items rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), yielding total scores from 11 to 55. These continuous scores were then converted into ordinal categories: low, moderate, and high EI.

Score Range	Ordinal Category	Interpretation
11-14	Low EI	Below average emotional skills
15-28	Moderate EI	Average or typical abilities
29-55	High EI	Above average or strong EI

Expert review by mathematics education and test & measurement professionals ensured the questionnaire's face, construct, and content validity. A pilot test was conducted in a similar district. The numeracy instrument demonstrated a reliability coefficient of 0.772, while the emotional intelligence scale's reliability was established using R Studio's ordinal alpha function. Specific reliability coefficients (e.g., Cronbach's alpha) were calculated for both instruments to ensure internal consistency. Construct validity was also assessed for both instruments, confirming they accurately measure their intended constructs within the Nigerian educational context. Cultural bias in the adapted EI tool was carefully addressed during adaptation and validation. Instruments were refined based on feedback. For data collection, necessary permissions were secured from school authorities and local education boards. Trained research assistants (Mathematics Teachers from selected schools) administered the instruments in person. Students completed the numeracy test and EI questionnaire under supervision to minimise bias and ensure uniform understanding.

Design

Correlational survey research design examining statistical relationships without variable manipulation.

Sample

385 students with Basic School Leaving Certificates from the Central Senatorial District of Ondo State.

Instruments

Adapted Emotional Intelligence Scale (11 items, 5-point Likert) and numeracy test with a reliability coefficient of 0.772.

Limitations

This study's correlational and cross-sectional design inherently limits the ability to infer causal relationships between emotional intelligence and numeracy capability. While a statistical association can be established, the direction of causality cannot be determined. Potential confounding variables, such as socio-economic status, prior mathematics achievement, teacher quality, and classroom environment, were not explicitly controlled for and may influence the observed relationship. The reliance on self-report measures for emotional intelligence introduces a risk of bias, and the cultural validity of the adapted Emotional Intelligence Scale for the Nigerian context, despite efforts to address it, remains a potential limitation. Finally, the multi-stage sampling procedure, while pragmatic, may introduce selection bias, limiting the generalisability of findings to all student populations within Nigeria.

Potential Mediating Variables for Future Research

Future research should consider exploring potential mediating variables that could further elucidate the relationship between emotional intelligence and numeracy capability. Key variables to investigate include: maths anxiety, which could inhibit performance regardless of EI; academic self-efficacy, influencing students' belief in their ability to succeed; intrinsic motivation towards learning mathematics; and various socio-economic factors that may moderate both EI development and educational outcomes.

Data Analysis

The emotional intelligence and essential numerical items were statistically acceptable. The discrimination level is 0.366, and the difficulty level is 0.409. The items' degrees of difficulty and discrimination are both higher than 0.30. The Residual Root Mean Square (RMSR) = 0.06. Tucker Lewis Index (TLI) = 0.973, Root Mean Square Error Approximation (RMSEA) = 0.341. Three (3) factors were extracted:

- Factors 1 > 0.3 are loaded for items 8, 10, 11, and 12.
- Factors 2 > 0.3 are loaded for items 13, 14, 16, and 17.
- Factors 3 > 0.3 are loaded for items 4, 5, and 9.

To make the instrument valid, items 1, 2, 3, 6, 7, 15, 18, 19, and 20 were eliminated because they were less than 0.3 (the benchmark for an item to load on a factor). The items' descriptive statistics include the Basic Numbers (Mean = 8.7273, SD = 1.9911). Descriptive statistics such as Mean and Standard Deviation were used to answer the research questions, while the hypotheses were subjected to inferential statistics like the Paired Sample t-test and Pearson Product-Moment Correlation (PPMC) analysis, at a 0.05 level of significance.

RESULTS

The study applied Multiple Imputation (MI) with Expectation Maximisation (EM) and Missing Value Analysis (MVA) to handle missing data, ensuring robustness and accuracy (Azur et al., 2011; Jakobsen et al., 2017). Little's MCAR test revealed that the data were not Missing Completely At Random ($p < .05$), indicating systematic missingness requiring careful statistical treatment.

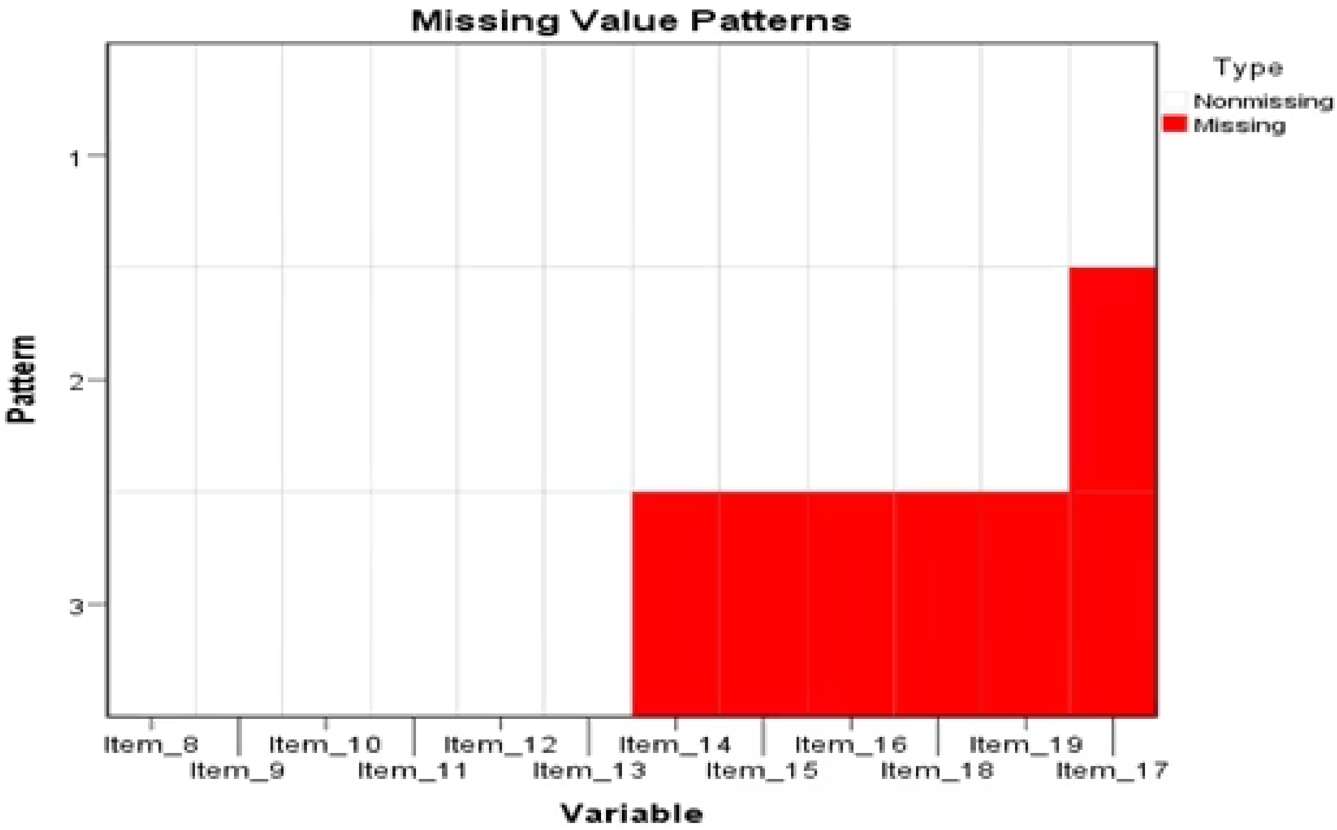

Figure 3: The Missing Value Patterns

Table 2: Estimated means for the missing items, calculated using the EM algorithm

Item_8	Item_9	Item_10	Item_11	Item_12	Item_13	Item_14	Item_15	Item_16	Item_17	Item_18	Item_19
.99	1.01	.93	.79	.76	.48	.56	.70	.77	.77	.39	.72

a. Little's MCAR test: Chi-Square = **192.856**, DF = **66**, Sig. = **.000**

Before data analysis, using SPSS (SPSS Analysis, 2025), these steps were taken to evaluate missingness, guaranteeing data quality, integrity, and error prevention. Avoiding Type I (false positives) and Type II (false negatives) errors, which can be caused by biased or insufficient data, requires this step (Allison, 2020).

Research Question 1: Is there any mathematical connectivity in students' emotional intelligence and numeracy capability?

Table 3 shows the results of the data analysis using Pearson's Product Correlation Analysis to answer Research Question 1 and Research Question 2.

Table 3: Pearson Product Correlation Analysis of the Relationship Between Mathematics Students' Emotional Intelligence and Numeracy Capability

		EMO_INTEL	MAT_BASIC_NUMBERS
EMO_INTEL	Pearson Correlation	1	.118*
	Sig. (2-tailed)		.044
	Sum of Squares and Cross-products	3393.397	141.678
	Covariance	11.742	.490
	N	385	385
MAT_BASIC_NUMBERS	Pearson Correlation	.118*	1
	Sig. (2-tailed)	.044	
	Sum of Squares and Cross-products	141.678	421.652
	Covariance	.490	1.459
	N	385	385

In Table 3, the covariance is 0.490, P-value = 0.044, which is less than the 0.05 level of significance. The positive covariance shows that as students' emotional intelligence increases, their numeracy capability increases. Therefore, there was a statistically significant association between students' emotional intelligence and numeracy capability.

Research Question 2: Is there any relationship between mathematics students' emotional intelligence and numeracy capability?

In Table 3, the correlation coefficient (r) = 0.118, p-value = 0.044, which is less than the 0.05 level of significance. Therefore, there was a relationship between mathematics students' emotional intelligence and numeracy capability. A Pearson Product-Moment Correlation was conducted to determine the relationship between students' emotional intelligence and their numeracy capability. Results revealed a statistically significant positive correlation between emotional intelligence and numeracy performance, $r(383) = .118$, $p = .044$. Although the strength of this correlation is weak, it was statistically significant at the 0.05 level. To further interpret the practical significance of this relationship, the effect size was computed using Cohen's d formula; the effect size was approximately 0.238. This result indicates a small effect size according to Cohen's (1988) guidelines. This suggests that while there is a significant statistical relationship between emotional intelligence and numeracy capability, the magnitude of the effect is small.

0.118

Correlation Coefficient

Weak but statistically significant positive relationship between EI and numeracy.

0.044

P-value

Significant at 0.05 level, indicating statistical meaningfulness of the relationship.

0.238

Effect Size (Cohen's d)

Small but educationally meaningful practical impact according to Cohen's guidelines.

DISCUSSION

The present study investigated the relationship between mathematics students' emotional intelligence and their numeracy capability, addressing two research questions. Specifically, Research Question 1 explored whether there is any mathematical connectivity between students' emotional intelligence and numeracy capability, while Research Question 2 examined the presence and significance of any relationship between the two variables.

The results, as presented in Table 3, showed a Pearson correlation coefficient (r) of 0.118 with a p-value of 0.044, which is statistically significant at the 0.05 level. This indicates a weak but statistically significant positive relationship between students' emotional intelligence and their numeracy capability. The positive covariance (0.490) further supports the trend that as emotional intelligence increases, numeracy capability also tends to improve. These findings affirm the existence of a mathematical and statistical association between emotional intelligence and numeracy performance amongst mathematics students.

Although the strength of the correlation is weak ($r = 0.118$), its statistical significance suggests that emotional intelligence contributes, albeit modestly, to students' mathematical performance, especially in tasks involving basic numerical understanding. To further interpret this, the effect size for $r = 0.118$ is classified as small according to Cohen's (1988) conventions. This means that emotional intelligence explains approximately 1.4% of the variance in numeracy capability ($r^2 = 0.014$). While statistically significant, this indicates a limited practical impact when considered in isolation. For a more robust interpretation, future studies should report confidence intervals for the correlation coefficient. This outcome aligns with previous studies, which underscore the role of emotional factors in academic achievement, particularly in mathematics-related contexts.

For instance, Petrides et al. (2004) observed that emotional intelligence significantly influences cognitive performance by enhancing self-regulation and stress management, key factors in mathematics learning. Similarly, MacCann et al. (2020) found that students with higher emotional intelligence are better able to manage academic anxiety, which can support improved numeracy performance. Likewise, research by Putwain et al. (2020) shows that emotional self-regulation helps learners remain persistent and focused during challenging tasks such as mathematical problem-solving.

Furthermore, research by Ahmad et al. (2024) in a Nigerian teacher-education context revealed that emotional intelligence significantly predicts mathematics performance, supporting the view that emotional and cognitive competencies are interconnected and that enhancing emotional intelligence may foster better academic outcomes in mathematics.

To assess the practical significance of this finding, Cohen's d effect size was calculated. Based on the Pearson correlation coefficient ($r = .118$, $p = .044$), the calculated effect size using Cohen's d was approximately 0.238, indicating a small effect size (Cohen, 1988). This means that while the relationship between emotional intelligence and numeracy capability is statistically significant, the magnitude of the difference or relationship is small in practical terms. That is, its practical impact is limited. Nevertheless, even small effects can be educationally meaningful, particularly when scaled across large student populations or incorporated into long-term educational interventions.

According to Cohen's (1988) conventional thresholds, this reflects a small effect size, implying that the impact of emotional intelligence on numeracy capability, although statistically significant, is modest in practical terms. Nevertheless, small effects can accumulate and become educationally meaningful over time, especially when interventions are applied across large groups of learners (Hattie, 2009). This aligns with prior research (Duckworth and Seligman, 2005; Petrides et al., 2004) showing that emotional factors such as self-regulation and motivation contribute to academic performance in mathematics, even when the direct impact is limited. Furthermore, in educational contexts, even small improvements in numeracy performance, if driven by enhanced emotional skills, could justify the integration of social-emotional learning (SEL) strategies into mathematics instruction.

Whilst the correlation is weak in magnitude, its statistical significance suggests that emotional intelligence may play a small yet meaningful role in supporting students' numeracy skills. Students with higher emotional intelligence might demonstrate greater persistence, better stress management, and lower levels of maths anxiety, factors that facilitate improved mathematical reasoning (Petrides et al., 2004). However, the observed correlation ($r = 0.118$) is notably weaker than findings from broader meta-analyses, such as MacCann et al. (2020), which reported stronger relationships between emotional intelligence and academic performance (e.g., a pooled correlation $\rho = .20$ overall, and $\rho = .24$ for ability-based EI measures). This discrepancy could be attributed to several factors:

- **Measurement Issues:** The specific emotional intelligence instrument used in this study might differ in its construct validity or reliability compared with those yielding stronger effects in other contexts, especially concerning whether it employs self-report versus ability-based measures.
- **Cultural Validity:** The cultural context of Nigeria may influence how emotional intelligence is expressed or how it impacts academic performance, potentially affecting the validity of Western-developed EI instruments.
- **Confounding Variables:** The study may not have fully controlled for other significant variables known to influence academic outcomes, such as socio-economic status (SES), prior academic achievement, and teacher quality, which could have masked a stronger underlying relationship.
- **Restriction of Range:** The sample being limited to students with a Basic School Leaving Certificate might represent a restricted range of emotional intelligence and numeracy capabilities, thereby attenuating the observed correlation.

Regarding statistical power, with an N of 385, the study had approximately 80% power to detect correlations of $r = .14$ or larger at an alpha level of 0.05. The observed correlation of $r = .118$ approaches this threshold, suggesting that the study possessed adequate power to detect a statistically significant effect, even if small. This further reinforces that the weak correlation is unlikely to be a result of insufficient power, but rather reflects a genuinely small practical effect within this population and context. The comparison with international research highlights the need for context-specific studies and careful consideration of methodological factors when interpreting effect sizes.

Further analysis, although not the primary focus of this study, considered the influence of categorical variables, including school location (urban versus rural) and educational background (public versus private school experience). These contextual variables may moderate the strength and nature of the relationship between emotional intelligence and numeracy.

For instance, students in urban schools may have greater access to emotional learning resources and extracurricular programmes that cultivate emotional intelligence, which can enhance numeracy performance. In contrast, students in rural areas often have limited exposure to structured emotional education, reducing opportunities for the development and expression of emotional competencies in academic settings (UNESCO, 2020). Similarly, educational background can influence both emotional intelligence and numeracy outcomes. Students in better-resourced schools, such as many private schools, often benefit from smaller class sizes and stronger social-emotional learning provision, which can support higher performance in both emotional intelligence and numeracy (OECD, 2015). These contextual differences highlight the need for stratified interventions that account for school type and location. Educational implications of the present findings further emphasise the importance of integrating social-emotional learning (SEL) into mathematics education, consistent with evidence demonstrating that SEL improves both emotional competencies and academic achievement (Durlak et al., 2011).

CONCLUSION

This study examined the relationship between mathematics students' emotional intelligence and their numeracy capability by addressing two research questions.

1. The findings revealed a statistically significant but weak positive correlation between emotional intelligence and numeracy capability ($r=0.118$, $p=0.044$).
2. Although the effect size calculated using Cohen's d (0.238) suggests a small practical impact, the relationship indicates that students with higher emotional intelligence tend to perform slightly better in numeracy tasks.
3. The results affirm that emotional intelligence contributes, albeit modestly, to students' mathematical performance, particularly in the domain of basic numerical understanding.
4. Moreover, the inclusion of contextual factors such as school location and educational background suggests that environmental and systemic influences may moderate this relationship, potentially amplifying or dampening the effects of emotional intelligence depending on access to resources and support systems.
5. These findings support existing literature that links emotional self-awareness, regulation, and motivation with improved academic outcomes, especially in mathematics.
6. While the observed relationship may be weak in statistical terms, its educational relevance should not be dismissed, as even small effects can accumulate to produce meaningful change, particularly when addressed at scale or over extended periods.

RECOMMENDATIONS

Based on the study's findings, the following recommendations are made for educators, policymakers, and researchers:

1. Schools should incorporate Social-Emotional Learning (SEL) frameworks into the mathematics curriculum to help students manage math-related anxiety, build resilience, and enhance focus during numeracy tasks.
2. Educational interventions should be context-specific, especially considering school location (urban versus rural) and educational background (public versus private). Rural and public schools may require additional support and resources to offer emotional learning opportunities comparable to those available in urban or private institutions.
3. Teachers should receive training in emotional intelligence development techniques to better support students' emotional needs during mathematics instruction. Educators play a critical role in creating emotionally supportive learning environments that foster academic success.
4. Since small effects can become significant over time, schools should implement long-term SEL programmes, especially at the foundational education levels, to systematically improve both emotional and academic competencies.
5. Future studies should explore moderating and mediating variables, such as gender, socio-economic status, and teacher-student relationship quality, to better understand the mechanisms through which emotional intelligence impacts numeracy. Mixed-method approaches could also provide deeper insights into how students perceive and apply emotional skills in mathematical contexts.
6. Ministries of Education and school boards should support policy development that emphasises emotional intelligence as a core component of academic curricula, recognising its role in fostering holistic student development.

ACKNOWLEDGEMENT

Not Applicable

CONFLICTS OF INTEREST

The author declares no conflict of interest.

FUNDING

This research received no funding from any agency.

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Received: June 19, 2025

Accepted: August 16, 2025

Published: November 05, 2025

Citation:

Isaac-Oloniyo F. O. & Oloda F. S. S (2025). Finding the Mathematical Connectivity of the Emotional Intelligence Skills through Numeracy Capability. *SustainE, 3*(3), 542-565. In A. A. Atowoju, E. O. Oyekanmi, A. A. Akinsemolu, & D. M. Duyile (Eds.), *Sustainability, Innovation, and Development: A Festschrift in Honour of Rt. Rev. Prof. Obeka Samuel Sunday* [Special issue]. https://doi.org/10.55366/suse.v3i3.27