



**AN ANALYSIS OF THE RELATIONSHIP BETWEEN EMOTIONAL INTELLIGENCE AND ALGEBRAIC PROBLEM SOLVING ABILITY OF SECONDARY SCHOOL STUDENTS IN SOKOTO, NIGERIA**

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**ABSTRACT:** *The purpose of this study is to determine the relationship between emotional intelligence and the algebraic problem-solving ability of secondary school students in Sokoto state, Nigeria. 100 respondents were used as the sample for the survey at two secondary schools in Sokoto, Nigeria. The targeted respondents were the senior secondary two (SSII) students. The findings of the study showed that there is a moderate relationship between the emotional intelligence of the students and their algebraic problem-solving ability. It was also discovered that male students have a low relationship in their emotional intelligence and algebraic problem-solving ability compared to female students whose emotional intelligence and algebraic problem-solving ability were found to be moderate.*

**KEY WORDS:** Emotional intelligence, Algebraic problem solving, Secondary schools.



## INTRODUCTION

Education plays a vital role in the development of a country. It cannot be denied that the success of any nation's educational system depends on a number of factors and one of which is the level of emotional awareness (intelligence) of the people of the said nation in achieving national goals. One's success in life does not depend solely on intellectual intelligence (Norila & Ikhsan, 2014). In our society today and in schools generally, one aspect that has been overlooked is emotion. In mathematics, students are usually assessed on how well they can solve mathematical problems, their ability to understand mathematical literacy, mathematical competencies, and so forth. However, what has been defined as Emotional Intelligence (EI) is usually not assessed among students (Nor et al., 2016).

### Emotional Intelligence

Emotions are involved in everything people do: every action, decision and judgment. Emotionally intelligent people recognize this and use their thinking to manage their emotions rather than being managed by them. In the course of the last two decades, the Emotional Intelligence (EI) concept has become a very important indicator of a person's knowledge, skills and abilities in the workplace, school and personal life. Emotional Intelligence is defined as the ability to identify, assess and manage the emotions of one's self, others and groups (Susan & Nancy, 2013). It is argued that emotional intelligence represents ability in a person to reason with emotions and to use emotions to facilitate thought. A number of scholars and researchers are associated with the development of the concept of emotional intelligence. These include Howard Gardner, Wayne Payne, John Mayer, Peter Salovey and David Goleman. For instance, Goleman who makes the EI concept popular because of his book published in 1995 adopts a five-dimension definition, four of which are similar to the abilities proposed by Mayer and Salovey. These four dimensions of EI are in perfect agreement with a review of the EI literature conducted by Davies, Stankov and Roberts (1998). Specifically, the following four EI dimensions appear to be common to the definitions provided by different EI researchers. These four dimensions are:

- i. **Perceiving Emotions:** This is defined as the ability of a student to be able to recognize both verbal and non-verbal information from his/her emotional system. It also entails the ability to distinguish between precision and lack of precision, honesty and lack of honesty in expressing emotions (Mayer & Salovey, 1997).
- ii. **Using Emotions:** This relates to the ability of a student to use his/her emotions to facilitate his/her thought to enable him/her to solve algebraic problems. It implies the ability of the persons to make use of their emotions and direct them towards constructive activities and personal performance. A person who has a high ability in this aspect would be able to keep their behavior under control when they are extremely happy or unhappy. According to Goleman (1995), this dimension is labeled as "motivating oneself". He further described it as organizing emotions for paying attention, self-motivation and mastery, and for creativity (Goleman, 1995).
- iii. **Understanding Emotions:** This refers to a student's ability to understand emotions in them and others, which involves cognitively processing their emotions with respect to their feelings. This relates to the individual's ability to understand his/her emotion deep inside and be able to express this emotion naturally. People who are high in this ability



will sense their emotions deep inside and acknowledge them well ahead of others. In Goleman's (1995) term, this dimension is labeled as "knowing one's emotions".

- iv. **Managing Emotions:** This relates to the ability of a student to be able to put their emotion under control in the sight of any task they are faced with. Furthermore, it is the ability of a person to regulate his/her emotion when s/he is faced with the task of solving algebraic problems. A person high in this ability would be able to bounce back more quickly during psychological distress.

### **Problem Solving**

Problem-solving is based on the process of finding out solutions to a problem by using an organized thought process. This is a process where a creative and critical thing is processed in reasoning out or solution to problems faced by the student within a group or individually. It is a mental process which gives effective problem-solving techniques in concluding and overcoming difficulties that appear to interfere with the attainment of a solution (Bala & Shaafiu, 2016). A student with effective problem-solving ability can be identified through their use of a wide range of strategies in tackling their problems, has good arithmetic skills, high self-confidence, checks answers for reasonableness and is able to understand the problem and solve it with critical and analytical skills. Students with these skills exhibit a high problem-solving ability and are able to attempt any type of difficulties they face.

Furthermore, problem-solving is a cognitive-behavioral process through which steps having a logical succession are followed to find a solution to a problem. Problems generally consist of conditions about uncertainty, accuracy and reality we cannot be sure of, difficult problems and relations (Kalaycı, 2001). Problem-solving is defined as the capacity of the individual to comprehend a problem without having a clear solution method and solve it (Bellanca, 2013). Any definition of "problem" should consist of the three ideas that: the problem is present in some state, but it is desired that it be in another state, and that there is no direct, obvious way to accomplish the change (Mayer, 1992). According to most descriptions of mathematical problem solving, the first step is problem representation, converting the words (and pictures) of the problem into an internal mental representation; the second step is problem solution, going from mental representation of the problem to a final answer. We can further break problem representation into two sub-processes: problem translation, which involves converting each sentence or major clause into an internal mental representation, and problem integration, which involves combining the information into a coherent structure (Mayer, 1992)

Additionally, Pisa (2013) states that problem-solving is fundamentally complex and it includes the components of understanding found in individuals, in addition to the components of relationships. The reasoning components of individual problem solving include understanding and representing the problem content, applying problem-solving strategies, and applying self-regulation and metacognitive processes to monitor progress toward the goal.

Teaching and learning algebra among secondary school students is a key to teaching and learning mathematics in its entirety. This is so because algebra provides a sound background for the learning of other branches of mathematics (Kulbir, 1995). In fact, this is the reason why algebra is taught earlier than other branches of mathematics because algebra has



its roots in both arithmetic and geometry (Doug, 2002). Hence for a student to be able to understand and also comprehends this algebra, he or she needs the knowledge of applying problem-solving strategies of understanding and representing the content of the problem.

## LITERATURE REVIEW

Quite a number of studies have been conducted in different places in relation to students' emotional intelligence. For instance, Aruna (2014) conducted a study in Dubai to determine the impact of emotional intelligence on the academic achievements of expatriate college students in that country. In the study, the researcher observed that expatriate students with positive emotional intelligence traits succeeded in academic achievement, whereas expatriate students with negative emotional intelligence traits failed in gaining academic achievements. Although the tool used for data collection, in the study, was a structured questionnaire designed by the researcher, which covered the demographic profile of students, their academic achievement and their perception of emotional intelligence. This tool in the researcher's view was not adequate to measure emotional intelligence since it only provided for students' perception of their emotional intelligence.

Joyce (2011) examined the role of Emotional Intelligence in college students' success. The study included students enrolled in an Introduction to a Business course at a large state college in Florida. The Bar-On 2004 (Emotional Quotient Inventory) with 133 items was used to assess students' emotional intelligence. Results revealed that there was a slight positive correlation between traditional measures of academic success (GPA, attempted-to-completed credit hour ratio, grade in the course) and emotional intelligence.

However, a study carried out in Malaysia showed that students' emotional intelligence is an indicator of their academic achievement. For example, Azizi et al., (2009) have reported that there is a significant moderate positive relationship between emotional intelligence and academic achievement among 399 form four students in 10 secondary schools in the vicinity of three States, namely: Johor; Kelantan and Terengganu. Researchers from abroad also reported the same (Hogan et al., 2010; Qualter et al., 2012; Mahasneh, 2014; Seng et al., 2016; Adibah et al., 2016; Musonda, 2017). All their findings supported that emotional intelligence is essential in influencing students' academic achievement.

A lot of the studies examined were outside Africa, and therefore cultural context cannot be ruled out in the relationship between emotional intelligence and students' problem-solving ability. It is important to ascertain if similar findings would be found in a different cultural setting. This paper examines the relationship between emotional intelligence and algebraic problem-solving ability of Secondary school two (SSII) students in Sokoto, Nigeria.

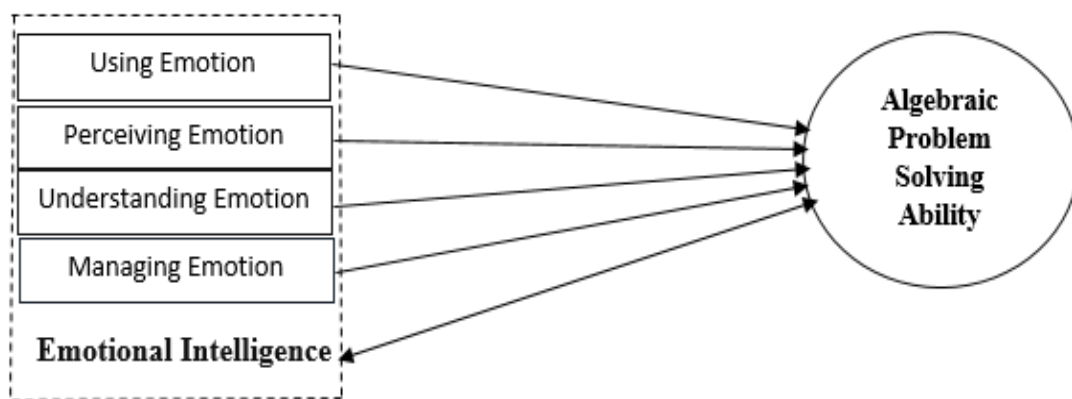
### Theoretical Framework of Emotional Intelligence

The concept of emotional intelligence has its background in past research of early scholars who believed that emotional intelligence should be depicted in the context of all that makes up human intelligence and not in isolation. Research shows that around the 1920s, a psychologist named Thorndike theorized that there were three types of intelligence: social, mechanical and abstract. It is argued that Thorndike used the term "social intelligence" to describe the skill of understanding and managing other people (Serrat, 2010; Musonda,

2017). Social intelligence is defined as “one’s ability to understand other people, what motivates them, how they work, how to work with them and the ability to act wisely in the relationship between human beings” (Yahaya, 2015, Pp 124). In 1983, Howard Gardner posited the theory of Multiple Intelligences in his book entitled *Frames of Mind*. In the book, he argued that people have more than one type of intelligence, and these types of intelligence were also cognitive in nature but could not fully be defined by a model such as the standard intelligent quotient (IQ) tests.

The term emotional intelligence was first used in 1990 by two psychologists, Peter Salovey and John Mayer. At first, they defined emotional intelligence as the ability of a person to monitor one’s own and other peoples’ feelings and emotions, to discriminate among them and to use the information to guide one’s thinking and action. They later modify the definition as the ability to perceive, appraise and express emotions accurately, the ability to access and generate feelings when they facilitate thought, the ability to understand emotion and emotional knowledge and the ability to regulate emotions to promote emotional and intellectual growth (Mayer & Salvey, 1997). However, an emotionally intelligent person is said to be able to use, perceive, understand and manage his/her emotions and that of others. This implies that an individual needs to know his/her emotions and control those emotions as a way of motivating oneself. Hence, it is also important that an individual understands other people’s emotions and uses that understanding or knowledge to manage those other people so as to develop relationships which encourage learning from others. Thus, the emotional intelligence of students is important so that they identify, assess and make use of not only their emotions but also of their classmates so that the classroom becomes a place for conducive maximum learning.

This study uses a conceptual model as a basis to study the relationship between Emotional Intelligence as the independent variable and algebraic problem-solving ability as the dependent variable among secondary school students in Sokoto Nigeria.



**Figure 1: The Conceptual Model**



## **Present Study**

The literature shows a dearth of research on the relationship between emotional intelligence and students' algebraic problem-solving ability among secondary school students in Sokoto, despite the importance of emotional intelligence in life achievement and success and its potential usefulness in the context of academic institutions. It is against this backdrop that this research was carried out to find out whether emotional intelligence has any relationship with students' algebraic problem-solving ability among secondary school students in Sokoto, Nigeria.

## **Research Objective**

The research objective are:

- (i) To examine the level of relationship between emotional intelligence and algebraic problem solving ability among secondary school students in Sokoto state
- (ii) To determine if there is any significant relationship between male students' emotional intelligence and their algebraic problem solving ability among secondary school students in Sokoto state?
- (iii) To determine if there is any significant relationship between female students' emotional intelligence and their algebraic problem solving ability among secondary school students in Sokoto state?

## **Research Questions**

The following questions guided the study:

- (i) Is there any significant relationship on emotional intelligence and algebraic problem solving ability amongst secondary school students in Sokoto state?
- (ii) Is there any significant relationship between male students' emotional intelligence and their algebraic problem solving ability among secondary school students in Sokoto state?
- (iii) Is there any significant relationship between female students' emotional intelligence and their algebraic problem solving ability among secondary school students in Sokoto state?





## **METHODOLOGY**

### **Research Design**

The study employs a correlational research design. In correlational research design, the researcher seeks to establish the degree of relationship between two or more variables (Louis et al., 2004). This was used in order to determine if there is any relationship between emotional intelligence and students' algebraic problem-solving ability in Sokoto state. The students' emotional intelligence scores were correlated with their scores in solving algebraic problems.

### **Participants**

A sample consisting of hundred (100) Senior Secondary two (SSII) students, with ages ranging from thirteen (13) to eighteen (18) was used for this study. Fifty-seven (57) out of the sample were males and forty-three (43) were females. All of which are in secondary schools two (SSII) in Sokoto state.

### **Instrument**

The first step of this study was to develop a workable EI measure for students in Sokoto. There are some existing measures of EI but they do not appear to be suitable for secondary school students in Sokoto, due to differences in culture, environment and location. For instance, Salovey et al. (1995) developed a thirty-item Trait Meta-Mood Scale which was used by Martinex-Pons (1997) on 108 parents, teachers, and administrators in two public elementary schools. However, Carson et al. (1997) also developed a 14-items measure of Goleman's five EI dimensions and Carson and Carson (1998) used the measure in examining the relationship between EI and career commitment in a sample of 75 nurses. Mayer, Salovey and Caruso (1997) developed an EI measure that required respondents to react to various types of items in a computer program. The questionnaire took the respondents more than an hour to complete the measure and yet the psychometric properties of this measure have not been reported. Hence, all the existing measures are developed in Western countries and many measurement items may be culturally specific.

It is not clear whether these measures will be applicable to students in Sokoto. Thus, it is necessary to develop a workable EI measure for students in Sokoto. To develop a usable EI measure for Sokoto students, a concept analysis was carried out based on the emotional intelligence construct and sub-constructs. The fundamental idea is to define the concept of the variable under investigation and all its elements or domain. Furthermore, literature related to the variable under study was also reviewed to gather additional data on the construct and sub-constructs. Hence, this was done in order to complement the concept analysis. Based on the reviewed literature and the concept analysis, the researcher develops the items for the measurement of the emotional intelligence scale. The face validity of the items generated was examined by the author of this study. The content validity was also determined by Subject Matter Experts (SME); based on the experts' comments, the content validity was calculated using the Content Validity Ratio (CVR) of Lawshe (1975). The instrument was modified after the content validation and some of the items were dropped as a result. The instrument initially had thirty-two (32) items which dropped to twenty-nine (29) after the content validation. It was measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The algebraic problem-solving test was also content validated by experts



in the field. The algebraic problem-solving scale contained fifteen items and was scored on '1' for correct answers and '0' for wrong answers.

### Data Analysis

The data obtained from the questionnaire were analyzed using the Statistical Package for Social Sciences (SPSS) version 22 to measure the reliability value of emotional intelligence dimensions. The reliability index of .679 was obtained for Using Emotion (UE), .710 for Perceiving Emotion (PE), .817 for Understanding Emotion (UNE) and .623 for Managing Emotion (ME). The results are reported as means and standard deviations (SD). The Spearman's rank order correlation was used to determine the relationship among the variables. In addition, the Pearson moment correlation coefficient was also used. It is statistically significant when  $p < 0.05$ .

Informed consent was obtained from each participant and the purpose of the study was explained to the participants. Confidentiality was assured by the researcher to the participants throughout the period of the study.

## RESULTS

This section presents the results and findings of the analysis with respect to the research questions. The data analysis will be discussed in line with the research questions. However, to answer the questions, means and standard deviations of EI and algebraic problem test scores were calculated. Data for the EIQ and the algebraic problem-solving tests were inserted into Statistical Package for Social Sciences (SPSS) version 20 for analysis. This is presented below:

**Table 1: EI dimensions and APST, mean and level EI**

<b>EI Subscales</b>	<b>Mean</b>	<b>S.D</b>	<b>Level</b>
Using Emotion	3.69	.92	Moderate
Perceiving Emotion	3.47	.68	Moderate
Understanding Emotion	3.92	.34	High
Managing Emotion	3.96	.32	High
APST Scores	10.35	4.23	Low

A total of 29 items were presented to the respondents to determine the type of EI possessed among them. The table above presents the mean score for each of the four (4) dimensions in EI from the responses of 100 respondents. The items were measured using the 5 points Likert scale. Of the total, the table shows that 2 EI dimensions were categorized at a high level, namely understanding and managing. The other two dimensions which are using and perceiving emotions were all at a moderate level.

To explore the relationship between emotional intelligence and algebraic problems solving scores the correlation coefficients were calculated and demonstrated in the table below.





**Table 2: Correlation between Algebraic problem solving test score and Emotional Intelligence**

			<b>EIQT</b>	<b>APST</b>
<b>Spearman's rho</b>	EIQT	Correlation Coefficient	1.000	.236
		Sig. (2-tailed)	.	.026
		N	100	100
<b>Spearman's rho</b>	APST	Correlation Coefficient	.236	1.000
		Sig. (2-tailed)	.026	.
		N	100	100

Table 2 above addressed the first research question aimed at determining whether there is a significant relationship between Emotional Intelligence scores as measured by EIQT and algebraic problem-solving scores among secondary school two (SSII) students' in Sokoto State. Spearman's Rank Order Correlation ( $\rho$ ) was used to find out whether there was a correlation. The coefficient of correlation was found to be ( $\rho = .236$ ). The correlation value, therefore, established that there is a moderate correlation between emotional intelligence and algebraic problem-solving test scores.

**Table 3: Pearson Product Moment Correlation Analysis of EI and Algebraic problem solving test scores of SS2 Male Students**

<b>Number of Male Students</b>	<b>Correlation Coefficient</b>	<b>Degree of Freedom</b>	<b>Calculated r-value</b>	<b>Critical t-value</b>
57	.391	55	13.11	1.96

Table 3 above shows that the correlation coefficient between EI of SS2 male students and their algebraic problem-solving test score is 0.391. This implies that there is a low positive correlation between EI of SS II male students and their algebraic problem-solving test scores. Consequently, since the calculated r-value (13.11) is more than the critical t-value (1.96), the correlation is significant. Therefore, there is a significant low positive relationship between EI and algebraic problem-solving test scores of SSII male students.

**Table 4: Pearson Product Moment Correlation Analysis of EI and Academic Achievement of SS2 Male Students in Mathematics**

<b>Number of Female Students</b>	<b>Correlation Coefficient</b>	<b>Degree of Freedom</b>	<b>Calculated r-value</b>	<b>Critical t-value</b>
43	0.490	41	9.03	1.96

Table 4 above shows the Correlation Coefficient between the Emotional Intelligence of SS2 Female students and their algebraic problem-solving test scores as 0.490. However, the calculated r-value is 9.03 which is more than the critical t-value of 1.96. Hence, it indicates that there is a significant moderate positive relationship between the Emotional Intelligence of SS2 female students and their algebraic problem-solving test scores



## DISCUSSION OF FINDINGS

Given the possible importance of EI to students' development, this study attempts to explore empirically the relationships between EI and the algebraic problem-solving ability of secondary school students in Sokoto, Nigeria. Results obtained from the respondents show that there is a significantly moderate relationship between the emotional intelligence of the students and their algebraic problem-solving ability, which implies that emotionally intelligent students are not necessarily the best algebraic problem solvers. Thus, the result is in agreement with the result of Azizi et al. (2009) who reported that there is a significant moderate positive relationship between emotional intelligence and academic achievement among 399 secondary school students. However, the findings are also in line with Adibah et al. (2015) that emotional intelligence predicts a student's mathematical competency but with a low correlation value. Another study conducted by Azuka (2012) among SSII secondary school students also observed that the relation between emotional intelligence and academic performance is significantly low.

In considering the second and third research questions, the study has established that there is a low positive significant correlation between the algebraic problem-solving ability of male students and their emotional intelligence. Hence, it also indicated that there is a moderately significant relationship between female students' algebraic problem-solving ability and their emotional intelligence. This implies that there is a slight or no gender difference between males and females in terms of their problem-solving ability and their emotional intelligence. The result is in agreement with other previous findings, that there are no gender differences between male and female students in their emotional intelligence and academic achievement, problem-solving attitude and metacognitive ability (Azuka, 2012; Sharei et al., 2012; Mahasneh, 2014).

Though there are limitations to this study, yet it has implications. First, the development of the EI items for secondary school students with four dimensions of Using, Perceiving, Understanding and Managing Emotions. However, only the two dimensions of using and perceiving emotion were found to be high in the range. On the other hand, the other 2 domains which are understanding and managing are at a moderate level. These findings are similar to findings of a study conducted by Noriah et al. (2004), where most of the adolescents surveyed have EI at a moderate level, and most of them need to regulate their emotions and develop good social skills to interact with others. Consequently, these findings could be used to help the concerned parties to build and organize special programs to help young people, not only those that are part of this study to improve their EI to a higher level, especially in the context and perspective of algebraic learning in mathematics.

## CONCLUSION

Conclusively, from this study and other studies conducted earlier by previous researchers, it can be said that the EI of secondary school students is still at a moderate level. From a mathematical point of view, the respondents viewed their feelings toward emotional intelligence and problem-solving ability at a moderate level. Since there is a positive relationship between EI and students' algebraic problem-solving ability, parallel to the expectation in the educational policy of Nigeria. The small correlational value between EI



and the students' algebraic problem-solving ability should be a matter of concern for teachers and parents for possible ways to foster an enabling environment for the improvement of emotional intelligence in students.

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