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Research paper

An analysis of the relationship between emotional intelligence and algebraic problem solving ability of secondary school students in Sokoto State, 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. 100 respondents were used as the sample for the survey at two secondary school in Sokoto state, Nigeria. The targeted respondents are senior secondary two (SSII) students in Sokoto state, Nigeria. Findings of the study showed that there is a moderate relationship between emotional intelligence of the students and their algebraic problem solving ability. Furthermore, it was discovered that male students have a low relationship in their emotional intelligence and their algebraic problem solving ability compared to the female students whose emotional intelligence and algebraic problem solving ability was found to be moderate.

Keywords: *Algebraic Problem Solving; Emotional Intelligence; Secondary Schools.*

1. Introduction

Education is a principal tool in the progressive advancement of any deliberate vision minded society. It cannot be an over emphasis that the success of any nations' educational system depends to a large extent on a number of factors one of which is the level of emotional awareness (intelligence) of the people of the said nation in achieving national goals. Success in the life does not depend completely on intellectual intelligence [1]. To date, in our society and 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 on. But, the aspect of their emotions are most often neglected and as such not assessed among students [2].

1.1. Emotional intelligence

EI is pictured as the ability to identify, judge and cope with emotions of one's self, of others and of groups [3]. It is premised that emotional intelligence portrays an ability in a person to reason with and make use of emotions to complement thought. Handful figure of researches are associated with development of the concept of emotional intelligence. Stating but a few, Howard Gardner, Wayne Payne, John Mayer, Peter Salovey and David Goleman and so on. [4] brought the concept of EI to limelight as a result of his published book, he projected five-dimension of EI, four out of which are comparable to the dimensions by [5]. These four dimensions are in perfect agreement with a recent review of the EI literature by [6]. Explicitly, the following four EI dimensions appear to be mutual to the definitions provided by different EI researchers. These are categorically underpinned below:

1.1.1. Perceiving emptions

This is view as the talent in a students that gives him or her the discernment to be able to distinguish both verbal and non-verbal information from his/her emotional system. It implies the ability in person to discriminate between precision, honesty or vice visa, in articulating emotions [7].

1.1.2. Using emotions

This relates to the ability of a student to use his/her emotions to facilitate his/her thought to enable him/her solve algebraic problems. It depicts the skills of the persons to use their emotions guided in the direction of constructive activities and peculiar performance. An individual highly talented in this regard would be able to keep their behaviour under control irrespective of the situation surrounding them. According to [4] this dimension is labelled as "Motivating oneself".

1.1.3. Understanding emotions

This is refers to the ability of a student to be able to understand emotions in them and in others, which involve cognitively processing their emotions in respect to their feelings. This associates to an individual's ability to strappingly apprehend emotion and be able to express this emotion naturally. [4] proposed, this dimension is labelled as "Knowing one's emotions".

1.1.4. 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 display of a persons' expertise to adjust his/her emotion when s/he is faced with the task of solving alge-

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braic problems. A person who possess high ability in this regard is always able to bounce back more hastily during psychological distress.

1.2. Problem solving

Problem solving is centered on the process of discovering solutions to a problem by using an organized thought process. It is a procedure where creative and critical thinking is managed in reasoning out solution to problems faced by the student within a group or individually. In addition, is a mental process which is exercised by an individual in order to overcome difficulties that appears to interfere with the attainment of solution [8]. Normally, student with good problem solving ability can be recognized through their use of wide array of strategies in confronting their problems, has good arithmetic skills, high self-confidence, cross checks answers for certainty and also able to understand and solve problem with critical and analytical skills. Students with these skills exhibit high problem solving ability and are able to attempt any type of difficulties faced by them.

Furthermore, Problem solving is a cognitive behavioural procedure through which steps having a logical sequence are employed to find a solution to a given problem. Problems generally involve conditions about uncertainty, accuracy and reality one cannot be sure [9]. However, problem solving can further be describe as the capacity of the individual to comprehend a problem without having a clear solution method of how to solve it [10]. Additionally, [11], puts that problem solving is essentially multifaceted and comprises modules of understanding found in individual.

Teaching algebra in Nigeria secondary schools is the partway to teaching and learning of mathematics in its entirety. This is due to the fact that algebra provides a sound background for the learning of other branches of mathematics [12]. In fact, it is the fundamental reason why algebra is taught earlier than other branches of mathematics because algebra has its roots in both arithmetic and geometry [13]. Hence for a students to be able to understand and also comprehend it, they need knowledge of applying problem solving strategies.

2. Literature review

Relatively one can say a handful number of studies has been steered in different place in relation to students' emotional intelligence. Impact of emotional intelligence on academic achievements of expatriate college students was investigated by [14] in Dubai. In the study, the researcher observed that expatriate students with positive emotional intelligence traits succeeded in academic achievement, whereas expatiate students with negative emotional intelligence traits failed in gaining academic achievements. Though the instrument employed by the researcher for data collection, in the study, was a structured self-designed questionnaire, which covered the demographic profile of students, their academic achievement and their perception on emotional intelligence. This tool was in the researcher's view not adequate to measure emotional intelligence since it only provided for students' perception on their emotional intelligence.

Adeoye and Emeka [15], looked at students' Emotional intelligence and self-efficacy as elements of academic achievement in English language among students in Oyo state senior secondary schools, the outcome of the study revealed that emotional intelligence courses bring the most significant effect on the achievement of English language. The implication of this is students who were exposed to emotional intelligence courses obtain better achievements in English than their counterpart.

However, study carried out in Malaysia showed that student's emotional intelligence is an indicator to their academic achievement. For example, [16] submitted an observation of a significantly moderate optimistic relationship between EI with academic achievement of 399 form four students in 10 secondary schools. In the same vein researchers from abroad also concord [17 - 21]. The aforementioned findings buttressed that emotional intelligence is a pillar in influencing student academic achievement.

Most studies before now were examined outside Africa, and therefore cultural context cannot be ruled out in the relationship between EI and students' problem solving ability. It is important to ascertain if similar findings would be found in a different cultural setting. Hence, what necessitate the present study.

2.1. Theoretical framework of emotional intelligence

The theory of emotional intelligence has its origin in the works of early scholars who held that emotional intelligence should be depicted in all context of human intelligence. Thorndike in 1920's posited three classes of intelligence: social, mechanical and abstract. Social intelligence is pictured as ''one's ability to understand other people, what inspires them, how they work, how to work with them and the ability to act wisely among other people" [22]; [21]; [23]. In 1983, Howard Gardner profound the theory of Multiple Intelligences in his book entitled "Frames of Mind; there he argued that people have more than one type of intelligence, these classes of intelligence are cognitive in nature but could not fully be explained 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 an individual to observe him/herself and other peoples' feelings and emotions, and further use the information to guide one's thought. This they subsequently amended as the ability to perceive, appraise and express emotions accurately, to assess and generate feelings facilitated by thought [7]. However, emotionally intelligent person is said to be able to use, perceive, understand and manage his/her emotions and that of others. This invariably implies that an individual requires to recognize his/her emotions, control those emotions as a way of motivating oneself. Hence, it is also important that an individual understands other people's emotions and use that understanding or knowledge to manage those other people so as to develop relationship 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 of Emotional Intelligence and Algebraic problem solving ability fig 1 present the conceptual model.

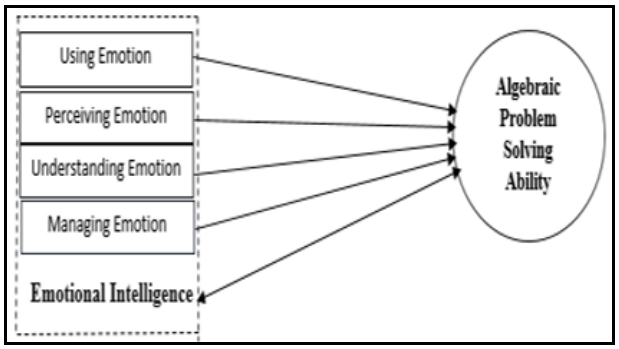


Fig. 1: The Conceptual Model.

2.2. Research objective

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 gender difference on emotional intelligence and students algebraic problem solving among secondary school in Sokoto state.

2.3 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?

3. Methods

The very processes and steps involve in the methods adopted in the present study are underpinned below:

3.1 Research design

This study applied correlational research design to verify the relationship between EI and students' algebraic problem solving ability in Sokoto state. The students' emotional intelligence scores was correlated with their scores in solving algebraic problems.

3.2. Participants

A sample consisting of hundred (100) Senior Secondary two (SSII) students, with age ranging from thirteen (13) to eighteen (18) were 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) of Sokoto state.

3.3. Instrument

Measures of EI exist, but do not seems to be appropriate for secondary school students in Sokoto, due to differences in culture, environment and location. Taking for instance, [24 - 26]. Though, it was developed in Western countries and many measurement items may be culturally specific.

It's applicability to students in Sokoto appear obscure. Thus, the leading to develop a workable EI measure for students in Sokoto. First, a concept analysis was carried out. The fundamental idea is to define the concept of the variable under investigation and all its element or domain. Furthermore, literature related to the variable under study was also review to gather additional data on the construct and sub-constructs. Hence this was done in other to complement the concept analysis. Based on the reviewed literature and the concept analysis the researcher develop the items for the measurement of the emotional intelligence scale. The instrument was given to Subject Matter Experts (SME), based on their comments, the instrument was modified using content validity was calculated using the Content Validity Ratio (CVR) of [27].. It kicked started with thirty two (32) items which dropped to twenty nine (29) after the content validation, it was measured on a five-point Likert. The algebraic problem solving test was also content validated by experts in the field. The algebraic problem solving scale containing fifteen items and was score on '1' for correct answer and '0' for a wrong answer.

4. Data analysis

Data collected was analysed using the appropriate Statistical tool. 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, Pearson moment correlation coefficient was also used.

4.1. Result

This section presents the results and findings of the analysis with respect to the research questions. However, to respond to 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 22 for analysis.

Table 1: EI Dimensions and APST, Mean, SD and Level of EI

EI Subscales	Mean	S.D	Level
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 present the mean score for each of the four (4) dimensions in EI from the responses of 100 respondents. The items were measured using 5 points Likert scale. Of the total, table 1 shows that 2 EI dimensions were categorized at high level, namely understanding and managing. The other two dimensions which are using and perceiving emotions were all at moderate level.

Table 2: Correlation between Algebraic Problem Solving Test Scores and EI

			EIQT	APST
Spearman's rho	EIQT	Correlation Coefficient	1.000	.236
		Sig. (2-tailed)	.	.026
		N	100	100
Spearman's rho	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 score 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 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 SSII Male Students

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

The table above presents the correlation coefficient between EI of SSII male students and their algebraic problem solving test score as 0.391. This suggests 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 greater 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 Algebraic Problem Solving Test Scores of SSII Female Students

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

The table above puts forward the Correlation Coefficient of the Emotional Intelligence of SSII Female students and their algebraic problem solving test scores as 0.490. However, the calculated r-

value 9.03 is greater than the critical t-value 1.96. Hence, it depicts that there is a significant moderate positive relationship between Emotional Intelligence of SII female students and their algebraic problem solving test scores.

5. Discussion

Projecting the likely importance of EI to students' development, this study explored empirically the relationships of EI and the algebraic problem solving ability. Results obtained from the respondents shows that there is 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 best algebraic problem solvers. Thus, the result is in agreement with that of [16] whom reported that there is a significantly moderate positive relationship between emotional intelligence with academic achievement. However, the findings is also in line with [2] that found out in their study that emotional intelligence predict students mathematical competency but with low correlation value. In another study conducted by [28] among Secondary School Two (SSII) students, also observed that relation between emotional intelligence and academic performance is low.

In considering the second and third research questions, the study has established that there is low positive significant correlation between algebraic problem solving ability and emotional intelligence of male students. Hence, it further puts that there is a moderately significant relationship between female students' algebraic problem solving ability and their emotional intelligence. This implies that there is 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 is no gender differences between males and females students on their emotional intelligence and academic achievement, problem solving attitude and metacognitive ability [28 - 21].

Though the study is not without limitation yet, it has implications. The development of the EI items for secondary school students with four dimensions of Using, Perceiving, Understanding and Managing Emotions. However, only for the two dimension of using and perceiving emotion were found to be in the high in range. On the other hand, other 2 domains which are understanding and managing are at a moderate level. This findings is similar to the study conducted by [30], 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.

6. Conclusion

Conclusively, from this study and other studies conducted earlier by previous researchers, it can be hold that the EI of secondary school students is still at the moderate level. From a mathematical point view, the respondents viewed their feelings towards emotional Intelligence and problem solving ability at the 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 thing of concern for interested researchers to call for improving the research in the area of students' emotional life.

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