



EMOTIONAL INTELLIGENCE AS PREDICTORS OF STUDENTS' ACADEMIC ACHIEVEMENT IN CHEMISTRY

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ABSTRACT

This study was conducted to determine the predictive power of emotional intelligence on students' academic achievement in chemistry in Kogi East and West senatorial districts. Three research questions and three null hypotheses guided the study. A correlational statistical research design was used. The population of the study was 7,617 SS II Chemistry students in Kogi East and West senatorial districts with a sample size of 384 SS II chemistry students. Multistage sampling procedure was adopted. Two instruments were used for data collection which were Chemistry Emotional Intelligence Inventory (CEII) and Chemistry Achievement Test (CAT). Content validity of CAT was developed using table of specification while the construct validity of CEII was determined using factor analysis..The reliability indices obtained for CEII is 0.891 while reliability index of 0.71 was obtained for CAT. Data collected were analysed using regression analysis, Analysis of Variance (ANOVA) and t-test. The findings show that the Predictive power of emotional intelligence on students' academic achievement in chemistry is significant; the Predictive power of emotional intelligence on students' academic achievement in chemistry as moderated by gender and ethnicity are significant. Based on the findings, it was recommended among others that Conferences, seminars and in-service training in chemistry should be organized by school administrators and government for teachers to enable them gain adequate knowledge and experiences on how to manage emotional intelligence.

Keywords: Predictive power, Emotional Intelligence, Students' Academic Achievement in Chemistry.

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INTRODUCTION

Science is the systematic study of our environment which builds and organizes knowledge in the form of testable explanation and predictions about the universe. Science is the most important and major channel in which knowledge is transmitted. Through the application of science nations are built, societal aspirations and goals are achieved. The benefits of science lie on building knowledge about the universe and constructing new ideas that illuminate the world around us. These ideas are inherently tentative, but as they cycle through the process of science again and again and are tested and retested in different ways, we become increasingly confident in them. Furthermore, through this same interactive process, ideas are modified, expanded, and combined into more powerful explanations. There are three major branches of science which includes biology, chemistry and physics.

Chemistry has been one of the cornerstones of science, technology, and industry. It is apparent that chemistry plays a greater role in National Development through the industries in the world (Ibrahim, Adamu, Ibrahim, Ismaila & Abubakar, 2017). Chemistry is a branch of science that deals with constituents of matter like atoms molecules, ions, etc.; and its properties, structure, behaviour, and interactions among them (Anne 2019). Alan (2021) defined Chemistry as the science that deals with the properties, composition, and structure of substances (defined as elements and compounds), the transformations they undergo, and the energy that is released or absorbed during these processes. Chemistry is a branch of science that deals with the study of matter, its compositions, structural appearance, properties, and principles that govern the changes that take place within matter. Every substance, whether naturally occurring or artificially produced, consists of one or more of the hundred-odd species of atoms that have been identified as elements. These atoms, in turn, are composed of more elementary particles; they are the basic building blocks of chemical substances. Chemistry, therefore, is concerned not with the subatomic domain but with the properties of atoms and the laws governing their combinations and how the knowledge of these properties can be used to achieve specific purposes.

The knowledge of Chemistry has led to the creation of environmental friendly chemicals, cosmetics, fine and heavy chemical for industrial production of goods for the happiness of mankind. Chemistry provided mankind with a large number of life-saving drugs. Also we have environment-friendly chemicals that help us conserve nature. One such example is the replacement of Chlorofluorocarbons (CFCs) in refrigerators. Because of the advancements in science and the discoveries of chemistry, there is an increase in Comfort, Pleasure, and Luxury life styles today. Despite the numerous importance of Chemistry to mankind and the society at large, and Governments' efforts in making several provisions that will facilitate the teaching and learning of Chemistry in Senior Secondary Schools, Chemistry is still plagued with poor academic achievement. This is observed in the chemistry students results in West African Examination Council (WAEC) as reported by the Chief Examiner's report 2017- 2019. The Analysis of chemistry students' achievement in WASSCE in Nigeria (MAY/JUNE) 2014-2018 showed that in 2018, 27.84% of students failed, 31.98% had pass (that is D7 to E8) while only 40.18% had A1 to C6. In 2017, 32.27% of students failed, 281.50% had D7 to E8 while only 39.23% had A1 to C6 while in 2016, 28.85% of students failed, 31.40% had D7 to E8 and 39.75% had A1 to C6. In 2015, 26.56% of students failed, 34.76% had D7 to E8 while 38.68% had A1 to C6. The chemistry termly results in senior secondary schools in some parts of the study area in Kogi East and West senatorial districts also attest to student's poor academic achievement. To prove this matter further, 2019 weakness comments of the WASSCE Chief Examiner's Report stated that students' had problems in understanding the demands of the questions, exhibited poor communication skill, wrote trivial names instead of formulae, lacked adequate knowledge of chemical concepts, could not write simple half reaction equations, could not recognize redox reactions, could not draw correct and workable diagram for the preparation of chlorine gas in the laboratory and could not write the correct formula of a compound. Also in 2018, students lacked understanding of simple concepts in chemistry, had poor communication skill, were unable to give proper definition of concepts, unable to write formula instead of names, unable to write correct IUPAC names of organic compounds among others. These attested to poor Students' academic achievement at senior secondary school Chemistry.

Students' academic achievement in Chemistry has always been a concern of the Nigerian government, researchers, teachers, school administrators and parents. Many researches have been carried out and some factors which contributed to the poor academic achievement on

students were identified to include; poor teaching pedagogy and class size (Mohammed, Ali, Shyibu & Abubakar 2021); school and class environment, teacher's attitude, qualification, teaching style, as well as lack of instructional and learning materials and low instructional supervision (Omotola 2018). Michael and Ismail (2016) also reported that students with dysfunctional characteristics such as lack of confidence, low self-esteem, lack of self-control, and high anxiety are said to have low emotional intelligence, and this may affect their academic achievement.

Emotional intelligence is the knowledge, skills, and dispositions students possess to develop successful relationships with themselves and others. According to Goleman (2000) in Adigwe (2015), emotional intelligence is an individual's ability to recognise or perceive, incorporate or integrate and understand emotion in a manner that allow him/her to facilitate his/her thought-processes and stimulate personal development and progression. According to Serrat (2017), emotional awareness makes individuals with this competence; know which emotions they are feeling and why, realize the links between their feelings and what they think, do, and say, recognize how their feelings affect their performance; and have a guiding awareness of their values and goals. Emotional intelligence is a psychological construct that involves evaluation and expression of emotions experienced by oneself and others, as well as the capacity to understand and regulate such emotions. Emotional intelligence is the ability to perceive accurately, appraise, and express emotion; the ability to access and/or generate feelings when they facilitate thought, it is also the ability to understand emotion and emotional knowledge; and the ability to regulate emotions to promote emotional and intellectual growth (Mohzan, Hassan & Halil, 2013).

Emotional intelligence is related to academic achievement for two reasons. Firstly, academic achievement involves a great deal of uncertainty and secondly, the majority of academic work is self-directed, requiring high levels of self-management, self-awareness, self-regulation, and self-motivation thereby bringing high academic achievement. Thus, students that possess high emotional intelligence may perform better academically. Pool and Qualter (2012) pointed out that students with high emotional intelligence have better school attendance records, their classroom behaviour is more constructive and less often disruptive and they like school more and are less likely to be suspended or otherwise disciplined.

However, Shuib, Ishak, Amat and Ahmad (2019) investigated the relationship between emotional intelligence and academic achievement, and the result of their findings revealed that emotional intelligence did not influence student's academic achievement. Swanepoel and Britz (2018) reported that there is a positive relationship between Academic achievement and Emotional Intelligence. Kashani, Azimi and Vaziri (2012) investigated the use of emotional intelligence and its relationship on academic achievement and the results indicated that there is no relationship between emotional intelligence and academic achievement. Elhaj (2015) revealed that there was a significant positive relationship between Emotional Intelligence and achievement. Sahinidis, Kallivokas, Antonatou, and Sdrolias (2016) examined the influence of emotional intelligence on academic achievement and reported no influence of emotional intelligence on academic achievement. From the foregoing, one could notice that there are inconsistencies in the reports of the above studies. There is therefore the need for this present study to investigate the predictive power of emotional intelligence on students' academic achievement in senior secondary school chemistry. This present study seeks to find the predictive power of emotional intelligence on students' academic achievement in chemistry irrespective of their gender and ethnicity.

Researchers have expressed diverse views about gender and academic achievement, especially in sciences including chemistry. Some researchers opined that male students do better than female students while others like Ogunleye & Babajide, (2011) disagree with this view, arguing that achievement is a factor dependent on several factors such as socio-economic background, teaching method, among others. Ezeudu and Obi (2013), also showed that male students achieved significantly better than the female students in both urban and rural schools.

Ethnicity can be regarded as the level to which an individual feels connected to his or her ethnic group and this belief influences attitudes and behaviours. Blumberg (2011) also found that ethnicity (the degree to which an individual identifies with, participates in, and feels positive about one's cultural/ethnic group) is positively correlated with academic achievement. However, Cokley, Mc Clain, Jones, and Johnson (2012) reported that ethnicity is one of the major factors of students negatively predicted outcomes in high schools. Parker and Flowers (2012) conducted a study among college students to explore the influence of ethnic status on student achievement and the findings of the study revealed that ethnicity does not have any influence on student achievement. Therefore, this study looks forward to ascertaining how students' academic achievement relates to their level of emotional intelligence, gender and ethnicity.

Rational for the Study

The findings of this study will have both theoretical and practical significance. Theoretically, the study will be anchored on Goleman (1995) theories of emotional intelligence. Daniel Goleman (1946), a renowned psychologist and science journalist, proposed his theory. His concept stemmed from his experience and research, which focused on behaviours, emotions, and the brain. He is also the founder of the Emotional Leadership styles and the five components of emotional intelligence. He sees emotional intelligence as the ability to perceive emotions so as to assist though, to understand emotions and emotional knowledge, and to reflectively regulate emotions so as to promote emotional and intellectual growth.

Goleman's key Components of emotional intelligence are firstly; Self-Awareness which is the ability of an individual to know the current mood and its reasons. It enables individuals to understand their strengths and weaknesses and process the effect of moods, emotions, and drives. Secondly, motivation which is the inner passion that drives outward activities. It considers the benefits of engaging in activities in the long run rather than immediate gains. The stronger the motivation, the more the tendency to focus on the set goals by individuals.

Empathy is the third key Components of Goleman's emotional intelligence. It refers to the ability of individuals to respond to others based on their emotional make-up or reactions. The fourth is Social Skills; An individual's social skills determine the extent to which relationships and networks are built and maintained. It involves the ability of the individual to and common ground with other people under different circumstances and leverage their views about the world to build relationships. The last component is Self-regulation which is the ability to control unexpected or disruptive emotions or impulses by maintaining a positive outlook even when situations do not go as planned. The findings of this present study strengthens the tenets of Goleman's theory because chemistry students required to be empathic, motivated, self-awareness, be self-regulated and possess social skills for them to achieve high in chemistry.

Practically, the result of this study will be of immense educational benefit to students, teachers, parents and school administrators, and curriculum planners. This will be achieved if the result of this study is presented in seminars, workshops or published in journals. On the part of the students, the findings of this study would poise their emotional intelligence in school via

sharing of important ideas and teamwork with their mates. The findings of this study will also enable the students to be adequately informed on the contributions of emotional intelligence to their academic achievement. This will develop their emotional intelligence leading to great improvement in their academics. When this happens; it will make students to have good relationship with teachers and others, good classroom management and discipline as well as putting more effort in academic works. Thus, the following research questions were pursued in this study;

1. What is the predictive power of emotional intelligence on students' academic achievement in Chemistry?
2. What is the predictive power of emotional intelligence on students' academic achievement in chemistry as moderated by gender?
3. What is the predictive power of emotional intelligence on students' achievement as moderated by ethnicity?

Hypotheses

The following null hypotheses were formulated and will be tested at a 0.05 probability level:

- H₀₁:** Emotional intelligence is not a significant predictor of students' academic achievement in chemistry.
- H₀₂:** The predictive power of emotional intelligence on students' academic achievement in chemistry as moderated by gender is not significant.
- H₀₃:** The predictive power of emotional intelligence on student's achievement as moderated by ethnicity is not significant.

Materials and methods

This study employs a correlational research design. Correlation is the statistical technique for establishing the extent of relationship, association, or co-variation between two or more variables (Nworgu 2015). This research design was considered appropriate because the researcher is interested in establishing the relationship between emotional intelligence and students' academic achievement in chemistry. In similar studies, Ezema et al. (2019), Gana et al. (2019), Okenyi et al. (2019), Ugwuanyi, Okeke and Njeze (2020); Ugwuanyi, Okeke and Ageda (2020); Ugwuanyi, Okeke and Asomugha (2020), Achagh et al. (2020), Ugwuanyi et al. (2020) and Okenyi et al. (2021), Orji et al. (2023) have used this kind of design. The study was conducted in Kogi East and West senatorial districts of Kogi State. Kogi East and West senatorial districts are inhabited by Igala, Okun and Bassa ethnic groups whose occupation are mostly farming and fishing. Kogi East senatorial districts consist of 3 educational zones which includes Ankpa, Dekina and Idah while Kogi West senatorial districts also consist of 3 educational zones which includes Isanlu, Kabba and Lokoja. Kogi East and West senatorial districts are made up 16 LGAs. This consist of 9 LGAs in Kogi East and 7 in Kogi West Senatorial Districts. There are 202 senior secondary schools in Kogi East and West Senatorial Districts. This comprise of 121 in Kogi East and 81 in Kogi West. The choice of this area is due to persistence students' poor academic achievement in Chemistry as reviewed by WAEC Chief Examiner's reports, the Analysis of chemistry students' achievement in WSSCE in Nigeria (May/June) 2014-2018 and The chemistry termly results in senior secondary schools in some parts of the study area in Kogi East and West senatorial districts.

The population of the study consists of all the 7,617 SS II Chemistry students in Kogi East and West senatorial districts. This population is made up of 4182 males and 3435 females SS II chemistry students. On the bases of ethnicity, there are 4557 Igala, 282 Bassa and 2778 Okun.

The sample for the study consists of 384 SS II chemistry students. This was determined using Taro Yamen 1976 formula. Multistage sampling procedure was adopted; Firstly, purposive sampling technique was used to select three educational zone from Kogi East and West senatorial districts. The essence of purposive sampling is to make sure that all the ethnic groups in the districts are represented. Secondly, disproportionate stratified random sampling technique was used to draw 1 LGA each from the three selected educational zone. This will give a total to 3 LGAs. The choice of disproportionate stratified random sampling technique is to make sure that all the zone is present in the final sample. At the third stage, disproportionate stratified sampling technique was used to draw four (4) schools each from the three LGAs. This will give a total of (12) schools in all. Finally, disproportionate sampling technique was used to stratify the students in each sampled schools based on gender and 32 students comprising 16 males and 16 females was drawn. This gives a total of 384 SS II chemistry students made up of 192 males and 192 females.

Two Instruments were used for data collection in the study, which are: Chemistry Emotional Intelligence Inventory (CEII) and Chemistry Achievement Test (CAT). The CEII consist of 15 items adapted from Goleman Emotional Intelligence of 50 items on emotional intelligence. The CEII is structured into two sections, A and B. Section A provided personal data of the respondents such as gender and tribe while section B expressed their level of emotional intelligence. The CEII instrument is design with five (5) clusters (self-awareness, managing emotions, motivating oneself, empath and social skill) to assess student's emotional intelligence in chemistry. The instrument has 4-point rating scale of Strongly Disagreed (SD) = 1, Disagreed (D) = 2, Agreed (A) = 3, and Strongly Agreed (SA) = 4 (Appendix I).

The Chemistry Achievement Test (CAT) which consist of 30 multiple-choice items was developed by the researcher from the West African Examination Council (WAEC) past question papers 2010-2019 in Chemistry. CAT has two sections, A and B which was filled by the respondents. Section A provided their personal data; identification, gender and tribe while section B measure their achievement in chemistry (standard separation techniques, acid-based reactions, chemical industries, organic chemistry and periodic table of an elements). The development of CAT was done based on the guideline of the table of specification from the following content areas in chemistry; standard separation techniques, acid-based reactions, chemical industries, organic chemistry and periodic table of an elements. The six levels of the cognitive domain (remembering, understanding, applying, analysing, evaluating and creating) of the modified Bloom's taxonomy of education were applied in the construction of the table of specification. Each item has four (4) options (a, b, c, d) with one (1) option as the right response and others are distractors. These content areas were derived from Senior Secondary Education Chemistry curriculum. These topics were chosen because of consistent poor academic achievement of students in these topics both in internal and external examination (WAEC Chief examiner's report 2017 – 2019 and students termly. Each right response of the item is awarded two (2) mark to get a total of 60 marks. (Appendix II)

To determine the face validity of the instruments; CEII, and CAT together with the study title, purposes of study, research questions, hypotheses, marking guide for CAT and table of specification was sent to three experts from the Department of Science Education, University of Nigeria Nsukka. Two of the validators were from Chemistry Unit and one from the Measurement & Evaluation Unit. The researcher requested the assistance of the validators for

constructive criticism with respect to the; appropriateness of the instrument, suitability of the instrument for the respondents, clarity of language of the instrument, structure of the instrument and suggestions that will improving the instrument. The face validation of these instrument was done to ensure that; the items were clearly stated and unambiguous, no spelling errors, proper numberings were done, no item was double-barrelled, suitability of the items relate to the class of the students. The corrections and inputs made by the experts was used to modify and draft the final copy of CEII and CAT.

To determine the content validity of CAT, the development was guided by a table of specification constructed by the researcher using the five topics (standard separation techniques, acid-based reactions, chemical industries, organic chemistry and periodic table of an elements) for the study. To determine the construct validity of CEII, the 25 items instruments each was administered to 20 SS II students in Government Day Secondary School Ohueta – Ihima Okene LGA and Govt Sec. Sch. (steel city) Ajaokuta LGA both Kogi central senatorial district outside the sampled senatorial districts. After the administration, the items of each instrument were subjected to factor analysis. This was achieved making use of Principal Axis Factoring with Varimax Rotation. The essence was to make sure that the items to be loaded were not correlated. Items with factor loading value below 0.3 in all components were considered factorially impure while items with factor loading value 0.3 and above in more than one (1) component were considered factorially complex; whereas, items with loading value of 0.3 and above, loading in only one component were considered factorially pure and were selected based on the recommendation of Stevens (2002) that factor loading with absolute value of 0.3 and above loading in only one component should be reported. Thus, items 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 18, 22, 23 and 24 for CEII were considered factorially pure and selected while items 10, 17 and 19 are factorially complex and items 20, 21 and 25 are factorially impure were rejected. Hence, the final items for the CEII instrument were arrived to be 15.

To estimate the reliability of instruments, a trial testing was conducted on a group of students with similar characteristics to the intended sample of students; 20 SS II chemistry students in Otutu Community Sec. School Otutu Okene Kogi central senatorial district were used for trial testing since this place are outside the sampled senatorial districts for the main study. The data for the reliability estimate were collected using the various instruments (CEII and CAT). The estimate of internal consistency of the instrument CEII were determined using Cronbach alpha method. The choice of Cronbach-alpha was because it is the most suitable method of estimate internal consistency reliability for instruments that are polytomously scored (that is, instrument with no right/wrong responses). The reliability indices for CEII was 0.891. The internal consistency reliability for CAT instrument was established using Kuder-Richardson (K-R) formula 20. This method was used because it is highly suitable for estimating internal consistency reliability for instruments that are dichotomously scored (i.e., instrument with no right/wrong responses). A reliability index of 0.71 was obtained for CAT.

A face to face method of data collection was employed in the course of administering the instruments. This was to ensure maximum returns and clarified complications that arose at the point of responding to the items on the instruments. This instrument was administered to the twelve (12) schools in six days with one (1) school at a time and maximum of two (2) schools per day. The supervision was done by the researcher with the assistance from the Chemistry teachers in the various Schools. In the CEII, students were made to follow the instructions by ticking (✓) the responses that best correspond to their emotional intelligence levels while in the CAT, students were required to choose the most appropriate option that corresponds to the answer from the list of distractors or alternatives attached to each item.

The Chemistry Achievement Test (CAT) was administered first to the students and collected before administering the Chemistry Emotional Intelligence Inventory (CEII). This order was to access their achievement first and then the Emotional Intelligence to make them react emotionally to the questions they have just gone through. Thus the CEII was administered immediately after the achievement test. In the CEII, the students were required to tick a response that best describes their feelings about the emotional statement. After scoring the test, the scripts were collected based on the variables of emotional intelligence, gender and ethnicity as moderating variables. An identification number was written on each instrument; this enable the researcher to merge CAT and CEII of each student. All instruments collected were used for statistical analysis.

The data collected from the field was analysed using regression analysis. Regression analysis was used because it is most suitable statistical technique used for predicting the relationship between two or more variables. This analysis technique is chosen because the study seeks to find the predictive power of emotional intelligence on students' academic achievement in chemistry. Essentially, research questions 1 was answered using linear regression while research question 2 and 3 was answered using multiple regression. The predictive power of emotional intelligence on students' academic achievement in chemistry were determined using regression coefficient (R) and coefficient of determination (R²). Correlational coefficients (R) was classified into low (0 – 0.3), moderate (0.31 – 0.80) and high (0.81 -1) (Nworgu, 2015). ANOVA was used to test hypotheses 1 while hypotheses 2 and 3 were tested with the t-value and the associated probability value obtained using process Macro, all at 0.05 level of significance.

RESULTS

Table 1: Regression analysis for the predictive power of emotional intelligence on students' academic achievement

Model	N	R	R ²
1	384	.646 ^a	.417

Predictors: (Constant), Emo_Int

The result in Table 1 above shows the regression analysis for the predictive power of emotional intelligence on students' academic achievement in Chemistry. The result shows that a correlation coefficient (R) of 0.65 was obtained. This means that there is a moderate positive relationship between emotional intelligence and academic achievement of students in Chemistry. The coefficient of determination (R²) is 0.42. This is an indication that emotional intelligence has a predictive power of 42% of the academic achievement of students in Chemistry.

Table 2: ANOVA result of the predictive power of emotional intelligence on academic achievement

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12515.231	1	12515.231	273.626	.000 ^b
	Residual	17472.101	382	45.738		
	Total	29987.332	383			

Table 2 shows the ANOVA result of the significance of the predictive power of emotional intelligence on academic achievement of students in Chemistry. The result shows that an F-ratio $(1, 382) = 273.626$, $p = 0.000$ was obtained. This p-value of 0.000 is less than 0.05 level of significance, hence the null hypothesis is rejected. Conclusion drawn is that, emotional intelligence is a significant predictor of students' academic achievement in Chemistry.

Table 3: Multiple regression analysis of the Predictive power of emotional intelligence on students' academic achievement as moderated by gender

Model	N	Interaction	R	R ²	SE	Df	t	p
1	384	Gender x Emotional Intelligence	.6720	.4516	.0814	382	3.8188	0.0002

The result in table 3 reveals the predictive power of emotional intelligence on students' academic achievement as moderated by gender. The result shows that a correlation coefficient (R) of 0.67 was obtained. This means that there is a moderate positive relationship between emotional intelligence and academic achievement as moderated by gender. The coefficient of determination (R²) of 0.45 shows that 45% of the predictive power of emotional intelligence on the academic achievement of students is moderated by gender.

The result in table 3 above on the significance of the predictive power of emotional intelligence on the academic achievement of students in Chemistry as moderated by gender shows that a t-value of 3.8188 at 382 degrees of freedom with an exact probability value of 0.0002 was obtained. Since the exact probability value of 0.0002 is less than 0.05 level of significance, the null hypothesis is rejected. Thus, the predictive power of emotional intelligence on students' academic achievement in Chemistry as moderated by gender is significant.

Table 4: Multiple regression analysis of the Predictive power of emotional intelligence on students' academic achievement as moderated by ethnicity

Model	N	Interaction	R	R ²	SE	Df	t	p
1	384	Ethnicity x Emotional Intelligence	.6601	.4357	.0487	382	1.9490	0.0480

The data presented in Table 4 above shows multiple regression analysis of the predictive power of emotional intelligence on students' academic achievement in Chemistry as moderated by ethnicity. The result shows that a correlation coefficient (R) of 0.66 was obtained. This implies moderate positive relationship between emotional intelligence and academic achievement as moderated by ethnicity. The coefficient of determination (R²) of 0.44 means that 44% of the predictive power of emotional intelligence on the academic achievement of students in Chemistry is moderated by ethnicity.

Table 4 above shows the significant of the predictive power of emotional intelligence on the academic achievement of students in Chemistry as moderated by ethnicity. The result shows that a t-value of 1.9490 at 382 degrees of freedom with an exact probability value of 0.0480 was obtained. This exact probability value of 0.0480 obtained is less than 0.05 level of significance, hence, the null hypothesis is rejected. Inference drawn is, the predictive power of emotional intelligence on students' academic achievement in Chemistry as moderated by ethnicity is significant.

Discussion of the Findings of the Study

The findings of the study showed that the predictive power of emotional intelligence on students' academic achievement chemistry is moderate. Further analysis shows that the predictive power of emotional intelligence on students' academic achievement is significant. This result implies that emotional intelligence is moderately accountable for students' academic achievement in chemistry. The significance of the predictive power of emotional intelligence on students' academic achievement in Chemistry could be due to the fact that emotional intelligence enhances students' cognition, high level of self-awareness, self-regulation, and self-motivation. All these could have played a role that led to increase in students' academic achievement in Chemistry.

These findings are in agreement with the earlier findings of Pool and Qualter (2012), Adigwe (2015), Umate & Eya (2019) and Wafa (2019) who also found that emotional intelligence are significant predictors of students' academic achievement in Chemistry. This implies that, emotional intelligence gives students the ability to regulate one's feeling, problem solving, intrapersonal and interpersonal skills which are highly relevant to academic success. For instance, students who have in-depth knowledge of emotional management could use such skill to off-set stress and anxiety associated with problem-solving in chemistry, test taking and examination. Furthermore, ability to display interpersonal skills may assist students to seek academic help from teachers, peers and resource persons. This finding did not confirm the findings of Kashani, Azimi and Vaziri (2012) and Sahinidis, Kallivokas, Antonatou, and Sdrolias (2016) who found that there is no relationship between emotional intelligence and academic achievement.

The finding of the result showed that the predictive power of emotional intelligence on students' academic achievement in Chemistry as moderated by gender is positively moderate. Further investigation reveals that the predictive power of emotional intelligence on students' academic achievement in Chemistry as moderated by gender is significant. This result invariably means that the level of emotional intelligence between male and female students in respect to their academic achievement in Chemistry is different. In essence, it means that the relationship between emotional intelligence and achievement in chemistry for males is different from that of female students. The difference could be that the levels of self-awareness, self-regulation, social skills, empathy and motivation of male students is different from that of female students. It describes differences in their abilities, capacities, skills, or self-perceived ability to identify, assess, and manage emotions of one's self. These findings are in agreement with the earlier findings of Okereke and Onwukwe (2011), Afuwape (2011), Tenaw (2013), Ezeudu and Obi-Theresa (2013), Tenaw (2013) and Arsaythamby, Hong & Seung (2015) in their study reviewed that male students outperformed female students in chemistry while Jegede (2007) found that female students show higher anxiety towards the learning of chemistry in secondary schools than male students. The results of gender differences showed that male students obtained significantly higher achievement in chemistry compared to female counterparts.

The result from data analysis showed that the predictive power of emotional intelligence on students' academic achievement in Chemistry as moderated by ethnicity is positively moderate. Further analysis indicated that the predictive power of emotional intelligence as moderated by ethnicity is significant. This signifies that ethnicity has significant influence on students' emotional intelligence which leads to academic achievement in chemistry. This finding is in agreement with the earlier findings of Arsaythamby, Hong & Seung (2015), Chaiqua and

Robika (2016), Yuli, Achmad, and Nurbaity (2017) and Raisa Akifyevaa, and Alisa Alievac (2018) who also found that emotional intelligence in respect of student's ethnicity are significant predictors of students' academic achievement in Chemistry. The significance in this result could be based on the fact that students have developed critical self-reflection on their cultural background. Also they possess high order thinking skills, curiosity, social awareness, cultural awareness, creativity, empathy communication, and self-confidence which led to good success in academics.

Implications of the findings

The result of this study provides insight into how teachers could develop more efficient strategies and creating friendly learning/teaching environment. It enables teachers to restructure their teaching pedagogies and adopt a favourable leadership style to meet the learning needs of the students owing to the diversity in emotional intelligence. This will greatly enhance the effective teaching/learning of chemistry. It will provide a practical guide on how teachers could integrate indigenous language into the classroom setting and without gender bias. It will also provide teachers with relevant information about their students which informs them about areas they need to make adjustments so as to meet the unique needs of each student.

This study will also benefit school administrators as it will help them to develop and implement different kinds of educational programmes that will duly consider students' development and improvement on the emotional intelligence. Also, educational administrators will be able to design curriculum package that will integrate the teaching of relevant emotional intelligence skills. This will improve students' learning and academic achievement.

It will also enable government through curriculum planners (professionals) to have better ideas on how to innovate their instructional designs by presenting educational content in an interactive and multisensory manner instead of the traditional single media format. This will be possible when they read the findings of this study is an online publication, journals and when they attend seminars or conferences. It will also help the government to be informed on the impacts of emotional intelligence on academic achievement, thus compelling them to fund and support educational system that will help to achieve societal aspirations and goals.

Conclusion

The study set out to investigate the predictive powers of emotional intelligence on students' academic achievement in chemistry. Based on the findings of the study, the following conclusions were made:

1. Emotional intelligence has a significant predictive power on students' achievement in Chemistry. When students' shows high level of self-awareness, self-regulation, social skill, empath and self-motivation, it enhances their academic achievement. Emotional intelligence gives students the ability to regulate one's feeling, problem solving, intrapersonal and interpersonal skills which are highly relevant to academic success.
2. The results of the study also led to the conclusion that the predictive power of emotional intelligence on students' academic achievement in chemistry as moderated by gender is significant. Also, level of emotional intelligence between male and female students in respect to their academic achievement in Chemistry as moderated by gender is different. It may be as a result of differences in their levels of self-awareness, self-regulation, social skills, empathy and motivation.

3. Emotional intelligence has a moderate predictive power on students' academic achievement in Chemistry as moderated by ethnicity and it is significant

Recommendations

Based on the findings of the study, the following recommendation were made;

1. Government and school administrators should be organizing conferences, seminars and in-service training from time to time to enable teachers gain adequate knowledge and experiences on emotions intelligence in order to apply them appropriately.
2. Chemistry Teachers should encourage gender equality and should encourage the use of techniques that build confidence in both males and females alike. Teachers should be gender sensitive to encourage both male and female students alike in developing chemistry skills in respective of their ethnicity
3. Government should train and employ Chemistry Teachers who understand impact of emotions intelligence in order to achieve societal goal and aspiration.
4. Teachers and Parents or Guardian should ensure that equal chances and opportunities are given to the learners (students) irrespective of their gender and ethnicity. They should serve as mentors to the students (learners) in other to properly make them emotionally stable and increase their cooperative classroom interaction style in respective of their gender and ethnicity.

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