
ACADEMIC SELF-CONCEPT AND ATTITUDE TOWARDS CHEMISTRY AS PREDICTORS OF SENIOR SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN CHEMISTRY IN ANAMBRA STATE

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Abstract

Chemistry is considered a key foundation for scientific knowledge required for problem solving in an environment. This study was necessitated by the persistent poor students' achievement in chemistry in Nigeria. The purpose of this study was to determine the extent to which academic self-concept and attitude towards chemistry predict academic achievement in chemistry by senior secondary school students in Awka Educational Zone of Anambra State. Three research questions and three null hypotheses guided the study. Predictive correlational research design was used. The population of the study comprised of 13,767 senior secondary school students in 2020/2021 academic session in public secondary schools in Awka Education Zone of Anambra State. The sample size of 400 students were statistically determined using the Taro Yamane formula. Two instruments were used to collect data for this study, namely; Attitude towards Chemistry Scale (ATCS) and Academic Self-Concept Questionnaire (ASCQ). Also the participants' chemistry achievement scores used was the cumulative average score of three terms. Cronbach alpha reliability coefficient for ATCS and ASCQ yielded 0.816 and 0.799 respectively. Data were collected through face to face contact with the students with the help of five research assistants. A simple linear regressions model via SPSS version 23 was used to analyse the data. The findings revealed that Academic self-concept and Attitude towards Chemistry significantly predicted academic achievement scores of secondary school students in Awka Education Zone. It was also found that Academic self-concept and Attitude towards chemistry jointly predicted the chemistry academic achievement of secondary school students in Awka Education Zone. The study thus recommended among others that teachers should help students with poor self-concept by recommending them for counselling as it will encourage students to open up and share their academic challenges with them for necessary assistance, and that students should adopt positive attitude towards chemistry if they desire to have significant academic achievement in chemistry.

Keywords: *Academic Self-Concept, Attitude towards Chemistry, Academic Achievements*

1.0 Introduction

Development of any nation is a measure of her development in the areas of science and technology because technological growth of any nation leads to its social and economic development. In the world today, science and technology has become a dominant development indicator. Russia, America, Japan and China are typical examples of nations which are referred to as developed as a result of their advancement in the areas of science and technology (Agbaje and Alake, 2014). The role of science in this modern era is wide and profound as it has become an indispensable tool that no nation wishing to progress in the socio-economic sphere will neglect its learning in schools. Thus, science education plays a critical role in engaging students to pursue technological careers considered essential in modern societies in order to handle scientific development challenges.

According to Tytler, (2014), science is increasingly a central aspect of work and everyday lives. Individuals, Educators, policy makers and researchers are focusing on ensuring that science education continues to help in preparing future citizens scientifically. In Nigeria, these facts can be seen in the importance and priority accorded to science and manifested in various policy statements and steps that encourage the citizens to pursue science and technology based courses (FRN, 2013). Government policies regarding the study of sciences include; the establishment of special science schools, maintaining admission ratio of 60:40 in favour of science students' in tertiary institution and the introduction of basic sciences in the primary schools' curriculum. All these were done to promote the study of science with the hope that, a solid foundation in the sciences would equip millions of Nigerian youths for successful science-based careers, thereby contributing to the nation's technological advancement.

Within the context of pure science is chemistry which was introduced into the school curriculum content of senior secondary school because of its educational value, relevance to the need of the learner and the society as a whole. According to Oluwatosin and Bamidele (2014), chemistry is the bedrock of science and technology. It is one of the basic subjects for physical science, agriculture, biochemistry, microbiology, pharmacy, medicine, metallurgy and all fields of engineering. The study of chemistry entails the learning of concepts, established principles, laws and theories and also substantial activity-oriented laboratory works. Chemistry is commonly viewed as a central science which requires the mastery of concepts regarding the structure and properties of matter and the changes it undergoes during chemical reactions. It is also viewed as the concept of energy and entropy in relation to spontaneity of chemical process which is a prerequisite to further study in all sciences. Chemistry is in essence, the gate keeper for future study in both pure and applied sciences and as such its students should be competent in mastering the necessary concepts and skills and be able to apply them in everyday living. As available evidence indicates, achievement in chemistry at the secondary school level remains low and unimpressive (Sanger, Breiner and Foor, 2018).

Academic achievement of student is the ability of the student to study and remember facts and communicate knowledge orally or in written form even in an examination condition. In other words, academic achievement in chemistry is the ability of a chemistry student to study and remember facts in the subject and communicate the knowledge orally or in written form even in an examination. Academic achievement of a student in chemistry should bear its foundation from the secondary education. If a good foundation is laid at the secondary school level, students can better cope with the challenges of the course or subject with great ease. Different people have explained different factors responsible for the academic achievement

of students. Factors that influence students' academic achievement in chemistry at the senior secondary school are not irrefutably known and could be multivariate in nature. They may include students' academic self-concept, attitude towards chemistry, interest in learning chemistry, study habit, attribution, self-efficacy, intelligence and motivation. Academic achievement of students in chemistry goes beyond an educational phenomenon to a psychological and sociological connotation. Thus, such academic achievement cannot be fully accounted for by only one or two variables but a number of them, and since students' academic achievement in chemistry depends on a number of variables, achievement could be enhanced through identifying and manipulating each of such variables. Therefore, this study will focus on these variables, namely; academic self-concept and attitude towards chemistry.

Self-concept is the core of human personality. It refers to the totality of people's perception about their physical, social and academic competence. It is the set of perceptions that the person has about himself, the set of characteristics, attributes, qualities, deficiencies, capacities limit, values and relationships that the subject knows to be descriptive of him (Ghaffer and Buksh 2021). The construct of self-concept is derived from self-worth theory and it's generally defined as an individual's perception based on self-knowledge or experience and formed through interaction with environment and attributes of their behaviour. Self-concept is an important construct in development psychology and education and has multidimensional construct, one general facet and several specific facets, one of which is 'academic self-concept' (Marsh and Martin 2021).

In a general sense, Kadir and Yeung (2016) defined academic self-concept (ASC) as an individual's academic self-perceptions or perception of their general ability in school. Academic self-concept refers to the way an individual regards his/her own academic achievement. Things such as their success, grade averages, motivation, creativity or how they navigated difficult subject areas. ASC refers also to the personal beliefs someone develops about their academic abilities or skills. A person's ASC develops with mental and physical growth and begins to develop at early childhood. Parenting styles and early education have an influence on academic self-concept. Students' attitude, perception and enjoyment of a subject or class lecture in school may also be viewed as academic self-concept. Students' self-perception plays an important role in students' adjustment in school during childhood and adolescence by directing their efforts toward their academic works. The multi-dimensional model of self-concept shows that an academic self-concept is one of the important facets of self that contribute to an individual's global self-concept together with social, emotional, and physical self-concept. This multidimensional model of self-concept refers to an important distinction between general self-concept which includes cognitive, affective and behavioral aspects and an individual's perception of their academic competence. Academic self-concept can further be conceived as a student's self-perception regarding specific academic domains or abilities. In this regard, academic self-concept may be viewed as a student's view of his or her academic ability when compared with other students or a description and an evaluation of their perceived academic competence. In a more comprehensive way, academic self-concept may be seen as specific attitude, feeling and perceptions about individuals' intellectual or academic skills representing their self-beliefs and self-feeling regarding the academic setting.

Academic self-concept can be classified into two major types that are positive academic self-concept and negative academic self-concept. Positive academic self-concept is seen when a person has confident and sure of himself, good interests, objective and not too sensitive. This individual may accept the criticism from others and may be able to express

his views and opinions. On the other hand, an individual who has negative academic self-concept is too subjective by nature (Hanan, Shabana, and Mona, 2016).

Attitude towards chemistry on the other hand, as a suspected predictor of academic achievement in chemistry is a positive or negative inclination towards chemistry and every activity that has to do with the subject which could be cognitive, emotional or behavioural (Kanapickiene, Stankeviciene and Biliunaite, 2021). It also denotes interests or feelings towards studying chemistry. It is the students' disposition towards liking or disliking chemistry. According to Kerami and Oskouei (2021), student beliefs and attitudes have the potential to either facilitate or inhibit learning. Attitudes are important to educational psychology because they strongly influence social thought. As most students come to school ready and willing to learn, the school can best foster and strengthen their predisposition and ensure that they leave school with the motivation and capacity to continue learning throughout life. Without development of the right attitudes, students may not be well prepared to acquire the new knowledge and skills necessary for successful adaptation to changing circumstances and the necessary situation to achieve in their academic pursuit. Beyond students' perception of how well school will prepare them for life, their overall attitude towards the study of chemistry is important as some of them view chemistry as being central to their daily life. To some others, chemistry is essential to their long term well-being and this attitude is reflected in their participation in academic and non-academic pursuits.

Students with positive attitude towards chemistry tend to have good relations with their chemistry teacher(s). However, some students express negative attitude towards chemistry as they tend to believe that it is a difficult subject made only for the extraordinarily intelligent. Such negative attitudes may result in their becoming disaffected with the subject causing them to resort to disruptive behaviour and in some cases display negative attitudes towards chemistry teachers. Students' attitude to chemistry can be seen as a disposition towards learning it, and it is an important condition for a chemistry student's feeling of well-being, social engagement and competence. High positive attitude towards chemistry for a chemistry student increases intrinsic motivation because it fosters self-confidence. It is only with positive attitude towards chemistry that a student can develop good sense of belonging and engagement in the subject.

According to Johnson and Herrmann, (2019), a well-designed and engaging chemistry lesson can have a positive impact on students' cognitive, affective and/or behavioural processes. The affective attitudinal responses are the feelings and emotions that a person has toward the subject. The cognitive attitudinal responses refer to a person's evaluative beliefs that he has about the attitude object. The behavioral attitudinal responses are not behaviors per se, but are the person's action tendencies toward the attitude object. These processes occur within the student and thus are not observable. Together or separately, they can form an attitude toward chemistry lessons in school. In other words, psychologists have postulated that chemistry lessons implemented in the school can trigger some hidden processes within the student and an attitude is a general evaluative summary of the information derived from those hidden processes.

All chemistry students at the senior secondary school level aspire for success in the subject but they are driven by different motives and stimuli for attainment of success. These students do different things to attain the desired academic achievement in chemistry. Some, due to lack of self-confidence, may resort to examination malpractice to attain high test scores, some have examination phobia which may be due to some unpleasant situations experienced at

younger age in school that has resulted in apathy at schooling, and some have a preconceived notion that chemistry is a difficult subject which causes them develop a negative attitude toward its study. While some of these students attribute their successes and failures to outside factors like luck, teachers and other influential persons; some accept total responsibility for their successes and failures. There may also be other social and environmental factors that militate against chemistry students' achievement. Various researchers in the time past has tried to determine the relationship between academic achievement and some personality variables in literature but there is still consistent poor academic achievement of students in chemistry (Woldeamanuel and Gizaw, 2019 ; Ali and Awan, 2013 ; Yuksel and Geban, 2014). Efforts have also been made by educational researchers to improve academic achievement especially in chemistry but adequate attention has not been paid to the affective components such academic self-concept and attitude towards chemistry. Prior studies did not focus the simultaneous and concurrent effects of the two variables (that is academic self-concept and attitude toward a subject) on students' academic achievement. Generally, they were focused on only one variable but examining the effect of variables on academic achievement one by one does not give information about relative responsibilities of attitude and academic self-concept. Literature also included studies not within the context of variables constituting the subject of the present study that multi-dimensionally examined academic achievement. The present study thus aims to fill this gap not subjected in studies, which is the distinctive contribution of the present study to literature. Given aforementioned information, the present study basically aims at explaining how academic self-concept and attitude towards chemistry predicts academic achievement in chemistry of senior secondary school students in Awka Education Zone.

1.1 Purpose of the Study

The purpose of this study is to determine the extent to which academic self-concept and attitude towards chemistry predicts academic achievement in chemistry by senior secondary school students in Awka Education Zone of Anambra State. Specifically the study will seek to ascertain:

1. The extent to which academic self-concept predict academic achievement in chemistry of senior secondary school students in Awka Education Zone.
2. The extent to which attitude towards chemistry predict academic achievement in chemistry of senior secondary school students in Awka Education Zone.
3. The joint predictive effect of academic self-concept and attitude towards chemistry on academic achievement in chemistry of senior secondary school students in Awka Education Zone.

1.2 Research Questions

The study was guided by the following research questions:

1. To what extent does academic self-concept predict academic achievement in chemistry among senior secondary students in Awka Education Zone of Anambra State?
2. To what extent does attitude towards chemistry predict academic achievement in chemistry among senior secondary students in Awka Education Zone of Anambra State?
3. To what extent do academic self-concept and attitude towards chemistry jointly predict academic achievement in chemistry among senior secondary school students in Awka Education Zone of Anambra State?

1.3 Research Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

1. Academic self-concept does not significantly predict academic achievement in chemistry among senior secondary students in Awka Education Zone of Anambra State.
2. Attitude towards chemistry does not significantly predict academic achievement in chemistry among senior secondary students in Awka Education Zone of Anambra State.
3. Academic self-concept and attitude towards chemistry do not jointly predict academic achievement in chemistry among senior secondary students in Awka Education Zone of Anambra State.

2.0 Review of Related Literature

2.1 Conceptual Framework

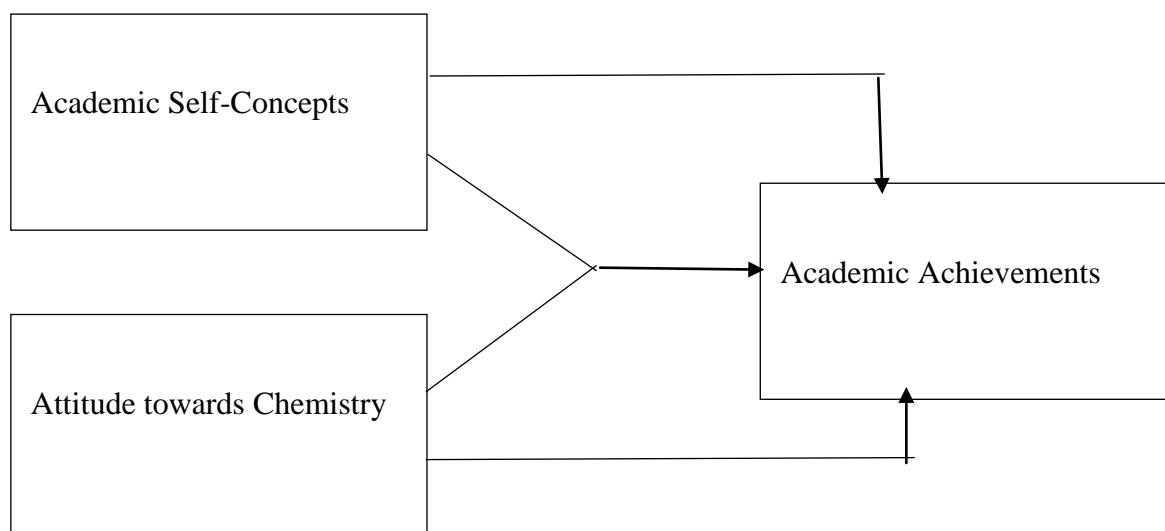


Figure 1: Schematic presentation of conceptual framework

Figure 1 shows the interaction between the variables of the study. It shows how academic self-concept predicts academic achievement independently, how attitude towards chemistry independently predicts also academic achievements and how academic self-concept and attitude towards chemistry jointly predict academic achievement.

2.2 Empirical Studies

Musengimana, Kampire and Ntawiha (2021) provided a review of literature that emphasized on the factors affecting secondary school students' attitudes toward chemistry. Thirty-six studies were selected in Google scholar and ERIC database in the time frame from 1977 to 2019. Gender, instructional methods, and grade level were found to be the most common factors positively affecting students' attitudes toward chemistry. However, students' interest, classroom environment, the relevance of curriculum, teachers' behaviour, perceived difficulty and self-directed effort in the science subjects were also studied to check if there is any relation to the attitude of students while learning chemistry. The findings indicated that these factors have to be controlled to enrich positive attitudes toward chemistry among secondary students and to improve their performance in chemistry. This study is related to the present in

that both considered attitude towards chemistry as one of the variables but differ in the location of the study.

Arnieszca and Ikhsan (2020) examined the differences in students' attitudes toward chemistry based on gender and grade level. The participants were 186 senior high school students in Kalimantan Barat, Indonesia, selected by convenience sampling technique. The data collection tool used was the Likert-scale Attitudes toward Chemistry Questionnaire by Salta that has been validated and proven reliable using *Pearson Correlation* and *Cronbach Alpha*. The questionnaire consisted of 23 items, including aspects of the importance of chemistry, difficulty of chemistry, the interest of chemistry, and usefulness of chemistry in the future career. *Mann Whitney* analysis was used to describe the effect of gender and grades on attitudes toward chemistry. The result showed that students had a neutral attitude toward chemistry. There are significant differences in attitudes towards chemistry between male and female students in all aspects. The differences in students' attitudes towards chemistry based on grades only exist in the aspect of the importance of chemistry. This study is related to the present study in that they both consider attitude towards chemistry as an independent variable but differ in the method of data analysis and location.

Herrera, Al-Lal, and Mohamed (2020) analysed the academic achievement, as well as the self-concept, personality and emotional intelligence, according to gender and cultural origin of the participants (European vs. Amazigh), and also examined what dimensions of self-concept, personality and emotional intelligence predict academic achievement. A final sample consisting of 407 students enrolled in the last 2 years of Primary Education were utilized for the study. By gender, 192 were boys (47.2%) and 215 girls (52.8%), with an average age of 10.74 years old. By cultural group, 142 were of European origin (34.9%) and 265 of Amazigh origin (65.1%). The academic achievements were evaluated from the grades obtained in three school subjects: Natural Sciences, Spanish Language and Literature, and Mathematics. Instruments used for data collection of the psychological constructs analyzed were the Self-Concept Test-Form 5, the Short Form Big Five Questionnaire for Children, and the BarOn Emotional Quotient Inventory: Youth Version-Short. Findings showed, first, the grades in the subject of Spanish Language and Literature varied depending on the gender of the students. Likewise, differences were found in self-concept, personality, and emotional intelligence according to gender. Also, the physical self-concept varied according to the cultural group. The study further found that academic self-concept showed a greater predictive value. This study is related to the present study in that they both consider academic self-concept as one of the independent variables but differ in subject area, other independent variables and location.

Tan (2019) investigated the level of academic self-concept of sophomore university students, assessed their extent of use of learning strategies as moderating variables on their math achievement specifically in problem solving. Descriptive correlational design was employed in the conduct of the study with 240 students' respondents randomly chosen as representative samples. A partial correlation was used to measure academic self-concept effect to students' accomplishment. Findings revealed that academic self-concept of students in mathematics is moderate which suggested that higher self-concept in academics and extent of utilisation of learning strategies in solving mathematical problems would result to a high problem-solving achievement. In addition, problem solving achievement was partially moderated through learning strategies. As the students extensively used the learning approach, the more that they were confident in dealing word problems in mathematics. The higher the extent of use of the strategies, the higher the problem solving achievement will be incurred by the students. This

study is related to the present study in that they both consider academic self-concept as one of the independent variable but differ in academic subject, location and method of data analysis.

Woldeamanuel and Gizaw (2019) investigated the relationship between attitudes and motivations of first year Biology and Chemistry students to learn chemistry. The study adopted correlational research design. A total of 155 first year biology and chemistry students (95 first year Biology and 60 Chemistry students) taking chemistry in the second semester of 2017/2018 at Dire University, Ethiopia, were involved in this study. Data for the study were collected using Attitude Inventory Test and the Achievement Motivation Scale. Data were analyzed using Statistical Package for Social Science (SPSS) version 21. The results showed that there is no statistically significant difference between biology and chemistry students in their attitudes and motivation towards learning chemistry. Furthermore, there is no a statistically significant relationship between attitudes and motivation of these students towards learning chemistry. This study is related to the present in that both considered attitude towards chemistry as one of the independent variable and same research design but differ in the geographical scope of the study.

Villa et al. (2017) analyzed the impact of student's attitudes toward the school discipline of Physics and Chemistry and their reasoning abilities on academic achievement on that school subject, among Portuguese 9th grade students. The participants were 470 students (267 girls – 56.8% and 203 boys – 43.2%), aged 14–16 years old. The attitude data were collected using the Attitude toward Physics-Chemistry Questionnaire (ATPCQ) and, the Reasoning Test Battery (RTB) was used to assess the students reasoning abilities. Achievement was measured using the students' quarterly (9-week) grades in the physics and chemistry subject. The relationships between the attitude dimensions toward Physics-chemistry and the reasoning dimensions and achievement in each of the three school terms were assessed by multiple regression stepwise analyses and standardized regression coefficients (b), calculated with IBM SPSS Statistics 21 software. Both variables studied proved to be significant predictor variables of school achievement. The models obtained from the use of both variables were always stronger accounting for higher proportions of student's grade variations. The results show that ATPCQ and RTB had a significantly positive relationship with student's achievement in Physics-chemistry. This study is related to the present study in that they both consider attitude towards chemistry as one of the independent variables but differ in the location of research.

Abd El Aziz Rady et al (2016) studied the relationship between academic self-concept and students' performance among school age children in freedom school for basic education of boys and girls in Cairo. A descriptive correlational design was utilized in the study and the purposive sample was composed of 182 school age children and their teachers. Tools of data collection was a structured questionnaire Results indicated that there was a significant statistical relationship between academic self-concept and students' performance among school age children. The study thus recommended the implementation of psycho-educational program in formal and informal curriculum for parents, teachers to provide a chance for students express themselves and developing their self-esteem and self-confidence. The study is related to the present study in that they both consider academic self-concept as one of the independent variable but differ in location.

Yuksel and Geban (2014) examined chemistry course achievement in relation to the academic self-concept, attitudes towards the chemistry course and logical thinking skills. The study sample consisted of 252 students in a vocational high school in Ankara who voluntarily participated with convenience sampling method. In data analysis, the study used correlation analysis, multiple regression, stepwise regression analysis, t-test and discriminant analysis.

Findings revealed that academic self-concept and logical thinking were significant predictors on academic achievement. As a result of discriminant analysis, the academic self-concept and logical thinking were determined to be the variables which distinguish successful students from unsuccessful ones. This study is related to the present study both consider the attitude towards chemistry and academic self-concept as the independent variables but differ in location and method employed in data analysis.

Kpolovie et al (2014) used multiple prediction design to ascertain the magnitude of relationship and prediction that students' interest in learning and attitude to school individually and collectively have on their academic achievement. A stratified random sample of 518 was drawn with the aid of table of random numbers from the 14459 students who enrolled for the 2013 May/June Senior Secondary Certificate Examination (SSCE) in Bayelsa State. Multiple regression statistical technique was used for analysis with SPSS to test tenability of each postulated null hypothesis at 0.05 alpha. Results showed significant correlation and multiple prediction of students' academic achievement with the predictor variables; accounting for 21.60% of the variance in students' academic performance. The study thus concluded that improvement of students' interest in learning and attitude to school could contribute in boosting their performance academically. This study is related to the present study in that both considered attitude towards chemistry as one of the independent variable but differ in the location.

3.0 Methodology

The researcher adopted a correlational research design, which is a type of non-experimental research method. The study was conducted in Awka Education Zone of Anambra State, Nigeria. The zone is one of the six educational zones in Anambra State and covers five Local Government Areas (LGAs) of Anambra State namely; Anaocha LGA, Awka North LGA, Awka South LGA, Dunkofia LGA and Njikoka LGA and is currently hosting 61 public schools. The zonal office situated in Awka oversees the activities of the public school in the zone under the overall control of the Post Primary Schools Service Commission Headquarters in Awka. The population of the study comprised of 13,767 senior secondary school students in 2020/2021 academic session in public secondary schools in Awka Education Zone of Anambra State. Since the population is a finite one, the sample size of 400 students were statistically determined using the Taro Yamane formula. The calculated sample size was distributed to the population using proportionate random sampling technique because of the number of schools in each local government area varies. Proportionate random sampling was used to draw 119 students from Awka –South, 52 students from Awka –North, 105 from Anaocha, 52 from Njikoka, and 72 from Dunukofia. Simple random was used to select the number of schools from each local government.

The instrument for data collection is a standardized questionnaire, titled “Academic Self-Concept Questionnaire (ASCQ)” developed by Liu and Wang (2005); and an Attitude Scale developed by Salta and Tzougraki (2004). The academic self-concept questionnaire will be used to assess academic self-concept of students has a total of 20 items on a four scale response format: strongly agree (4), agree (3), disagree (2), and strongly disagree (1). The attitude towards chemistry scale will be used to measure the attitude of students towards chemistry has a total of 30 items on a four scale response format. Data for students' academic achievement in chemistry will be their termly results that will be obtained officially from the school management.

The validity of the questionnaire was determined by two experts in the Department of Science Education and one expert in the Department of Education Foundations, Nnamdi

Azikwe University Awka. Since the study adopted standardized instruments, further pilot study was conducted to ascertain the reliability of the instruments since the reliability of the standardized instruments were done some years back and in a different location. The reliability of the instruments were established using Cronbach Alpha technique. Cronbach Alpha was used because the items in the instrument have multiple ratings. The instruments were administered on 20 secondary school students randomly selected from one of the public schools in Enugu State which was outside the area of the study. The Academic Self-Concept Questionnaire with 20 question items has a coefficient value of 0.799, while the Attitude towards Chemistry Scale with 30 question items has a coefficient value of 0.816. The general coefficient is 0.776. The result of the reliability indicated an internal consistency among variables hence the instruments are reliable as all the variables have coefficient values above the criteria value of 0.70.

The researcher collected data for the study through face to face contact with the students with the help of five research assistants, one for each LGA. The research assistants were briefed by the researcher on how to administer and retrieve the questionnaire. In answering the research questions and testing the hypotheses, the Regression analysis technique was employed using SPSS version 23.

4.0 Results and Discussion

Data collected for the study were statistically analyzed and presented based on the research questions and hypotheses that guided the study using appropriate tables where necessary.

Research Question 1: To what extent does academic self-concept predict academic achievement in chemistry among senior secondary students in Awka Education Zone of Anambra State?

Table 1: Simple Linear Regression Analysis of the Extent to Which Academic Self-Concept Predict Academic Achievement in Chemistry of Senior Secondary School Students in Awka Educational Zone.

Model	R	R ²	Adjusted R ²	Std. Error of the Estimate
1	.472	.237	.215	4.833

Data in Table 1 reveal that the correlation coefficient between academic self-concept and students' chemistry academic achievement is 0.472 with coefficient of determination of .237. This shows that there is a low and positive relationship between self-concept and students' chemistry academic achievement in Awka education zone. This means that academic self-concept to a high extent helps secondary school students to be better academic achievement in chemistry. Besides, the coefficient of determination of 0.237 means that 23.7% variation in the students' chemistry academic achievement can be explained by their academic self-concept.

Research Question 2: To what extent does attitude towards chemistry predict academic achievement in chemistry among senior secondary students in Awka Education Zone of Anambra State?

Table 2: Simple Linear Regression Analysis Showing the Extent to Which Attitude towards Chemistry Predict Academic Achievement in Chemistry of Senior Secondary School Students in Awka Educational Zone

Model	R	R ²	Adjusted R ²	Std. Error of the Estimate
1	.527	.295	.231	4.764

Data in Table 2 reveal that the correlation coefficient between attitude towards chemistry and students' chemistry academic achievement is 0.527 with coefficient of determination of .295. This shows that there is a moderate and positive relationship between attitude towards chemistry and students' chemistry academic achievement in Awka education zone. This means that attitude towards chemistry to a high extent boosts secondary school student's academic achievement in chemistry. Besides, the coefficient of determination of 0.295 means that 29.5% variation in the students' chemistry academic achievement can be explained by their attitude towards chemistry.

Research Question 3: To what extent do academic self-concept and attitude towards chemistry jointly predict academic achievement in chemistry among senior secondary school students in Awka Education Zone of Anambra State?

Table 3: Model Summary for a joint contribution of academic self-concept and attitude towards chemistry on academic achievement in chemistry of senior secondary school students in Awka Education Zone.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.648 ^a	.398	.372	4.37621	.398	27.505	2	964	.000

a. Predictors: (Constant), Academic self-concept, Attitude towards chemistry

Data in Table 3 reveal that both academic self-concept and attitude towards chemistry contributed positively ($r = .648$) to the chemistry academic achievement of secondary school students in Awka education zone with a coefficient of determination of .398. This indicates that 39 percent variation in students' chemistry academic achievement is jointly accounted for by their academic self-concept and attitude towards chemistry. Therefore, academic self-concept and attitude towards chemistry jointly contributed 39 percent to the chemistry academic achievement of senior secondary school students in Awka education zone.

Hypothesis 1: Academic self-concept does not significantly predict academic achievement in chemistry among senior secondary students in Awka Education Zone of Anambra State.

Table 4: Regression on the Predictive Power of Academic self-concept on Chemistry Academic Achievement of Senior Secondary School Students in Awka Education Zone of Anambra State.

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	
		B	Std. Error	Beta			
1	(Constant)	25.476	4.327		5.988	.000	
	Academic Self-concept	.443	.083	.472	5.150	.000	
	R						.000
	R ²						.000
	F						.000

a. Dependent Variable: Chemistry Academic Achievement

Data in Table 4 reveal that the predictive influence of academic self-concept on senior secondary school students' chemistry academic achievement scores in Awka Education Zone of Anambra State was ascertained at $\beta = .472$, $p < .05$ ($n = 400$). The p-value ($p \leq .000$) is less than 0.05, so the null hypothesis was rejected. Therefore, academic self-concept significantly predicted the chemistry academic achievement of senior secondary school students in Awka Education Zone of Anambra State.

Hypothesis 2: Attitude towards chemistry does not significantly predict academic achievement in chemistry among senior secondary students in Awka Education Zone of Anambra State.

Table 5: Regression on the Predictive Power of Attitude towards chemistry on Chemistry Academic Achievement of Senior Secondary School Students in Awka Education Zone of Anambra State.

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	
		B	Std. Error	Beta			
1	(Constant)	33.152	4.098		8.137	.000	
	Attitude towards chemistry	.441	.077	.527	5.761	.000	
	R						.000
	R ²						.000
	F						.000

a. Dependent Variable: Chemistry Academic Achievement

Data analysis in Table 5 reveal that the predictive influence of attitude towards chemistry on senior secondary school students' chemistry academic achievement scores in Awka Education Zone of Anambra State was ascertained at $\beta = .527$, $p < .05$ ($n = 400$). The p-value ($p \leq .000$) is less than 0.05, so the null hypothesis was rejected. Therefore, attitude towards chemistry significantly predicted the chemistry academic achievement among senior secondary school students in Awka Education Zone of Anambra State.

Hypothesis 3: Academic self-concept and attitude towards chemistry do not jointly predict academic achievement in chemistry among senior secondary students in Awka Education Zone of Anambra State.

Table 6: Model Summary for Joint Predictive Effects of Academic Self-concept and Attitude towards Chemistry on Chemistry Academic Achievement of Senior Secondary School Students in Awka Education Zone of Anambra State.

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	
	B	Std. Error				
1						
	(Constant)	25.306	4.427		5.987	.000
	Academic Self-concept	.339	.082	.416	4.814	.000
	Attitude towards chemistry	.334	.091	.364	4.321	.000
	R	.648 ^a				.000
	R ²	.398				.000
	F	27.425				.000

The result in Table 6 shows that the multiple regression coefficient (R) was .648 while R² was .398. This is an indication that the predictor variables jointly contributed 39% to explain the variances in response and the corresponding F (2, 397) = 27.425, is statistically significant (p < .05). Therefore, the finding indicates that the presence of both variables would have a greater impact on the chemistry academic achievement of senior secondary school students in Awka Education Zone of Anambra State. The null hypothesis was rejected implying that academic self-concept and attitude towards chemistry jointly predicted the chemistry academic achievement of senior secondary school students in Awka Education Zone of Anambra State.

4.1 Discussion of Findings

The findings of the research revealed a positive relationship between academic self-concept and chemistry academic achievement of secondary school students. When further subjected to statistical analysis, Academic self-concept significantly predicted chemistry academic achievement of senior secondary school students in Awka Education Zone. This finding is in line with Herrera, Al-Lal and Mohamed (2020) who asserted that academic self-concept showed a positive predictive value on academic achievement on science subjects and literature. Also, Tan (2019) revealed that academic self-concept of students in mathematics is moderate which suggested that higher self-concept in academics and extent of utilization of learning strategies in solving mathematical problems would result to a high problem-solving achievement. Furthermore, Rady, Kabeer and El-Nady (2016) opined that there was a significant statistical relationship between academic self-concept and students' academic performance among school age children. Research by both McCoach and Siegle (2013) also suggested that self-concept, especially academic self-concept helps to predict students' academic achievement. They state that as much as one-third of the variance in achievement can be accounted for by academic self-concept. Finally, Oluwatosin and Bamidele (2014) revealed that there was a positive correlation between students' self-concept and their academic performance in chemistry and that chemistry students attending private school have higher level self-concept compared to those attending public schools. Contrary to this finding, few studies have come to differing conclusions about academic self-concept and academic achievement based on their findings. Research done by Harms et al (2021), showed evidence to the contrary, namely that humble self-assessments are more conducive to academic achievement. Despite much research, no consistent studies clearly indicating the link between academic self-concept and academic achievement could be found. Furthermore, Wang and Wei (2020) asserted that academic self-concept did not significantly prediction academic achievement. The relationship between academic self-concept and achievement was negative.

The findings of the research revealed a positive relationship between attitude towards chemistry and chemistry academic achievement of secondary school students. When further subjected to statistical analysis, Attitude towards chemistry significantly predicted chemistry academic achievement of senior secondary school students in Awka Education Zone. This finding is in line with the study by Musengimana, Kampire, and Ntawiha (2021) which indicated that amongst other factors, positive attitudes toward chemistry among secondary students would improve their performance in chemistry. Villa et al. (2017) in their study found attitude towards chemistry as a significant predictor variable of school achievement in chemistry. Furthermore, Kpolovie et al (2014) also asserted that attitude to learning a subject is a significant predictor of academic achievement in that subject. Ali and Awan (2013) study indicated that attitude towards science had significantly positive relationship with the achievement of science students at secondary level. On the contrary, Das, Halder and Mishra (2014) found that attitude towards education and academic achievement have very low negative relation which is not statistically significant. Furthermore, Lee (2014) reported that students in most countries/education systems who performed well in the PISA reading and mathematics tests, such as in Shanghai-China, South Korea, Hong Kong-China, Singapore, and Japan as well as Western countries like Finland and the Netherlands, do not have positive attitudes toward school and learning.

The findings of the study showed that academic self-concept and attitude towards chemistry jointly predicted the academic achievement in chemistry of senior secondary school students in Awka Education Zone. Comparing this finding with the relative contributions of each of the predictors to the chemistry academic achievement of the students, it revealed that though each of them has a positive relationship with the chemistry academic achievement of the students, both independent variables when combined, jointly predicted the chemistry academic achievement of the students. This implies that students need healthy and improved academic self-concept and positive attitude towards chemistry to have better academic achievement in chemistry. The finding of this study corroborates with Yahaya (2020), which reveals that though both self-concept and attitude to course of study are significant predictors of students' academic achievement, it further indicates that attitude to course of study is a better predictor of academic achievement of students than self-concept. Moreso, result supports the findings of Tan (2019), McCoach and Siegle (2013) who earlier reported that academic achievement of students in the area of study was mostly predicated by their attitude to course of study and self-concept. Yahaya (2020), also asserted that self-concept and attitude towards a subject jointly predicted academic achievement.

5.0 Conclusion and Recommendation

In conclusion, the findings from these results revealed expected outcomes. The expected outcomes in line with literature show that academic self-concept is a positive predictor of academic achievement. Also, attitude towards chemistry is a predictor of academic achievement. Both variables jointly predicted achievement, accounting for a 39 percent variation in students' chemistry academic achievement. It is concluded that a healthy academic self-concept will help better students' academic achievement in chemistry. Furthermore, a positive attitude towards chemistry will boost senior secondary school students' chemistry achievement scores. Therefore, the earlier students can boost their self-concept and attitude towards subjects, the better achievement scores they will get.

The findings of this study have general and applied implications. This study has educational implications for the students, educationists/school administrators, school counsellors & educational psychologists, teachers at both secondary and tertiary levels and

the society at large. It is clear from the findings of this study that both academic self-concept and attitude towards chemistry positively predicts chemistry academic achievement. Chiefly, this study affects students more, given that individual beliefs and attitudes breed positive or negative outcomes. Students should work on their belief systems, especially their self-concept and wear positive attitudes as an approach to learning any subject. As attitude and self-beliefs impact an individual performance in a subject, students need to cultivate healthy attitudes and self-concept in order to improve their academic achievement.

Educationists and school administrators as persons with pivotal role in affecting the school and educational sector generally, should be better enlightened at some issues students are having, as concerns poor achievement. For students who are struggling to cope academically and perform as they should, can be aided by educationist and school administrators as they will be able to come up with effective strategies to deal with self-concept and attitude issues. These could include interfacing with parents to discuss these problems. Educational psychologists and school counsellors who are responsible for the psychological welfare of students in school, having seen that students need to have healthy self-concepts and attitudes, can help in handling adolescents who are low in self-concept and have poor attitude towards learning, therapeutically help them in identifying individual coping strategies so as to aid manage and control their self-concept issues and improve their attitudes to learning chemistry. Teachers in secondary are people with the closest relationship with adolescents other than their parents and peers. Sometimes as a result of this self-concept issue, students could be withdrawn from school activities. This could affect their interactions and participation in the classroom. As a way of proffering solutions to these problems, teachers are in the best place to find out if such problems like poor attitude and unhealthy self-concept are weighing down on the students and recommend such students to school counsellors citing their suspicions.

Based on the findings of this study, the following recommendations were made: Since there is a moderate and positive relationship between academic self-concept and students' academic achievement, teachers should make more efforts to build positive self-concept in their students. Teachers should help students with poor self-concept by recommending them for counselling. This disposition will encourage students to open up and share their academic challenges with them for necessary assistance; Students should adopt positive attitude towards chemistry if they desire to have significant academic achievement in chemistry; Psychologists and school counsellors should pay attention to the academic self-concept of students who are academic underachievers.

Teachers should also make the classroom enriching while adopting the student-centred and participatory policy in their method of teaching. Stimulus variation is also recommended to arouse and sustain the interest of the students during classes. Teachers should look closely into students who have poor attitude towards their subjects. When identified, they should be referred, when necessary, to educational psychologists to ascertain any physical, social and or psychological factors which may be affecting the students' poor attitude and academic underachievement.

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