STUDENT'S PERSONALITY TYPE AND GENDER AS DETERMINANTS OF SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN QUANTITATIVE ANALYSIS IN AKURE, NIGERIA

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Abstract
The main purpose of this study was to determine the influence of personality types and gender on students' achievement in quantitative analysis. For this descriptive survey research, two research questions and two hypotheses were generated. Using two well-validated instruments (Students' Achievement Test in Quantitative Analysis (SATQA), and Student's Personality Type Questionnaire (SPTQ), the data was collected from 600 chemistry students from 5 randomly selected schools in Akure South Local Government, Ondo State. This was analyzed using frequency counts, mean, percentage, Analysis of Variance (ANOVA), and t-test. The results are that most of the respondents (72.5%) had low achievement in quantitative analysis in chemistry. Also, regarding students' personality types, agreeableness was ranked highest based on the mean score, followed by openness, conscientiousness, extraversion, and neuroticism, implying that agreeableness is the most predominant personality. It was found that there was no significant difference in students' achievement in quantitative analysis based on personality type ($F_{(4, 595)} = 0.76$; $p>0.05$). There was also no significant difference in male and female students' achievement in quantitative analysis in senior schools' chemistry ($t = 0.07$; $p>0.05$). We concluded that both personality types and gender had no impact on students' achievement in Quantitative Analysis in chemistry. However, it is recommended that teachers make efforts to create chemistry learning environments with consideration for the differences relating to students' personality types and gender.

Keywords: Students' Personality Types, Gender, Achievement in Quantitative Analysis.

Introduction

Chemistry is known widely as the scientific study of the properties and behavior of matter. It occupies a pivotal position in science and technology and is needed in every aspect of human endeavor. (Abubakar and Eze, 2010). In a developing country like Nigeria, the importance of chemistry cannot be overemphasised. According to Igbonugo (2015), chemistry helps to ensure the continuous availability of students in the expected number who take important professions such as medicine, pharmacy, dentistry, food science, agriculture, engineering, science education, and, environmental education. Giginna and Nweze (2014) pointed out that the study of chemistry as a science subject has tremendous importance to mankind as the application of its principles has helped in modern inventions. The study of Chemistry entails the learning of concepts, established principles, laws, and theories and also substantial activity-oriented laboratory work. The laboratory experiments are geared towards exposing learners to the practical demonstrations of some of the principles taught in theory, to test the authenticity of chemical laws and show the properties of substances. No doubt, Chemistry education needs to be given attention and priority in every nation's educational system. Among the objectives of

the revised edition of the senior secondary education chemistry curriculum, are to enable students to develop an interest in the subject of chemistry, acquire basic STM knowledge and skills, and apply skills to meet societal needs of creating employment and wealth. (NERDC, 2007).

Quantitative analysis (QA) is a topic in chemistry that students have to learn. This is a practical, activity-based aspect of chemistry designed to offer students a direct feel of scientific phenomena. Learning QA fosters students' conceptual understanding of reactions, enables them to calculate known quantities and concentrations of chemical substances within a sample solution, and consequently, equips students with the critical skills and knowledge for future careers in areas such as drug manufacturing, process control, environmental monitoring, medical diagnostics, and food production. For instance, the neutralization process i.e. acid-base titration, is a common part of QA. The volume of the acid required to neutralize a given quantity of base is determined, calculated, and recorded in appropriate units. Despite the importance of quantitative analysis to students and society at large, there seems to be a decline in students' performance. It has been suggested that students should be exposed to more practical sessions in quantitative analysis.

Some of the factors that have been shown to influence learners' achievement are student-related ones. One of them is the student's personality type. An individual's personality is the quality of the perception and comportments that often prompt one to act similarly or differently from others. It is said to account for the dissimilarities in students' persistent sensitivity, reasoning, and attitudes towards their studies (Khan, 2018). Understanding personality types may provide explanations as to the differences in the way that students learn and sustain different levels of sensitivity, logic, and persistence. According to Bergner (2020), a person's personality is the relatively permanent and prominent set of traits and styles exhibited, "which characteristics represent (a) dispositions (i.e., natural tendencies or personal inclinations) of this person, and (b) ways in which this person differs from the "standard normal person" in his or her society". However, there has been an increasing interest in the big five personality types (openness to experience, conscientiousness, extraversion, neuroticism, and agreeableness) and their role in students' academic achievement, especially in secondary school.

There are indications that personality types could positively or negatively influence students' academic achievement (Ogunleye, 2011; YildizDurak, 2023). Students who are classed as Openness to experience tend to be innovative, inquisitive, and highly clever. Conscientious personality to pays close attention to facts and details. Extraverts are known to be emphatic, friendly, outgoing, and active in academic work. Neuroticism reflects a personality that is commonly emotionally unstable and sensitive. Many have been known to exhibit apprehension, hostility, and susceptibility. While, agreeableness is a personality type that represents individuals who are supportive, accommodating, pleasing, caring, and trusting in their dealings with others. This class is strongly associated with students' academic performance determination.

In a study on personality characteristics, Olowookere, Alao, Adekeye, & Ayorinde (2017**)** found conscientiousness to be positively related to academic achievement while neuroticism was negatively related to academic performance. It also discovered that extraversion, openness to experience, and agreeableness were unrelated to academic achievement which is an indication that personality characteristics significantly predicted academic achievement partially because only conscientiousness was found to significantly contribute to students' academic achievement. Eyong, David, Bassey, and

Umoh (2014) in their study examined the impact of personality traits on the academic performance of secondary school students in Cross River State. This ex-post facto research involved 8530 SSI students drawn from 20 schools that were randomly chosen in Cross-River State, Nigeria, using the 44-item Big Five Personality Model questionnaire. It was found that the achievements of students with high levels of conscientiousness and agreeableness were significantly different from those with low levels of personality type. Results also revealed that learners with high levels of conscientiousness did better than those with low levels and that highly agreeable students performed better than their less agreeable classmates.

According to Meyer, Fleckenstein, Retelsdorf, and Köllera (2018), conscientiousness can predict students' achievement in mathematics while 'openness to experience' may have the same influence on their English grades. According to Durak (2018), extraversion and agreeableness had a significant impact on academic achievement, while conscientiousness had a strong influence. Neuroticism and receptivity to new things, on the other hand, were discovered to be unrelated to academic success. According to Bakar and Chew (2018), agreeableness, conscientiousness, extraversion, and neuroticism were linked to academic achievement. In another vein, extraversion and learning styles positively correlated while neuroticism correlated negatively with students' learning styles (Siddiquei and Khalid, 2018). Another factor that may interplay among varying personalities is gender.

The Collins Online Dictionary (2020) defines gender as a state of being male or female concerning cultural and social duties that society deems as fitting for each person. Gender also refers to the roles and features assigned to individuals as female or male (Nnamani &Oyibe, 2016). It is believed that gender is the result of the cultural acquisition of knowledge and lifelong socialization and is not biologically dependent. This is reflected in the ascription of certain characteristics to males; such as "dominance/assertiveness, tactfulness, intellect, self-confidence, bravery, aggression, and logical thinking while females are identified by fearfulness, submissiveness, talkativeness, and tactlessness (Nnamani &Oyibe, 2016).

There are divergent views on the relationships between gender and academic achievement; particularly in science. For instance, Jabor, Machtmes, Kungu, Buntat, and Nordin (2011) discovered that there were significant differences in mathematics GPA scores between age groups and gender. In a related study, Khwaileh and Zaza (2011) found that college female students' general academic performance was better than their male peers. Another study by Olowookere, Omonijo, Odukoya, and Anyaegbunam (2020) titled "Student Gender: Exploring the Effect of Gender and Personality Characteristics on Educational Performance" revealed that male and female students differ from one another in terms of academic performance but not in terms of personality traits. The females performed better than the males.

Furthermore, Marc Jackman and Morrain-Webb (2019) also concluded that females outperformed males. However, Okonna, Ushie, and Okworo (2014) and Olasehinde and Olatoye (2014) found that there is no significant gender difference in academic performance. Therefore, this study determined if students' personality types and gender influence students' achievement in quantitative analysis in chemistry in senior secondary schools in Akure, Nigeria.

Research Questions

1. What is the level of students' achievement in quantitative analysis?
2. What are the personality types among senior secondary school chemistry students?

Hypotheses

H_1 There is a significant difference in the achievement of students in quantitative analysis based on personality type.

H_2 There is a significant difference in the achievement of students based on gender.

Methods

The study adopted the descriptive survey research design. The participants in this study comprised six hundred (600) secondary school two (SSII) chemistry students from 5 randomly selected secondary schools in Akure South Local Government. These students had been previously taught the concept by their respective teachers. Students' Achievement Test in Quantitative Analysis (SATQA), and Student's Personality Type Questionnaire (SPTQ) were the instruments used for this study.

The Students' Achievement Test in Quantitative Analysis (SATQA) was developed using the West African Examination Council (WAEC,2020-2021) past questions as a guide. This instrument was initially validated content-wise and further subjected to a reliability test, Kuder-Richardson formula-20. The value obtained was 0.77. The 24-item multiple choice test was given to the students after informing them about the test in advance. Each correct answer attracted one (1) mark. Therefore, the highest achievable score was 24. The distribution of the scores was used to judge the general level of the students' achievement in Quantitative Analysis.

The Student's Personality Type Questionnaire (SPTQ) was adapted from the Big Five personality scale developed by Goldberg (1993). Using the Test-retest method, the instrument was administered to a total of 20 chemistry students who were not supposed to be part of the main study sample, and a Cronbach alpha value of 0.82 was obtained.

Research Procedure /Data Collection

After obtaining all necessary authorizations from the sampled schools, the Student's Personality Type Questionnaire (SPTQ) was first administered to the chemistry students. This was followed by the Students' Achievement Test in Quantitative Analysis (SATQA).

Results

Research question 1: What is the level of achievement of senior school chemistry students in quantitative analysis in Akure, Nigeria?

Table 1: Students' Achievement Scores in Quantitative Analysis

Level	Score range	Frequency	Percentage (%)
Low	0 – 13	435	72.5
High	14 – 24	165	27.5

Total	24	600	100.0

Table 1 indicates that 435 (72.5%) of the respondents have low achievement in quantitative analysis in chemistry while 165 (27.5%) have high achievement in quantitative analysis in chemistry. Also, the mean achievement score is 11.23, implying that majority of the respondents had low achievement in in quantitative analysis in chemistry.

Research question 2: What are the personality types among senior school chemistry students?

Table 2: Students' personality types

S/No.	Items I see myself as someone who	Mean	Std.D
Openness			
1.	Is original and comes up with new ideas	2.99	0.79
2.	Is curious about many things	3.17	0.79
3.	Is ingenious, a deep thinker	2.91	0.87
4.	Has an active imagination	3.16	0.80
5.	Is inventive	2.99	0.92
6.	Values artistic, aesthetic experiences	3.23	0.72
Weighted mean = 3.08			
Conscientiousness			
7.	Does a thorough job	3.18	0.82
8.	Can be somewhat careless	3.23	0.88
9.	Is a reliable student	3.24	0.78
10.	Tend to be disorganized	3.13	0.87
11.	Tends to be lazy	2.70	0.99
12.	Is easily distracted	2.85	1.01
Weighted mean = 3.05			
Extraversion			
13.	Is talkative	3.21	0.77
14.	Is full of energy	3.08	0.75

15.	Is outgoing, sociable	2.68	0.93
15.	Is sometimes shy, inhibited	2.70	0.87
16.	Generates a lot of enthusiasm	2.65	0.91
17.	Is reserved	2.76	0.83
18.	Is talkative	3.21	0.77
Agreeableness			
19.	Tend to find fault with others	3.17	0.73
20.	Is helpful and unselfish with others	3.09	0.76
21.	Starts quarrel with others	2.77	0.98
22.	Is generally trusting	3.33	0.72
23.	Is sometimes rude to others	3.32	0.86
24.	Likes to cooperate with others	3.13	0.95
Weighted mean = 3.13			
Neuroticism			
25.	Worries a lot	2.84	1.00
26.	Can be moody	2.85	0.90
27.	Remains calm in tense situation	2.45	0.96
28.	Gets nervous easily	2.61	1.01
29.	Is emotionally stable not easily upset	3.27	0.66
30.	Worries a lot	2.93	0.82
Weighted mean = 2.82			
Criterion mean = 2.50			

Grand Weighted Mean = 2.99

Table 2 reveals the grand weighted mean scores for each personality type. These weighted mean scores were ranked from the highest to the lowest as follows: Agreeableness was highest by the mean score (3.13), followed by openness (3.08), conscientiousness (3.05), extraversion (2.85), and lastly, neuroticism (2.82), respectively. Table 2 further indicates the grand weighted mean of 2.99, implying only three personality types with weighted means above this grand weighted mean were the

predominant personality types among senior school chemistry students. These are agreeableness, openness, and conscientiousness.

Hypothesis 1: There is a significant difference in the achievement of students in quantitative analysis based on personality types?

Table 3: ANOVA showing difference in the achievement of students in quantitative analysis by personality type

Sources of Variance	Sum of Squares	Df	Mean Square	F	Significant
Regression Residual Total	32.317 6291.016 6323.333	4 595 599	8.079 10.573	0.764	0.549

Table 3 reveals that there was no significant difference in the achievement of students in quantitative analysis based on personality type ($F_{(4, 595)} = 0.76$; $p>0.05$). This means the personality type of students did not influence the achievement of students in quantitative analysis

Hypothesis 2: There is a significant difference in the achievement of students in quantitative analysis based on gender?

Table 4: t-test showing the difference in male and female students' achievement in quantitative analysis

Gender	N	Mean	Std.d	Df	T	P value	Remark
Male	275	11.24	3.21	598	0.071	0.943	N.S.
Female	325	11.25	3.29				

N.S. denotes not significant at 0.05 level of significance

Table 4 reveals that there was no significant difference in male and female student achievement in quantitative analysis in senior schools' chemistry ($t = 0.07$; $p>0.05$). This implies that gender has no impact on students' performance in quantitative analysis. Table 4 also reveals that female students have a slightly better achievement mean score (11.25) than their male counterparts (11.24); although not significant.

Discussion

The findings revealed that the majority of the respondents had low achievement in quantitative analysis in chemistry. This result is in attestation to WAEC Chief Examiner's report, (2019) which also reveals the low achievement of students in practical chemistry. Students' inadequate knowledge and low

previous learning experiences on topics relating to quantitative analysis may have contributed to their low achievement of student in quantitative analysis.

In this study, agreeableness was found to be the most predominant personality type among senior school chemistry students. This is similar to the findings of Khan (2018), whose findings reveal that extraversion and agreeableness had a significant impact on academic achievement, while conscientiousness had a strong influence. This is perhaps due to the cultural milieu of the learning environment. The majority of the students in the western part of Nigeria are taught to be sensitive and responsive to one another, not being competitive.

Findings also revealed that there was no significant difference in the achievement of students in quantitative analysis based on personality type. This result agrees with that of Olowookere et al, (2017**)** who found that conscientiousness and neuroticism were related to students' academic performance. Whereas, extraversion, openness to experience, and agreeableness were unrelated to academic achievement. This implies that the personality type of the senior secondary chemistry students does not influence their achievement in quantitative analysis. That is, the personality types possessed by students do not determine high or low levels of students' achievement in quantitative analysis. The level of students' achievement in quantitative analysis may also be dependent on other factors such as attitudes, study habits, and previous learning experiences.

From the findings, it was also discovered that the gender of the chemistry students has no impact on achievement in quantitative analysis. However, the female students had a slightly better achievement mean score than their male counterparts. The difference was not significant. This is in line with the results obtained by Okonna, Ushie and Okworo (2014); Olowookere, Omonijo, Odukoya, and Anyaegbunam (2020) and Olasehinde and Olatoye (2014) who concluded that there were no appreciable differences in male and female students' overall achievement in biology, chemistry, and physics.

Conclusion and Recommendations

It was concluded that most students in Akure South, Nigeria have low achievement in quantitative analysis in chemistry and possess the agreeableness type of personality. Also, the achievement of students in quantitative analysis does not vary based on personality type and gender.

Based on the findings of this study, the following recommendations were made;

1. Teachers should be professionally equipped by attending seminars, conferences, and workshops on more effective ways of teaching the concept of quantitative analysis in chemistry.
2. Teachers should also use instructional techniques that will maintain the parity of gender and personality types in students' learning outcomes in chemistry.
3. Students should be guided through adequate counseling and mentoring on their personality type and how it may relate to their learning achievement.

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