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PATH ANALYSIS OF THE RELATIONSHIP BETWEEN STUDENTS' PERSONALITY TRAITS AND ACADEMIC ACHIEVEMENT OF SECONDARY SCHOOL STUDENTS IN COMPUTER SCIENCE IN BENUE STATE, NIGERIA

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ABSTRACT

The study investigated the relationship between students' personality traits and students' academic achievement in Computer Science in Secondary schools in Benue State using Path analysis. It was guided by six specific objectives and six research questions raised for the study. Three hypotheses were formulated for the study and tested at 0.05 level of significance. The study adopted triangulated research design. The study was carried out in Benue North West Educational Zone of Benue State, Nigeria. The population of the study is 4293 Students. This comprises all the senior secondary II students in Benue North West Educational Zone. The sample size for the study is 384. This was obtained using Krejcie and Morgan Table for sample size determination. Student Personality Trait Questionnaire (SPTQ) and Students Profoma were validated by three experts. Cronbach Alpha method was used to determine the reliability coefficient of the Students' Personality Traits Questionnaire and it yielded a total reliability coefficient of 0.72. Data were collected through face to face administration of copies of the instruments with the help of five research assistants. As a path analytic study, data collected were analyzed using multiple regression analysis in Mplus. The study found that the causal model for providing an explanation of the achievement of students in Computer science is the model involving students' personality traits of openness to experience and conscientiousness. The study also found that there is no significant difference in the model fit of the empirically observed model and the theoretical model proposed for the study. It was revealed that the significant paths through which the independent variables (students' personality traits) caused variation on the dependent variable (students' academic

achievement) are those of openness to experience and conscientiousness. Based on the findings of this study, it was concluded that students' personality traits of openness to experience, conscientiousness, extraversion, agreeableness and neuroticism plays a role in students' academic achievement in Computer Science, and they account for 15.0% variation in students' academic achievement in Computer Science in secondary schools in Benue state. It was recommended among others that Curriculum planners and teachers should incorporate learning strategies and classroom activities that nurture and leverage openness (e.g., creative tasks, exploration) and conscientiousness (e.g., time management and goal setting) to enhance academic achievement.

1.0 INTRODUCTION

1.1 Background of the Study

Education is a fundamental component of human development. It represents the most impactful social institution within any society. Its primary goal is to deliver systematic and scientific outcomes that fulfil both individual and societal needs. Generally, education seeks to pass down a shared set of beliefs, values, norms, and knowledge from the adult population to the younger generation (Arugba, 2019). The high demand for education stems from its significant contributions to a nation's overall growth. Consequently, to provide education, various subjects are taught at different levels of educational institutions globally, aligning with the goal of using education as a tool for effective national development. These levels range from pre-primary, primary, secondary, to tertiary institutions, with subjects categorized into disciplines such as sciences, arts, commerce, and technical studies.

At the secondary school level, one of the subjects taught is Computer Science. This subject focuses on the theories and methods of processing information in digital form. It encompasses the principles, theories, and applications of technologies that are essential for accessing information (Kremer, 2018). In 1988, the Federal Government of Nigeria introduced Computer Science Education into the national secondary school curriculum through the National Computer Policy, making it a mandatory subject at the junior level. Additionally, the Federal Ministry of Education, according to Adefunke, Ayodele, & Olufemi, (2014) acknowledged the critical role of computers in the contemporary world and incorporated computer studies and science into the Nigeria education system. According to the National Computer Policy, the primary objective is to ensure that the general public recognizes the impact of Information and Computer Technology on daily life, comprehends

the structure and function of computers and their history, and appreciates the economic, social, and psychological effects of computers (Jegede & Owolabi, 2013).

The teaching and learning of Computer Science at the secondary school is done with an intention to achieve the set objectives of Computer Science education such as; to provide students with a solid foundation in core computer science concepts such as algorithms, data structures, programming languages, and software development; to ensure that students gain proficiency in multiple programming languages, software tools, and platforms, enabling them to develop and implement software solutions. These objectives usually are written in behavioural terms. Achieving these objectives is a goal of every Computer Science students. The extent to which these goals can be achieved may be determined through students' personality traits. Students' personality traits refer to the characteristic patterns of thoughts, feelings, and behaviours that students' exhibit consistently over time and across different situations. The Big Five personality traits model comprising openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism provides a widely accepted framework for describing individual differences, which in turn shape how students perceive and engage with their academic environment, peers, and learning tasks.

1. Openness to experience is a general appreciation for art, emotion, adventure, unusual ideas, imagination, curiosity, and variety of experience. Students who are open to experience are intellectually curious, open to emotion, sensitive to beauty and willing to try new things (Sackett & Walmsley, 2014). Openness to experience is the ability of an individual to be creative, imaginative, and zealous to experience new things amongst other things. Openness to experience is the tendency of the individual to be imaginative and free minded, sensitive to situations, original in thinking, attentive to inner feelings and intellectually curious. Such individuals are willing to entertain new ideas and unconventional values. Individuals open to experience exhibits characters of been imaginative, curious, broad minded, intelligent and artistically sensitive (Barrick, Neubert, & Mount, 2021). Openness to experience by students helps them in seeking new things constructively which can enhance their academic achievement. Openness involves a willingness to explore new ideas and engage with abstract concepts. In Computer Science, students with high openness may excel in areas that require creativity and innovation, such as software design or algorithm development. Their curiosity may also lead them to explore new programming languages or technologies, enhancing their learning and achievement. Another personality trait that is of concern to the researcher is Conscientiousness.

2. Conscientiousness as one of the personality traits is a tendency to display self-discipline, act dutifully and strive for achievement against measures or outside expectations. It is related to the way in which students control, regulate, and direct their impulses (Toegel & Barsoux, 2012). Conscientiousness is having the likelihood to act dutifully, exhibit self-discipline, and aim for achievement contrary to a limit or outside expectation. Conscientiousness describes socially prescribed impulse control that facilitates task and goal directed behaviour, such as thinking before acting, delaying gratification, following norms and rules, and planning, organizing, and prioritizing tasks (McCrae & Costa, 2016). The prediction of academic achievement of students in Computer science whether positive or negative will depend on the traits possessed by the students. Where the traits are positive, positive performance may be experienced and where negative, negative performances may equally be experienced. This trait is associated with diligence, organization, and a strong sense of responsibility. Students high in conscientiousness tend to be more disciplined and methodical, which can lead to better time management and thoroughness in coding, debugging, and completing assignments. As a result, they are more likely to achieve higher grades and excel in Computer science courses. Also another personality trait of interest to the researcher is Extraversion.

3. Extraversion is indicated by positive feelings (emotions) and tendency to seek company of others. It represents the likelihood to be sociable, assertive, active, upbeat, cheerful, and optimistic; such individuals like others, prefer groups, enjoy excitement and stimulation, and experience positive effect such as zeal, energy, and excitement (Uziel, 2016). The realization and practicality of the role of extroversion by students may help in predicting such students' academic achievement. Extraverts enjoy interacting with people, are often enthusiastic and action-oriented individuals. They possess high group visibility, like to talk and assert themselves. Extraverted students, who are sociable and outgoing, may perform better in collaborative learning environments, such as group projects or pair programming. However, since Computer science often requires long periods of focused, solitary work, introverted students may find themselves better suited to the individual aspects of the discipline, potentially balancing out the effects of extraversion. Similarly, another personality of concerned by the researcher is Agreeableness.

4. Agreeableness is the tendency to be trusting, compliant, caring, considerate, generous, and gentle. Such individuals have an optimistic view of human nature. They are sympathetic to others and have the zeal to help others; in reciprocation they expect others to be helpful. In essence, agreeable individuals are straightforward and have communal orientation toward

others. Agreeableness incorporates constructs of sympathy, cooperativeness, and easy-going with others. It is described as the degree to which a person is good natured, warm and cooperative as opposed to irritable, uncooperative, inflexible, unpleasant and disagreeable. Asante (2017) Agreeableness exhibited by individuals in the classroom through cooperative learning, and been helpful in explaining areas of difficulties amongst students may help in the prediction of students' academic achievement particularly for Computer science. The agreeableness trait reflects individual differences in general concern for social harmony. This trait, which includes being cooperative and empathetic, can be beneficial in team-based projects and collaborative coding tasks, where effective communication and teamwork are essential. However, Computer Science often requires critical thinking and assertiveness, especially when debugging or evaluating different approaches, which may be more challenging for highly agreeable students. Another personality of interest by the researcher is Neuroticism.

5. Neuroticism measures the continuum between emotional adjustment or stability and emotional maladjustment or neuroticism. People who have the tendency to experience fear, nervousness, sadness, tension, anger, and guilt are at high end of neuroticism. Individuals scoring at the low end of neuroticism are emotionally stable and even tempered. Kumari (2014) defined Neuroticism as a general tendency to experience negative effects such as fear, sadness, embarrassment, anger, guilt and distrust. It is the degree to which a person is calm and self-confident in learning computer as opposed to being anxious and insecure. Neuroticism helps in the prediction of students' academic achievement in Computer science base on the behaviours that will be experienced. The prediction can tilt towards any side as positive or negative. High levels of neuroticism, characterized by anxiety and emotional instability, can negatively impact achievement in Computer science. Students who are prone to stress may struggle with the frustration that often accompanies debugging and problem-solving, leading to lower persistence and potentially lower academic performance.

Students' personality traits may indeed explain a substantial portion of the variation in their academic achievement. This study is however, exploring this possibility through the use of path analysis in Structural Equation Modelling (SEM). Path analysis is a statistical technique used to examine the causal relationships between sets of variables. It involves constructing a model of the hypothesized causal relationships between the variables and then testing this model using statistical methods **(**Kline, 2015**).** Path analysis allows researchers to examine both direct and indirect effects of variables on one another, as well as to control for other

factors that may influence these relationships**.**Path analysis examines the predictive association among variables over time. It is an extension of multiple regressions as it involves various multiple regression models and equations that are estimated simultaneously. In path analysis, a variable can be a dependent variable in one relationship and an independent variable in another. These variables are referred to as endogenous variables while exogenous variables are those that are not affected by other variables in the model (Byrne, 2022).

The knowledge of Computer Science is crucial to the actualization of the goals of 21st century and as such, the study of Computer Science and factors that may hinder students' academic achievement in the subject needs to be studied. This has necessitated for this study

1.2 Statement of the Problem

Computer Science is one of the most important subjects offered in schools because of its wide range of applicability in Information and Communication Technology (ICT). Computer Science is a vital field that drives innovation and technological advancement, enabling the development of solutions that address complex global challenges across various sectors such as healthcare, education, and business. Its importance lies in empowering individuals and organizations to harness the power of data, improve efficiency, and create new opportunities for growth and development in an increasingly digital world.

However, there is a growing concern about students' poor academic achievement in Computer Science at the secondary school level. Sakiyo and Badau (2012) assert that students' academic performance trend in Computer Science was low despite the high enrolment rate for WASSCE within the year 2015 to 2023. Students' poor achievement in Computer Science is seen to have often stem from a combination of insufficient foundational knowledge, and a lack of engagement with the subject's abstract concepts and problem-solving demands. Additionally, inadequate access to resources and effective teaching methodologies can further hinder students' ability to grasp complex computational theories and practical applications. Students' personality traits, such as high levels of conscientiousness and openness to experience, may significantly enhance their academic achievement in Computer Science by fostering diligence, attention to detail, and a willingness to explore complex problems. Conversely, traits like neuroticism, characterized by anxiety and emotional instability can hinder performance by increasing stress and reducing the ability to engage effectively with challenging material. It is in the view of this that this study is being carried out to find out the relationship between students' personality traits and academic achievement in Computer Science in secondary schools in Benue State using Path Analysis.

1.3 Objectives of the Study

The study determined the relationship between students' personality traits and academic achievement of Secondary School Students in Computer Science in Benue State using Path Analysis. Specifically, the study determined the;

1. Casual model for providing an explanation of the achievement of students in Computer Science based on the selected students' personality traits.
2. Extent to which the students' personality traits, (openness to experience and agreeableness) when taken together would predict the academic achievement of students in Computer Science.
3. Relative contributions of each of the students' personality traits to the prediction of the students' academic achievement in Computer Science.
4. Directions and estimates of the strengths of causation (path coefficients) of the students' personality traits in the model.
5. Direct and indirect influences of the students' personality traits on the students' achievement in Computer Science
6. Proportion (%) of the total influence that is direct and indirect.

1.4 Research Questions

The following research questions guided the study:

1. What is the casual model for providing an explanation of the achievement of students in Computer Science based on the selected students' personality traits?
2. To what extent would the students' personality traits, when taken together predict the academic achievement of students in Computer Science?
3. What are the relative contributions of each of the students' personality traits to the prediction of academic achievement in Computer Science?
4. What are the directions and estimates of the strengths of causation (path coefficients) of the students' personality traits in the model?
5. What are the direct and indirect influences of the students' personality traits on the students' achievement in Computer Science?
6. What proportion (%) of the total influence is direct and indirect?

1.5 Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance.

1. There is no significant model fit between the empirically observed data and theoretical model proposed for the study
2. Students' personality traits, when taken together would not significantly predict the academic achievement of students in Computer Science.
3. The relative contributions of each of the students' personality traits do not significantly predict students' academic achievement in Computer Science

2.3 Review of Related Empirical Studies

This section reviews empirical studies carried out by other researchers that are related and relevant to the present study.

Maruff (2010) conducted a study titled "A Path-Analytic Study of Socio-Psychological Variables and Academic Performance of Distance Learners in Nigerian Universities". The study provided a causal explanation of distance learners' academic performance through the analysis of the direct and the indirect effects of some students' socio-psychological variables such as age, gender, disability status, employment status, marital status, self-efficacy, self-regulations, study habits, self-concept and attitude. Five research questions were answered and five hypotheses tested at 0.05 level of significance. The study adopted descriptive survey research design of the "*ex-post facto"* type. Four Universities approved by the National Universities Commission to run distance learning programmes were used for the study. Two thousand and three hundred participants were selected through purposive sampling technique. Five hundred and seventy-five respondents were selected from each of the four universities. Five instruments: Students' Attitudes towards Distance Learning Questionnaire (r =0.86), Distance Learners' Self Efficacy Scale (r=0.75), Distance Learners' Self-Regulation Skills Scale (r = 0.68), Distance Learners' Study Habits Inventory (r=0.65) and Distance Learners' Self Concept Scale (r =0.75) were used to collect data. Path analysis was employed. The findings revealed that the data used for the study fitted the model and that there is no significant difference in the model fit of the empirically observed model and the theoretical model proposed for the study. The study also found that ten factors combined accounted for 3% of the total variance in distance learners' academic performance. Out of this total effect, 2.98% was direct, while 0.02% was indirect. Factors that demonstrated direct effects were age (β=.14), attitudes (β=.07), self-regulations (β=.06) and disability status (β=.06). On the other hand, self-concept (β=.01), employment status (β=.02), gender (β=.02), study habits

(β=.02), marital status (β=.03) and self-efficacy (β=.04) demonstrated indirect effects. Also, there were 23 significant and meaningful pathways (P<0.05) to distance learners' academic performance: P111 (.144), P113 (.056), P117 (.062), P11110 (.070), P103 (.086), P107 (.158), P109 (.273), P93(.065), P96(.062), P98(.481), P81(.140), P83 (.111), P84 (.054), P85 (.091), P86 (.211), P87(.247), P76(.382), P63(.085), P51(.525), P52(.061), P54(.127), P41(.411), and P43(.069). Furthermore, there were significant differences between disability status (t=2.39, df= 2298, P <0.05), marital status (t=2.31, df =2298, P <0.05) and mode of delivery (t=3.06, df=2298, P <0.05) on students' academic performance. However, academic performance was not significantly different on the basis of gender and employment status. Age, attitudes towards distance learning, self-regulation skills and disability status predicted distance learners' academic achievement in Nigerian universities. The reviewed study is relevant to the present study because it was on path analysis and students' academic achievement which is also the focus of the present study. However, both studies differ as the reviewed study was centered on university students while the present study is on secondary school students. Also, the present study differs from the reviewed study because it was more specific in terms of the subject area as it focuses on students' achievement in the area of Computer Science.

Soraya and Hakimi (2011) carried out a study on the Relationships between Personality Traits and Students' Academic Achievement, department of educational psychology and counselling university of Tehran, Tehran Iran. The research design adopted was correlation design with analysis of regression. The Population for this study was reported as 1050 (703 female and 347 male) students. The sample size was 285 participants (191 female and 94 male). After determining the sample size, participants were selected through

random cluster sampling. Personality traits were measured using NEO Five Factor Inventory (NEO-FFI). This 60-item inventory which is the shortened form of NEO-PI-R, was made by Costa and McCrae (1992). It is scored on a 5-degree Likert-type Scale, ranging from 1(completely disagree) to 5 (completely agree). Cronbach's alpha was used to estimate reliability of the inventory. The concurrent validity of the inventory was estimated between 0.45, for A, to 0.66, for E. This validity estimate is the correlation coefficient between the personal report form and the observer evaluation. Academic achievement was measured by students' self-reports (total mean of semesters). The findings revealed personality traits can predict academic achievement. Neuroticism and extroversion were negatively related to academic achievement, whereas, agreeableness and conscientiousness were negatively related

to academic achievement. The reviewed study was on the Relationships between Personality Traits and Students' Academic Achievement which is also the focus of the current study. The current study aim at using path analysis as a statistical tool to analysis the data under investigation.

Safdar and Gulap (2013) researched on relationship between students' personality traits and academic achievement in Khyber Pakhtunkhwa, Pakistan. Three research objectives which translated to research questions and hypotheses guided the study. The study adopted Correlational Survey research. The population for the study was 12009 secondary school students. Multi-stage sampling technique was employed to sample 800 secondary schools students using proportionate sampling technique. The instrument for data collection was Self-develop Questionnaire and the data was analyzed using Pearson product moment correlation at 0.5 level of significance. The result showed there was no significant relationship between the students' Personality traits extraversion, conscientiousness, agreeableness, neuroticism, openness to experience and their overall academic achievement. All the subjects were found significantly correlated to the students' personality traits extraversion while Biology, Mathematics, Physics and General Science correlated to the personality trait agreeableness. The study is similar to the present study in the area of the variables personality trait and correlation design. The reviewed study and the present study differ in terms of location. The present study focuses on establishing relationship between personality traits using path Analysis.

Francis and Oludipe (2013) carried out a study that constructed and tested a model for providing a causal explanation of secondary school achievements in Chemistry in terms of student variables with respect to anxiety, self-efficacy, gender, study habit, Mathematical ability and teacher's variables – gender, age, qualification and years of experience. The study was guided by six research questions. An ex-post facto research design was adopted for the study. The population was made up of all senior secondary school year two (SSII) students and their teachers in Epe and Ibeju-Lekki local government areas of Lagos state, Nigeria. Six and four schools were used in the two local government areas respectively. Four sets of instrument were used; these were (i) Personal Data Questionnaire for Teachers (PDQT) (ii) Study Habit Inventory (SHI) (iii) Mathematical Ability Test (MAT) and (iv) Chemistry Achievement Test (CAT). The data were analyzed using multiple regression analysis and IBM AMOS. The study found that the data used for the study fitted the model and that there is no significant difference in the model fit of the empirically observed model and the

theoretical model proposed for the study. The results showed that 7.60% of the variability in students' achievement in Chemistry was accounted for by all the seven predictor variables when taken together. It was revealed that only four of the variables-teacher age, teacher gender, qualification and experience had direct causal effect on student's achievement in chemistry. The reviewed study is similar to the present study as it examined the relationship between students' variables and their academic achievement using path analysis which is the main

Focused of the present study. However, both studies differ in terms of subject as the reviewed study was on Chemistry while the present study is on Computer Science. Also, both studies differ in terms of location and as the reviewed study was carried out in Lagos state while the present study will be carried out in States in Benue state.

Yoke and Lai (2015) researched on Personality Traits, Emotional Intelligence and Academic Achievements of University Students. Six (6) objectives were stated and were translated into research questions and hypotheses were raise to guide the study. Correlational research design was employed using a survey research method in which questionnaires were distributed to collect information on these variables. The population for the study was 2612 and the sample was 160 university students and Pearson product moment correlation was used to analyze the data. The findings of the study revealed significant relationship for extraversion, conscientiousness, agreeableness, and a negative and significant relationship between neuroticism and openness and academic achievement. The reviewed study was geared towards finding the relationship between Personality Traits and Academic Achievements of Students which closely related to the focus of the present study. The reviewed study was carried out using university students while the present study is centered on secondary school students.

Martey and Gligah (2016) assessed the Impact of Personality Traits on Academic Performance: Evidence from Tertiary Students in Ghana. The main objective was to investigate the association between the Personal traits (extraversion, neuroticism, openness to experience, agreeableness and conscientiousness) and Academic Performance. Both primary and secondary data were used in the study.The study adopted purposive sampling technique to select tertiary institutions whereas convenience sampling techniques was employed to select students. The target population comprised tertiary students, both sexes between the ages of 18 and 40. The sample for the study was 627 participants. Data were collected through the use of Questionnaire. The following statistics were used: descriptive statistics in

order to have clear picture of study variables. Regression analysis was used to measure the effect of independent variable on dependent variable. The findings revealed that, there was a significant positive relationship between the academic achievement of students of tertiary institution that are conscientious, agreeable and openness, however extroversion and neuroticism failed to pass the hypothesis test. The study is similar in the area of personality traits indices and both studies make used of purposive sampling. However, both studies differ in terms of location. Also this present studies makes use of path Analysis while the review study did not.

Kamilah, Seman and Ismail (2019) explored the relationship between the Big Five personality traits and academic performance among foundation students in private Malaysian universities. Two specific objectives will guide the study. Two research questions are formulated for the study and hypotheses. The design was Correlation Survey Design. The population for the study was 1948 students. The study sampled 137 foundation students from private universities in Malaysia, comprising 92 females and 45 males. Data were collected using Questionnaire and were analyzed using Pearson correlation analysis. The result showed extraversion and academic performance was negative. The result also showed that agreeableness, conscientiousness and openness were positively related to Cumulative Grade Point Aimed and generally that personality has a significant relationship with academic performance. The reviewed study is similar in the area of personality traits that will be part of the present study. However, both studies differ in terms of location.

3.0 METHODOLOGY

In this section, the procedure for carrying out the study is discussed. Specifically, it describes the research design, the study area, population of the study, sample and sampling techniques, instruments for data collection, validation of the instruments, reliability of the instruments, method of data collection and data analysis techniques.

3.1 Research Design

The study adopted triangulated research design. Triangulated research design is a research design that involves using multiple data sources, methods, or perspectives to investigate a research phenomenon. In this study, the triangulated research design comprised correlational survey and ex-post facto research designs. Correlational survey research design is a type of research design in which the researcher measures two or more variables and assesses the statistical relationship (i.e., the correlation) between them with little or no effort to control

extraneous variables. Ex-post facto research design on the other hand is a research design in which the independent variables (students' personality) have already occurred and the researcher begins with the observation on a dependent variable (students' academic achievement), followed by a retrospective study of possible relationship and effects (Emaikwu, 2015). The choice of triangulated design is due to the fact that it aims to enhance the validity and reliability of the findings by converging different sources of evidence and reducing potential biases or limitations associated with a single design. The triangulated research design which comprises correlational survey and ex-post facto research designs was chosen because the study investigate the relationship (correlation design) between students' personality traits and their academic achievement in Computer science after manifestations have occurred (ex-post facto design).

3.2 The Study Area

The study was carried out in Benue North West Educational Zone of Benue State, Nigeria. Benue North West Educational Zone Benue State has a population of about 1, 376, 641 (NPC Projection, 2021). Zone B comprises seven local government areas, including Buruku, Gboko, Guma, Tarka, Makurdi, Gwer West, Gwer East. Zone B has a rich and fertile land. The indigenes are predominantly crop farmers with some segment engaging in other aspects of farming such as fishing and animal husbandry. Aside farming, some people are civil servants, many of the urban dwellers are working in government establishments and private owned enterprises. The indigenes are believed to be very hospitable and accommodating to visitors and friends. Benue North West Educational Zone is housing numerous institutions of learning including the Joseph Sarwuan Tarka University; Benue State University, National Open University, Akperan Orshi Polytechnic as well as Akawe Torkula Polytechnic among several public and private primary and secondary schools.

3.3 Population of the Study

The population of the study is 4293 students. This comprises all the senior secondary II students in Benue North West Educational Zone (Benue State Teaching Service Boards Directorate of Planning, Research and Statistics, 2023).

This study necessitated due to high decline in students' academic achievement in computer science in secondary schools in Benue State.

3.4 Sample and Sampling Technique

The sample size for the study is 384. This was obtained using Krejcie and Morgan Table for sample size determination. Sampling for the study was done in multi-stages. At the first stage, simple random sampling was used to select four local government areas from the seven local government areas in Zone B. At the second stage, simple random sampling technique was used to select eight secondary schools from the four local government areas selected. At the third stage, purposive sampling technique was used to select four secondary schools that offer Computer Science as a subject. Lastly, simple random sampling technique was used to select the respondents from the four schools selected.

3.5 Instruments for Data Collection

Data for the study were collected using the following instruments developed by the researcher; Students' Personality Traits Questionnaire (SPTQ)"and "Students' Profoma (SP)". The Students' Personality Traits Questionnaire is in two sections A and B. Section A contains the demographic characteristics of the students. Section B is divided into five clusters. The first cluster have information on students' openness to experience, the second cluster information on students' conscientiousness, the third cluster information on students' extraversionand the fourth cluster information on students' agreeableness while the fifth cluster contains information on students' neuroticism. Each of these clusters have 10 items bringing the total number of items on the SPTQ to 50. Clusters 1 to 5 of the SPTQ is structured on a 4-point rating scale of Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD) with values of 4, 3, 2 and 1 for positively worded items. The negatively worded items are in reverse order of 1, 2, 3 and 4 respectively. The Students' Profoma was used in collecting the data relating to students' achievement scores in Computer Science in their second term examination.

3.6 Validation of the Instruments

To ensure that all the instruments measured what they were designed to measure, the instruments were given to three (3) experts for face validation. Two of the experts are from the Department of Guidance and Counselling, Joseph SarwuanTarka University, Makurdi while one is a Senior Secondary School two (SS2) Computer Science teacher from Vaatia College Makurdi Benue State who is deemed to be sufficiently knowledgeable in the contents of Computer Science at the secondary school level. The validators were asked to scrutinize the instruments with respect to; wordings of the items of the instruments, clarity of the items,

simplicity of vocabulary, relevance of items to the study and were also asked to make suggestions to help in modifying the items to suit the problem under investigation.

Based on the request of the researcher, the experts validated the instruments by restructuring some items that were not clearly structured. The experts removed and replaced some items that were found not relevant to the study and also ensured that all the items are in-line with the specific objectives of this study. The modification done to the items of the instrument by the validators ensured that the instruments measured what they were designed to measure.

3.7 Reliability of the Instrument

To ensure that the Students' Personality Traits Questionnaire will be consistent in measuring what it is designed to measure, its internal consistency was established as the instrument was trial-tested on 30 Senior Secondary two (SS2) students in Tarka Local Government Area of Benue state which have similar characteristics with the sample of the study. Cronbach Alpha method was used to determine the reliability coefficient of the instrument. The Cronbach Alpha coefficient was used because the items of the instrument are not dichotomously scored. In other words, the items of the instrument do not have a right or wrong answers, but are based on the perceptions and opinions of the respondents. The instrument yielded an overall reliability coefficient of 0.72 and it was adjudged to be suitable for the study.

3.8 Method of Data Collection

Data for this study were collected through direct delivery and retrieval approach. The researcher first visited each of the schools to be used for the study. The visit helped the researcher to make contacts with the school authority and sought approval to use students in those schools for the study. The Computer Science teachers in all the sampled schools were instructed and used as research assistants. After instructing the teachers, the copies of the instrument for the study were given to them to administer to the students on a face to face basis. The students were given 30 minutes to go through the instrument and to respond to them accurately, after which, completed copies were retrieved from them. With the permission of the school authority, the students' termly examination scores of Computer Science forSS2 were obtained and recorded in Profoma. All the data collected were then subjected to statistical analysis.

3.9 Data Analysis Technique

As a path analytic study, data collected were analyzed using multiple regression analysis in Mplus which is Path analytic statistical software. Research question one was answered descriptively using the arrow headed lines in the path diagram. Research questions two, three and four were answered using path coefficients. Research questions five and six were answered using coefficient of determination (R^2) in multiple regression. The coefficient of determination (R^2) quantified the proportion of variance in the dependent variable that is explained collectively by the independent variables in the model. Hypothesis one was tested using Chi-square goodness of fit in Mplus. Hypothesis two was tested using t-test of independent samples. Hypothesis three was tested using Analysis of Variance. All the hypotheses formulated were tested at 0.05 level of significance. A P-value of 0.05 and below implies a significant difference/relationship while a P-value above 0.05 implies no significant difference/relationship.

4.0 RESULTS AND DISCUSSION

This section presents results of the data analysis and discusses the findings of the research.

4.1 Results

The results of the study are presented according to research questions posed and hypotheses formulated as follows:

4.1.1 Research Question 1

What is the casual model for providing an explanation of the achievement of students in Computer Science based on the selected students' personality traits?

To answer this research question, Figure 2 and Figure 3 were used as follows:

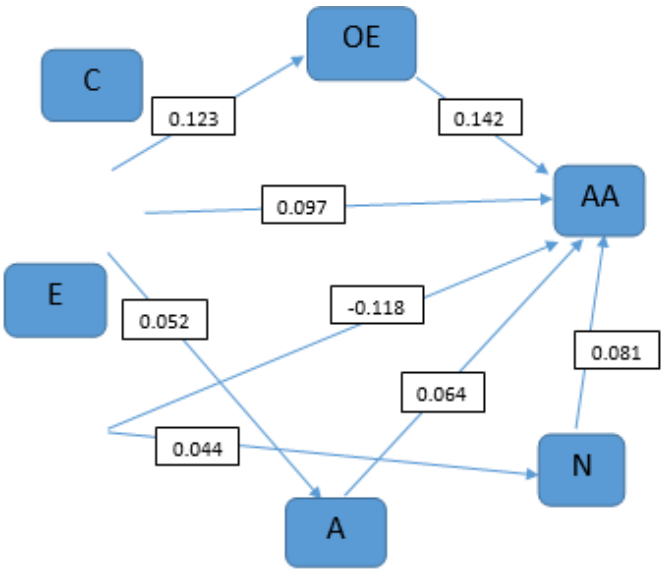

Figure 2: Theoretical Proposed Model.

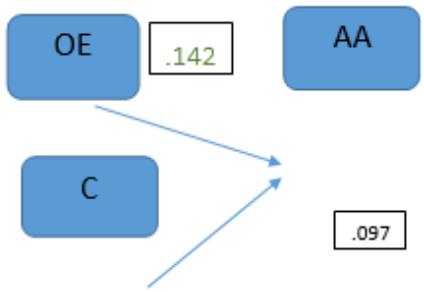

Figure 3: Observed Path.

Figure 2 shows the theoretically proposed model for the study developed by the researcher. Figure 3 is the observed path diagram developed by the researcher after the analysis and it shows that out of the five students' personality traits (Openness to Experience, Conscientiousness, Extraversion, Agreeableness and Neuroticism), only Openness to Experience (OE) and Conscientiousness (C) had significant paths with the students' academic achievement (AA). Thus, only Openness to Experience (OE) and Conscientiousness (C) were retained in the final observed path model (Figure 3). This implies that Figure 3 represents the model that best explains students' academic achievement in Computer Science based on the selected personality traits.

4.1.2 Research Question 2

To what extent would the students' personality traits, when taken together predict students' academic achievement in Computer Science?

Table 1: Regression Summary.

Model		R	R Square	Adjusted R Square	Std. Error
1		.387a	.150	.108	11.84231

Result presented in Table 1 shows that the correlation between personality traits and academic achievement was 0.387 (R = 0.387) with a coefficient of determination of 0.150 (R^2 = 0.150). This implies that 15.0% of the variation in students' academic achievement in Computer Science can be attributed to the combined influence of the five personality traits.

4.1.3 Research Question 3

What are the relative contributions of each personality trait to the prediction of students' academic achievement in Computer Science?

Table 2: Regression Coefficients Summary.

Variables	Estimate	S.E	T	P-Value
AA ---- OE	0.142	0.058	2.448	0.021
AA ---- C	0.097	0.041	2.366	0.026
AA ---- E	-0.118	0.072	-1.639	0.114
AA ---- A	0.064	0.069	0.928	0.361
AA ---- N	0.081	0.063	1.286	0.210

Result presented in Table 2 shows that Openness to Experience had the highest significant positive contribution (0.142), followed by Conscientiousness (0.097). Extraversion contributed negatively (-0.118), while Agreeableness and Neuroticism contributed positively but were not statistically significant.

4.1.4 Research Question 4

What are the directions and estimates of the strengths of causation (path coefficients) of the students' personality traits in the model?

Table 3: Path Coefficients of the Students' Personality Traits.

S/N	Variables	Direct Path (Estimates)	Indirect Path
1	AA ------- OE	PAAOE (0.142)	--------
2	AA ------- C	PAAC (0.097)	--------

Key: AA = Academic Achievement, OE = Openness to Experience, C = Conscientiousness

Result presented in Table 3 shows that the significant paths through which the independent variables (students' personality traits) caused variation in the dependent variable (academic achievement) are those of Openness to Experience and Conscientiousness. This implies that Openness to Experience (with estimate strength of 0.142) and Conscientiousness (with estimate strength of 0.097) were the only significant causal paths in the model.

4.1.5 Research Question 5

What are the direct and indirect influences of the students' personality traits on students' achievement in Computer Science?

Table 4a: Variables with Direct Paths.

Variables	OE	C	E	A	N
AA	0.142	0.097	-0.118	0.064	0.081
C	0.123			-0.052	
E					0.044

Key: AA = Academic Achievement, OE = Openness to Experience, C = Conscientiousness, E = Extraversion, A = Agreeableness, N = Neuroticism

Result presented in Table 4a shows that all the students' personality traits had direct influences on academic achievement. Also, Openness to Experience and Agreeableness had direct influence on Conscientiousness, while Extraversion had direct influence on Neuroticism.

Table 4b: Variables with Indirect Paths.

Variables	C	E
AA	0.021	-0.009

Key: AA = Academic Achievement, C = Conscientiousness, E = Extraversion

Result presented in Table 4b shows that among all the personality traits, only Conscientiousness and Extraversion had indirect influences on students' academic achievement.

4.1.6 Research Question 6

What proportions (%) of the total influences are direct and indirect?

Table 5: Proportions (%) of Total Direct and Indirect Influences.

Criterion	Predictors	TI (a)	% (b)	DI (c)	% (d)	II (a–c)	% (e)
AA	OE	0.163	29.11	0.142	25.36	0.021	3.75

	C	0.118	21.07	0.097	17.32	0.021	3.75
	E	-0.127	-22.68	-0.118	-21.07	-0.009	-1.61
	A	0.064	11.43	0.064	11.43	0.000	0.00
	N	0.081	14.46	0.081	14.46	0.000	0.00
	Total	0.299	100	0.266	89.50	0.033	10.50

Key: TI = Total Influence; DI = Direct Influence; II = Indirect Influence

The results presented in Table 5 show that the largest direct contribution to academic achievement came from Openness to Experience (25.36%), followed by Conscientiousness (17.32%). Extraversion had a negative direct contribution (-21.07%). The total influence of the predictor variables on academic achievement was 0.299, of which 89.50% was direct and 10.50% was indirect. This implies that students' academic achievement in Computer Science is influenced more strongly by direct personality effects than by mediated effects.

4.1.7 Research Hypothesis 1

There is no significant model fit between the empirically observed data and the theoretical model proposed for the study.

Table 6: Chi-Square and RMSEA.

Parameters	Value
Chi-square	4.218
Df	3
P-value	0.239
RMSEA	0.041
90% C.I	0.000 – 0.098
Probability RMSEA ≤ .05	0.612

The Chi-square value of 4.218 (p = 0.239) and RMSEA of 0.041 indicate good model fit. Therefore, the null hypothesis was not rejected.

4.1.8 Research Hypothesis 2

The relative contributions of each of the students' personality traits do not significantly predict students' academic achievement in Computer Science

Table 7: T-test Analysis.

Model	B	Std. Error	Beta	T	Sig.
Constant	48.376	21.184	—	2.283	.030
OE	.142	.058	.291	2.448	.021
C	.097	.041	.267	2.366	.026
E	-.118	.072	-.189	-1.639	.114
A	.064	.069	.103	.928	.361
N	.081	.063	.152	1.286	.210

Only Openness to Experience and Conscientiousness significantly predicted academic achievement ($p < 0.05$). The null hypothesis was therefore rejected.

4.1.9 Research Hypothesis 3

Students' personality traits when taken together would not significantly predict the academic achievement of students in Computer Science

Table 8: ANOVA.

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	512.384	5	102.477	3.652	.014
Residual	2386.517	23	103.762		
Total	2898.901	28			

Since the probability value ($p = 0.014$) is less than 0.05, the null hypothesis was rejected. This implies that the students' personality traits, when taken together, significantly predict academic achievement in Computer Science.

4.2 Summary of Major Findings

The following major findings emerged from the research questions answered and hypotheses tested in the study:

1. The theoretically proposed model was modified after empirical analysis, and the observed path diagram showed that out of the five personality traits (Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism), only Openness to Experience (OE) and Conscientiousness (C) had significant direct paths to Academic Achievement (AA). These two variables were therefore retained in the final observed model, which best explains students' academic achievement in Computer Science.
2. The goodness-of-fit indices ($\chi^2 = 4.218$, $df = 3$, $p = 0.239$; RMSEA = 0.041) indicated an adequate model fit. Therefore, there was no significant difference between the theoretical model and the empirically observed model, and the null hypothesis of poor model fit was not rejected.
3. When considered collectively, the five personality traits significantly predicted academic achievement in Computer Science ($F(5,23) = 3.652$, $p = 0.014$). The multiple correlation coefficient was $R = 0.387$, with $R^2 = 0.150$, indicating that 15.0% of the variation in students' academic achievement was explained by the combined influence of the personality traits.

4. The regression coefficient analysis showed that Openness to Experience (β = 0.142, p = 0.021) had the highest statistically significant positive contribution to academic achievement, followed by Conscientiousness (β = 0.097, p = 0.026). Extraversion (β = −0.118), Agreeableness (β = 0.064), and Neuroticism (β = 0.081) did not significantly predict academic achievement.
5. The significant causal paths identified in the model were AA ← OE (β = 0.142) and AA ← C (β = 0.097). This indicates that increases in Openness to Experience and Conscientiousness are associated with corresponding increases in students' academic achievement.
6. Although all five personality traits had direct effects on academic achievement (OE = 0.142; C = 0.097; E = −0.118; A = 0.064; N = 0.081), only Conscientiousness and Extraversion demonstrated indirect effects on academic achievement. Additionally, Openness to Experience and Agreeableness had direct effects on Conscientiousness, while Extraversion had a direct effect on Neuroticism.
7. In terms of proportional contributions, the total influence of the predictor variables on academic achievement was 0.299. Of this total, 89.50% represented direct effects, while 10.50% represented indirect effects. Openness to Experience contributed the largest direct proportion (25.36%), followed by Conscientiousness (17.32%). Extraversion had a negative direct contribution (−21.07%), whereas Agreeableness (11.43%) and Neuroticism (14.46%) made positive but smaller contributions.

4.3 DISCUSSION OF FINDINGS

The study revealed that only Openness to Experience (OE) and Conscientiousness (C) had significant direct effects on students' Academic Achievement (AA) in Computer Science, leading to the modification of the initially proposed theoretical model. This finding indicates that students who are more open to new experiences—curious, imaginative, and willing to explore novel ideas—tend to perform better academically. Similarly, conscientious students, characterized by diligence, self-discipline, and organization, are more likely to achieve higher in structured academic tasks such as Computer Science. The retention of only these two traits in the final observed model suggests that other personality traits, such as Extraversion, Agreeableness, and Neuroticism, do not directly influence achievement in this specific academic context, though they may have indirect or contextual effects.

A plausible reason for this finding is that Computer Science requires sustained attention, problem-solving skills, and openness to new concepts, which aligns closely with the

characteristics of Openness to Experience and Conscientiousness. Traits like Extraversion or Agreeableness may not directly impact academic performance because they relate more to social interactions and collaboration rather than individual cognitive engagement.This outcome aligns with previous research. For instance, Poropat (2009) found that Conscientiousness consistently predicts academic performance across disciplines, while Openness to Experience is particularly associated with success in subjects requiring creativity and abstract thinking, such as sciences and technology. Similarly, Chamorro-Premuzic and Furnham (2003) reported that these two traits are the most reliable personality predictors of student achievement, highlighting their critical role in fostering academic success.The findings of this study agreed with that of Maruff (2015) who conducted a study titled "A Path-Analytic Study of Socio-Psychological Variables and Academic Performance of Distance Learners in Nigerian Universities" and found also that the data used for the study fitted the model and that there is no significant difference in the model fit of the empirically observed model and the theoretical model proposed for the study. The results of this study also conform with that of Francis and Oludipe (2013) who carried out a study that constructed and tested a model for providing a causal explanation of secondary school students' achievements in Chemistry in terms of student variables and found that the data used for the study fitted the model and that there was no significant difference in the model fit of the empirically observed model and the theoretical model proposed for the study.

The study found that when considered collectively, the five personality traits (Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism) significantly predicted academic achievement in Computer Science ($F(5,23) = 3.652$, $p = 0.014$). The multiple correlation coefficient ($R = 0.387$) and coefficient of determination ($R^2 = 0.150$) indicate that approximately 15% of the variation in students' academic achievement can be attributed to the combined effect of these traits. This demonstrates that while individual traits like Openness and Conscientiousness have the strongest direct effects, the overall personality profile of a student also plays a meaningful role in academic outcomes.The reason for this finding could be that academic achievement is influenced by a complex interplay of multiple personality traits. While some traits exert stronger direct effects, others may contribute indirectly through interactions or mediation effects, highlighting the multidimensional nature of personality in learning contexts.

This result is consistent with earlier studies, such as Komarraju, Karau, Schmeck, and Avdic (2011), who reported that the Big Five personality traits collectively account for a significant

proportion of variance in academic performance, with Conscientiousness and Openness being the most influential. Similarly, Poropat (2009) found that personality profiles collectively, rather than single traits alone, provide a better understanding of student achievement, reinforcing the importance of considering multiple traits simultaneously in predicting academic success.

The study found that Openness to Experience ($\beta = 0.142$, $p = 0.021$) had the highest statistically significant positive contribution to students' academic achievement in Computer Science, followed by Conscientiousness ($\beta = 0.097$, $p = 0.026$). This indicates that students who are more curious, open to learning new ideas, and diligent tend to perform better academically. In contrast, Extraversion ($\beta = -0.118$), Agreeableness ($\beta = 0.064$), and Neuroticism ($\beta = 0.081$) did not significantly predict academic achievement, suggesting that these traits either have minimal direct impact or their effects are mediated by other variables.

The reason for this finding could be that Openness to Experience promotes intellectual curiosity and engagement with learning, while Conscientiousness fosters organization, self-discipline, and persistence, which are directly linked to successful academic performance. Extraverted students may focus more on social interactions than study, while Neuroticism may have mixed effects due to anxiety or motivation.

This finding aligns with prior research. For instance, Komarraju et al. (2011) reported that Openness to Experience and Conscientiousness are the strongest predictors of academic success across various subjects. Similarly, Poropat (2009) found that these two traits consistently show positive associations with academic achievement, whereas Extraversion, Agreeableness, and Neuroticism are less reliable predictors.

The findings of the causal paths in the model showed that the significant paths were AA ← OE ($\beta = 0.142$) and AA ← C ($\beta = 0.097$). This indicates that students' academic achievement increases as their levels of Openness to Experience and Conscientiousness increase. In practical terms, students who are curious, imaginative, and receptive to new experiences (Openness to Experience), as well as those who are diligent, organized, and disciplined (Conscientiousness), are more likely to perform well in Computer Science.The reason for this pattern is that Openness to Experience encourages engagement with novel ideas and problem-solving strategies, while Conscientiousness enhances study habits, persistence, and goal-directed behavior, all of which directly contribute to learning and academic success. Other personality traits in the study did not show significant causal influence, likely because their effects on achievement are indirect or context-dependent.

This finding is consistent with previous research. For example, Noftle and Robins (2007) found that Openness and Conscientiousness are the most consistent predictors of academic performance, as these traits support both cognitive engagement and disciplined study behaviors. Similarly, Poropat (2009) emphasized that Conscientiousness has a robust positive effect on academic outcomes across disciplines, while the influence of traits like Extraversion and Neuroticism tends to be weaker or non-significant.

The study revealed that all five personality traits had direct effects on students' academic achievement (OE = 0.142; C = 0.097; E = −0.118; A = 0.064; N = 0.081), but only Conscientiousness and Extraversion exerted indirect effects on achievement. This suggests that while each trait can influence academic performance to some degree, the pathways through which Conscientiousness and Extraversion affect achievement are partly mediated by other variables in the model, reflecting more complex relationships.Additionally, the analysis showed that Openness to Experience and Agreeableness had direct effects on Conscientiousness, implying that students who are open and agreeable are more likely to be organized, disciplined, and goal-directed. Extraversion also had a direct effect on Neuroticism, suggesting that more outgoing or sociable students may experience emotional fluctuations that indirectly impact performance.The reason for these findings is that academic achievement is influenced not only by the direct expression of personality traits but also by their interactions and mediated effects. Traits like Conscientiousness act as a central mechanism through which other traits enhance or dampen achievement.

This result aligns with previous research. Komarraju, Karau, and Schmeck (2009) found that Conscientiousness mediates the effect of other personality traits on academic outcomes, emphasizing its central role in learning. Similarly, Ziegler et al. (2012) highlighted that Openness and Agreeableness can enhance study behaviors through conscientious tendencies, while Extraversion may indirectly affect performance via emotional regulation.

The study revealed that the total influence of the five personality traits on academic achievement was 0.299, with the majority of this influence being direct (89.50%) and a smaller proportion mediated through indirect effects (10.50%). Among the traits, Openness to Experience contributed the largest direct effect (25.36%), followed by Conscientiousness (17.32%), indicating that these traits are the most influential in directly shaping students' academic performance in Computer Science. Interestingly, Extraversion had a negative direct contribution (−21.07%), suggesting that highly extraverted students may be more distracted by social interactions, which can reduce focus on academic tasks. Agreeableness (11.43%)

and Neuroticism (14.46%) contributed 3positively but less substantially, highlighting their modest role in predicting achievement compared to the dominant traits.These findings can be explained by the functional roles of the traits: Openness to Experience promotes curiosity, creativity, and engagement with learning, while Conscientiousness encourages organization, diligence, and goal-directed behaviors, which are critical for academic success. Extraversion's negative contribution aligns with evidence that social orientation can sometimes interfere with academic focus.

This result is consistent with prior studies. For example, Poropat (2009) reported that Conscientiousness consistently has the strongest direct effect on academic performance, while Openness to Experience contributes through engagement and intellectual curiosity. Similarly, Komarraju et al. (2011) found that Extraversion can have both positive and negative effects depending on the academic context, supporting the observed negative direct effect in this study.

5.0 CONCLUSION

This study established that students' personality traits significantly predict academic achievement in Computer Science among secondary school students in Benue State. The path analysis revealed that Openness to Experience and Conscientiousness were the only significant direct predictors of academic achievement, collectively accounting for 15% of the variance in students' performance. While all five Big Five personality traits demonstrated direct effects on achievement, only Conscientiousness and Extraversion exhibited indirect effects. These findings underscore the importance of personality in shaping academic outcomes, suggesting that educators and counsellors should consider students' personality profiles when designing instructional strategies and interventions to enhance Computer Science achievement.

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