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INTELLIGENCE AND ACADEMIC ACHIEVEMENT: A LONGITUDINAL SURVEY

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ABSTRACT: *With longitudinal survey design of survey research method, this study investigated the complex relationships between intelligence and academic achievement in Mathematics and English Language over a period of four years in Nigeria. A random sample of 637 Junior Secondary III students, aged 14 years, was drawn and followed till the end of their Senior Secondary III at the age of 17. Their Mathematics and English Language academic achievement were validly measured with Junior Secondary Certificate Examination (JSCE) scores and Senior Secondary Certificate Examination (SSCE) scores. Their IQ was validly and reliably measured with Culture Fair Intelligence Test that has been validated and standardized for use in Nigeria. Data were collected during the students' 2011/2012 JSCE and 2014/2015 SSCE. The IQ and JSCE as well as SSCE scores were subjected to partial correlation analysis at 0.05 alpha, using SPSS Version 22. Results showed statistically significant relationship between IQ and Mathematics achievement (0.499 and 0.495) when English Language is partialled out; and between IQ and English Language achievement (0.411 and 0.346) when Mathematics is partialled out; respectively across the junior and senior secondary levels of schooling. Results, among others, further indicated overwhelming evidence of stability of intelligence (0.702) with the four-year time interval in super corroboration of fluid and crystalized theory of intelligence. Coefficient of partial determination unveiled that IQ accounts for 24.90% to 24.50% of the variance in Mathematics achievement, and 16.89% to 11.97% of the variance in English Language achievement.*

KEYWORDS: Academic achievement; Complex relationships; Culture Fair Intelligence Test; English Language achievement; Intelligence; IQ; Longitudinal survey; Mathematics achievement; Partial correlation; Survey research.

INTRODUCTION

A single psychological construct that has and will continue to generate endless debates (Coon, 2001) and ever demand ceaseless concerted investigations is perhaps, the human intelligence (Kamil, 2004; Kanazawa, 2004) that accounts for man's most unique capacity for rational thinking and action, vis-à-vis other living organisms (Carter & Russell, 2009). Long before psychology emerged as a scientific field of study, ontogeny and phylogeny of intelligence has been investigated as one of the first human attributes to be a major target of genetic research. Three research articles on the laws of heritability, and on high intelligence and other abilities were published by Galton (1865); who later expounded them into a full book volume that became the first book on intelligence and heritability by Galton (1869). Several studies of monozygotic and dizygotic tweens raised apart and raised separately by their parents and by adopted parents were carried out for empirical rationalization of the debates on the nature of intelligence (Herrnstein & Murray, 1994).

From ancient times to the end of the first millennium; and through each of the centuries, down to the present day; great philosophers, scientists, theologians, and atheists alike have rigorously sought for and proffered explanations to intelligence, how the human cognition, brain or mind works (Balchin, 2010). But there is no definitive explanation that is by itself coherent enough to be mutually accepted by virtually all for human intelligence (Jensen, 1998; Fischman; 1993; Spinatha, Spinatha & Riemann, 2003); and the day that such explanation will eventually be arrived at to end all plausible debates on this attribute, is not yet at sight, and may most likely never be (Dilalla, 2000). By 'definitive explanation', I mean a definition or a theory of intelligence that is anchored on unquestionable verifiable evidence, and is indeed the very best of all kinds and unlikely to be further improved upon in serving as a true representative of every relevant aspect and facet of the trait to people of various spheres of life (Kpolovie, 2016; 2015; 2014).

As long as the totality of the workings of human intelligence remains largely a mystery, both the divergent evolutionary explication of natural selection (Darwin, 1998; 1871; Skottke, 2005; Coon, 2001), and the exclusive role of faith in an uncreated Creator (Copernicus, 1543; Aquinas, 1981) as the basis of the phenomenon, termed intelligence; and research works of varying kinds, of which the current investigation is one, will continue to be embraced as functional steps toward filling the existing knowledge gaps (Henderson, 2013; Hunt, 2010; Glendenning, 1998;). Even practical attempts at measuring intelligence is hailed at one end and condemned at the other end of the divide (Esters, 1999; Mackay, n.d.), depending on the philosophical standpoint of different concerned persons. This is largely so because the adequacy and accuracy with which a test is judged from its content to be valid, is a direct function of the adequacy and accuracy of the definition of the trait that the test is to measure (Kpolovie, 2014). That is why the more thorough, the more complete, the more detailed, and the more definitive the definition and theory of a trait is in covering every aspect of the construct; the greater the possibility of developing a test that is content valid on the attribute (Kpolovie, 2016; Herrnstein & Murray, 1994; Cattell, 1966). In other words, the content validity of a trait, say intelligence, cannot be higher than the extent to which the trait is exhaustively defined theoretically (Sternberg & Davidson, 2005; Kpolovie, 2010; Swerdlik, Sturman & Cohen, 2012; Sternberg, 2016). It is only when the entire components of intelligence are explicitly defined by its theory in the most precise manner; that the extent to which items in a test that accurately, adequately and proportionally measure the various components of the construct can be determined (Langer, 2004; Laster, 2011; Mackintosh, 2011; Kpolovie & Emekene, 2016). Therefore, for an intelligence test to possess content validity, the trait must be definitively defined exhaustively in precise terms by the theory on the construct (Salny & MENSA, 1989; Sternberg & Reis, 2004; Carlson, Geisinger & Jonson, 2014; Shuitz, Whitney & Zickar, 2014).

For the purpose of this investigation, intelligence is adequately defined as the general mental ability to quickly learn, solve novel problems, educe relationships, quickly process information accurately, think rationally, act purposefully, and most effectively adapt to one's environment as measured by Culture Fair Intelligence Test that has been validated and standardized for use

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in Nigeria (Kpolovie, 2015). Intelligence is acquired both by nature and at least 50 percent heritable in line with evolution theories that heritability and gene expression of organisms change overtime (Langer, 2004; Plomin & Spinath, 2004; Glendenning, 1998); and by nurture in accordance with environmental theories that the uniquely human attribute of culture launched mankind on a new trajectory (Coon, 2001; Buzan, 2003) and that migration and industrialization of modern society dramatically influence intelligence (Kamil, 2004; Skottke, 2005). From the operational definition that I have provided here, it is clear that intelligence tends to be a critically central trait around which all other psychological attributes revolve.

In the developed world, intelligence if frequently studied in relation to a variety of attributes (Fischman, 1993; Esters, 1999; Kanazawa, 2004; Dilalla, 2000; Emery & Clayton, 2004; Spinatta, Spinatta, Riemann, 2003). Intelligence testing is also done every now and then in advanced countries with several intelligence tests (Renzulli, Reis, 2004; Carter, 2011; Carter, Russell, 2009; Salny, MENSA, 1989; Mackintosh, 2011; Kirk, Gallagher, Anastasiow, Colman, 2015). The role of environmental factors for improvement of intelligence is accorded accelerated attention with several intelligence tests made available for practice (Vaughn & Bos, 2009; Balchin, 2010; Carnegie, 2002; Carter, 2005; 2011; Carter & Russel, 2007; Funder, 2012; MENSA, 2003; Munroe, 2003; Reisberg, 2015; Tracy, 2004; VanTassel-Kaska & Reis, 2003; Carlson, Geisinger, & Jonson, 2014; Tomlinson & Reis, 2004). Unfortunately, the developing countries, Nigeria in particular, do not attach any value to intelligence and its testing (Kpolovie, 1999; 2003; 2005; 2012; 20015; Kpolovie, Emekene, 2016). In attempt to explain differences in students' academic achievement, researchers in Nigeria have include several variables in their investigations and despondently exclude intelligence, claiming lack of instrument for measuring the attribute as a reason for the ignominious exclusion (Kpolovie, 2010; 2012; 2015; Kpolovie & Emekene, 2016). Variables often investigated by Nigerian researchers for seeming explanation of human cognitive differences include study habit, values, truancy, attitudes, self-concept, anxiety, social class, sex, aggression, self-esteem, introversion-extraversion, reinforcement, personality, neuroticism, achievement motivation, social interaction, radicalism-conservatism, creativity, curiosity, dogmatism, and ambitiousness; vocational choice, locus of control, schizophrenia, school location, school type, family size, principals' administrative styles, class size, teachers' job satisfaction, and teaching methods (Kpolovie, 2012; Kpangban, Eya & Igbojinwaekwu, 2013; Vikoo, 2015).

Intelligence, without which other unique attributes of man cannot function, demands to be concertedly investigated in Nigeria (Kpolovie, 2013a) and other Third-World countries. Each human has some intelligence, a capacity which underlies his ability to adjust to the new and to appropriately utilize the old information. It is this fundamental capacity that enables man to actively initiate cognitive interaction with his environment, to search for and respond to the environment in the most suitable form (Esters, 1999). Intelligence is a set of biological functions, which enables the individual to consistently search for the best fit, the most effective, economic, and integrated fit of information and experience that is accessible to him with the information which he had already internalized, assimilated and organized (Goldman, 2007; Littrell, Lorenz & Smith, 2009; Maxwell, 2014; Paul, 2005).

It is the intellectual power of an individual that determines the degree of assimilation and organization of already internalized materials and the extent to which this is relevant to the attainment of goals undertaken by him (Sternberg & Reis, 2004; Totton, 2006; Maxwell, 2002). The sequence, speed, range and complexity of these operations vary from one person to another. Intelligence determines the variety and abstractness of materials that a person can learn at any given age (Buzan, 2003; Fischman, 1993). The problem-finding and problem-solving reasoning ability, termed intelligence, deals with individuals' capacity to respond or search for answers and resolutions to felt cognitive discontinuity, tensions or curiosity (Glendenning, 1998). It is intelligence that allows for active recognition or recall of previously learned information and its application to a present problem (Kanazawa, 2004) ranging from simple rote application through extensive, complex reasoning to reorganization or transformation of a person's previous cognitive ability (Drummond, Sheperis & Jones, 2015; Kamil, 2004). Conservation of energy through selective allocation of energy expenditure in learning and problem-oriented operations for attainment of maximum goal through minimal energy is also a function of one's intelligence (VanTassel-Kaska, Reis, 2003; Mingat, Tan & Sosale, 2003).

Though intelligence means different things to different people, psychometrics unanimously see intelligence as general cognitive ability (Plomin & Spinath, 2004; Herrnstein & Murray, 1994), which Spearman (1904) simply termed general intelligence (g) and Cattell (1941; 1966; 1971; 1982; 1987) referred to as fluid intelligence (gf) and crystalized intelligence (gc). Intelligence as general mental ability refers to the substantial covariation among diverse measures of cognitive ability (Sternberg & Davidson, 2005) as indexed by an unrotated first principal-component score in factor analysis, and which typically accounts for over 40% of the total variance of diverse cognitive tests (Jensen, 1998).

Though this investigation is still part of a vicarious step towards assessment of intelligence in Nigeria, on the global scene intelligence testing began from time immemorial and will continue to be with increased momentum. Throughout the ages, human beings have been deeply involved in the evaluation of their own actions and those of others in order to understand and predict behaviour. Man has relentlessly sought to precisely measure, comprehend and manage human behaviour more effectively. Tests of intelligence or mental ability were the first standardized psychological tests to be developed in this regard (Kpolovie, 2014; Drummond, Sheperis & Jones, 2015; Kantowitz, Roediger III & Elmes, 2015; Shuitz, Whitney & Zickar, 2014; Reisberg, 2015; Sternberg, 2016). Little wonder then that the origin of mental measurement is said to be 'lost in antiquity'. Perhaps, only a chronicle of human behaviour in all of its bewildering development that can constitute a full account of the origin and growth of intelligence testing. Such record of the measurement of mental ability can only be said to be complete if it fully provides demonstration of everything that people have learned about themselves and the individual in relationship with others over hundreds of thousands of years; as well as a record that is rapidly being enlarged continuously (Swerdlik, Sturman & Cohen, 2012; Tomlinson & Reis, 2004).

As part of the richness of the seeming endless debate on intelligence, severe criticisms of intelligence tests and indeed all other tests of mental ability and academic achievement have been raised. Criticisms that intelligence tests do not really measure innate potential, they are rather "loaded with the cultural biases of middle-class Western society" besieged mental ability tests designers for many years (Aiken, 1970, 130). To overcome such criticisms, several attempts were made at developing "culture-free" intelligence tests; but all failed because no

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test of intelligence can be constructed without any reflection of certain aspects of the culture in which it was developed. The efforts were later shifted to development of "culture-fair" intelligence tests which are composed of only items reflecting experiences that are common to a wide range of cultures (if not all). The most successful attempts in this direction were the Culture Fair Intelligence Test by Cattell and Cattell (Kpolovie, 2015) and Raven's Progressive Matrices by J. C. Raven (Kpolovie & Emekene, 2016).

It is not only intelligence tests that have been subjected to criticisms over the years. All other types test (achievement, aptitude and personality) have their fair share. Ebel and Frisbi (1991) critics of tests have suggested that education could go on perfectly, and even much better than in the past, by abolishing tests and testing. Some have accepted tests grudgingly as a 'necessary evil' in education; and that the tests they have used leave so much to be desired. The test critics attribute failure to tests and that failure in the educational system can and should be banished by abolishing testing. They view failure as a most unwanted traumatic experience because no normal person enjoys it. To the critics, evaluation should be prohibited in education, and schools should run 'test-free' system. They also postulate that learning be most effectively be optimized by teachers and students who have no particular goals in view, and who pay no attention to results or feedbacks of their efforts. They argue that education should fundamentally be based on Connectivism theory (Siemes, 2005) that "learning is best done in self-administered social networks system, totally devoid testing and degree-awarding"; and that Massive Open Online Courses (MOOCs) that is largely based on this Connectivism principle (Kpolovie & Iderima, 2016, 17).

In spite of these criticisms, testing still and will continue to play pivotal role in every educational system globally. In fact, it would be foolish to think of teaching without evaluation. Measurement of educational achievement is indispensable for effective formal education. Everybody involved in the process of education (school administrators, curriculum planners, teachers, parents, students, and employers of labour) require periodic information on how successful their efforts have been. Testing can enable them to know the discrepancy (if any) between performance and standards of the educational program; and decide on the practices to continue and the ones to change. It was on this basis that the Joint Committee of American Association of School Administrators (1962, 9) reiterated that: "To teach without testing is unthinkable. Appraisal of outcomes is an essential feedback of teaching. The evaluation process enables those involved to get their bearings, to know in which direction they are going." Intelligence testing will continue to remain a top practice in in the educational system in spite of criticisms just as criticisms have not brought, and never bring achievement testing, aptitude resting, and personality testing to an end. Criticisms intelligence testing are psychometrically baseless. If there is any human trait that most demands to be measured is intelligence (Kpolovie, 2016).

For purposes of clarity and accuracy of measurement, Cattell (1987; 1971; 1966; 1941) theorized that intelligence which is the basis of all human characteristics is composed of two general factors, viz: fluid intelligence (*gf*) and crystallized intelligence (*gc*). While the fluid intelligence is general to many different fields and is for adaptation to new situation; the crystallized intelligence is specific to certain fields of learning and for maintaining developed habits. Furthermore, the fluid general intelligence depends on heredity (Cattell, 1982) and its

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peak of development is at the age of 14 to 15. The crystallized intelligence is a function of environment such as school and cultural experiences and it keeps developing rapidly up to the age of 25 to 35. In other words, the crystallized general mental ability indicates the extent to which an individual has appropriated the collective intelligence of his culture for his own use; and as a matter of fact, this is partly dependent upon that person's fluid intelligence, for he must have basic capacity to appreciate that which at one time must have been novel to him. To a large extent, the factors (experience, social culture, schooling, and so on) which enable a person to come into contact with his culture, and as a result of such contact, are independent of level of fluid intelligence. The fluid general intelligence component can be measured with a culture fair test of intelligence. A culture fair intelligence test is a test that is equally novel or equally common to all examinees, irrespective of the examinee's cultural background.

The main concern of this investigation is establishment of the relationship between intelligence and academic achievement in Mathematics and in English Language when the possible influence of each of these latter variables is held constant or partialled out statistically. Academic achievement is a criterion for ascertaining the capabilities of a student from which his demonstrated or expressed potentials at the end of a given educational program could be inferred (Kpolovie, 2012a; Oramah, 2012). It is the performance of an individual or group of individuals at the end of a particular academic program. Academic achievement generally refers to the performance or who well an individual is able to assimilate, retain, recall and communicate his knowledge of what has been learnt from an educational program (Joe, Kpolovie, Osonwa & Iderima, 2014). It is the observable knowledge or relatively permanent change in behaviour attained and skills developed in school subjects by the students as measured by certification examinations (Kpolovie, Joe & Okoto, 2014; Kpolovie & Obilor, 2013a).

Academic achievement in this investigation operationally refers to the measured or observed aspect of an individual student's mastery of Mathematics and English Language skills and subject contents specified in the Junior Secondary School and Senior Secondary School syllabuses and schemes of work as measured by Junior School Certificate Examination and Senior Secondary Certificate Examination, respectively, with scores in each of the examinations transformed into T-Scores with a mean of 50 and a standard deviation of 10. Academic achievement is concerned strictly with the actual academic performance of each of the students in Mathematics and in English Language that excludes their academic potentials in the subject areas. Such exclusion is because it might be possible for an individual to have high potential ability but demonstrate low or poor achievement academically. It is the measured relatively permanent changes in the students in Mathematics and English Language behavior due to exposures to well planned and executed formal educational programs offered in the Junior and Senior Secondary Schools in Nigeria. Academic achievement in this type of school setting is usually measured with teacher-made tests, internally developed and administered by the teachers; and standardized test which is externally developed and administered by an examining body like the West African Examination Council (WAEC) and the National Examination Council (NECO) as ways of evaluating outcomes or outputs of the secondary school academic programs (Kpolovie, 2012).

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Students' academic achievement could be a function of several factors like the teachers, school environment, school administration (Ololube and Kpolovie, 2012), culture, family socio-economic background, education funding (Kpolovie, 2013; Kpolovie & Obilor, 2013a), learning stiles adopted, study habit, student's personality (Joe, Kpolovie, Kalu & Iderima, 2014). Students' interest in learning, and students' attitude to school are also predictors of academic achievement, collectively accounting for the 21.60% academic achievement (Kpolovie, Joe & Okoto, 2014). Plomin and Spinath (2004, 112) noted that intelligence accounts for 40% of the total variance in diverse cognitive tests, that intelligence refers to "the substantial covariation among diverse measures of cognitive ability as indexed by an unrotated first principal-component score, which typically accounts for about 40% of the total variance of diverse cognitive tests." The current investigation is concerned with determination of the extent to which the students' intelligence influences their academic achievement in Mathematics and in English Language.

For the purpose of this study, nine research questions are posed as follows. What is the relationship between:

1. Intelligence (IQ) and Junior Secondary School III (JSS III) students' Mathematics academic achievement when the influence of English Language is partialled out?
2. IQ and English Language academic achievement of JSS III students when the influence of Mathematics is partialled out?
3. Mathematics and English Language academic achievement of JSS III students when their IQ is partialled out?
4. IQ and Senior Secondary School III (SSS III) students' Mathematics academic achievement when English Language influence is partialled out?
5. IQ and English Language academic achievement of SSS III students when Mathematics influence is partialled out?
6. Mathematics and English Language academic achievement of SSS III students when their IQ is partialled out?
7. JSS III and SSS III students' intelligence with a time interval of four years in-between?
8. JSS III and SSS III students' Mathematics academic achievement with a time interval of four years?
9. JSS III and SSS III students' English Language academic achievement with a time interval of four years?

Scientific discovery of knowledge that research is all about, demands more than mere establishment of relationship between two or more variables (Ololube & Kpolovie, 2012). In fact, research is not concerned merely with whether there is a relationship between two variables or whether there is a difference between two groups; but centrally with whether the relationship between two variables or the difference between two groups is statistically significant (Kantowitz, Roediger & Elmas, 2015; Keeves, 1990; Kpolovie, 2011; Ololube & Kpolovie, 2012). It is for this purpose that hypothesis is usually postulated and tested in a research. According to Kpolovie (2011, 42), "Hypothesis reveals that knowledge discovery is concerned with whether a statistically significant relation actually exists between two variables, and not (simply) with whether there is a relationship between the two variables." That a relationship exists between two variables, cannot be considered conclusively as a newly discovered knowledge or as an expansion of knowledge because such 'relationship' within the sample drawn from the population for the study could most probably be as just a function of sampling error, measurement error or chance occurrence that cannot be correctly generalized to the entire parent population. To this end, what counts validly as discovery or expansion of knowledge in research is when the 'relationship' is significant statistically at a predetermined level of significance which could be 0.05 or 0.01. It is for this reason that statement of hypothesis usually contains explicitly or implicitly, the term 'significant' (Kpolovie, 2011a).

In line with this demand of knowledge discovery, nine null hypothesis that correspond with the nine research questions are postulated for this investigation. Tenability of each of the hypotheses was tested at 0.05 level of significance. The hypotheses are that a statistically significant relationship does not exist between:

1. Intelligence (IQ) and Junior Secondary School III (JSS III) students' Mathematics academic achievement when the influence of English Language is partialled out.
2. IQ and English Language academic achievement of JSS III students when the influence of Mathematics is partialled out?
3. Mathematics and English Language academic achievement of JSS III students when their IQ is partialled out.
4. IQ and Senior Secondary School III (SSS III) students' Mathematics academic achievement when English Language influence is partialled out?
5. IQ and English Language academic achievement of SSS III students when Mathematics influence is partialled out?
6. Mathematics and English Language academic achievement of SSS III students when their IQ is partialled out.
7. JSS III and SSS III students' intelligence with a time interval of four years in-between?
8. JSS III and SSS III students' Mathematics academic achievement with a time interval of four years?
9. JSS III and SSS III students' English Language academic achievement with a time interval of four years?

METHODOLOGY

Survey research refers to any developmental field investigation that systematically collects, analyses and synthesizes quantitative data on a large representative sample of a given population to cross-sectionally or longitudinally identify, describe and explain the relative incidence, distribution and interrelations of educational, psychological, sociological, commercial or economic, political and clinical variables, as well as other characteristics about the sample through data obtained from personal interview, telephone interview, self-administered inquiry and computer-assisted inquiry for accurate generalization to cover the entire population (Kpolovie, 2016; 2010).

Broadly, there are two survey research designs, namely; first, cross-sectional survey design, and second, longitudinal survey design. Cross-sectional survey research design, as noted earlier is a developmental field study that is characterized with large representative samples of subjects drawn randomly from different ages or educational levels to be comparatively investigated simultaneously. That is, in this survey design, a number of different groups of individuals who respectively belong to different ages or educational levels, each of which is a cohort, randomly sampled from a specific age or educational level, are studied at one particular period of time of about some months of aggressive data collection or field work.

Longitudinal survey research design, which is the type adopted in this investigation, is a developmental field study that deals with repeated gathering of information or data about certain characteristics of a single group of subjects over a long period of time for determination of crucial changes in the characteristics that are probably associated with time intervals. In this design, data are collected at many different points in time from the same sample, respondents, subjects or participants about certain characteristics in them that can be reliably and dependably generalized to the time-related changes that occur in their population. Longitudinal survey design traces the same subjects and maintains contact with them over long period of time; and studies the changes in them in such a way that most effectively prevents or at least reduces subject mortality bias. Mortality bias is the type of bias that could distort, confound and invalidate findings of the investigation as a consequence of substantial losses of members of the sample over time.

The various agents or institutions of socialization like the family, community, health and religious organizations, political and economic organizations, and in particular the educational system are processes of change for better. The actual nature, direction, degree or magnitude and trends of such change can easily be depicted with longitudinal survey research design that collects data from the same people at various times over a long period and analyses them for the purpose of explicating the influence of the socialization process on the constancy and change of related characteristics, events or phenomena. Longitudinal survey research is concerned with the influence of socialization processes over time on the individuals and/or organizational systems though no specific independent variables are directly manipulated or controlled stringently for determination of true casual relationships. “Longitudinal design is the best survey design when a researcher wishes to assess the effect of some naturally occurring events” (Shaughnessy, Zechmeister and Zechmeister, 2000:167).

In the educational setting for instance, longitudinal survey is pertinent for detailed description and coherent explanation of the patterns of progression (how and partially why change occur) and stability (how and partly why change failed to occur) in the individuals (students, teachers or parents), classrooms, schools, educational systems, social subgroups, or the society. The study of constancy or stability and change or progress over a long period of time via repeated testing that longitudinal survey stands for, requires much effort both on the parts of the researcher and the respondents. Generally, certain factors, as outlined below, individually or jointly influence change and stability.

Longitudinal survey design which is the most desirable type of survey research designs, has six different forms. The six longitudinal survey designs are:

i. Trend studies
ii. Simultaneous cross-sectional studies

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iii. Time series
iv. Intervention studies
v. Panel studies
vi. Tracer studies

Of these six, the longitudinal survey design used for this investigation is the 'Time Series Longitudinal Survey Design'.

Time series longitudinal survey design is suitably adopted for developmental investigation of physical and intellectual characteristics of the same subjects over successive periods of time (Kpolovie, 2016). Time series longitudinal survey design is also known as cohort study longitudinal survey. The design is built on the principle that human physical and cognitive development is a continuous process which can be more meaningfully investigated by a series of observations taken of the same persons at different successive points in time. Continuous time scale with strong metric properties can be used in the observation or examination of intellectual and physical changes across long period of time, with or without equal time intervals between successive observations. Thus, in time series longitudinal survey design, the same sample is followed across successive time periods with corresponding increases in the age of the subjects to carefully collect and analyse information on a wide range of relevant variables about them on the aspects of human development under investigation (Kpolovie, 2010).

Time series longitudinal survey is very effective, efficient and advantageous as it, according to Keeves (1990), can be used for direct identification of:

a. Intra-individual constancy and change in a way that best reduces influence of extraneous variables that arise from changing environmental circumstances, because repeated observations are made of the same subjects over time.
b. Differences between individuals or groups in the intra-individual sequences of development by clearly depicting the homogeneity and heterogeneity in the development being investigated between and within individuals and groups.
c. The constancy and change in the dimensions that characterize membership of a group or class to be examined through investigation of relationships associated with such characteristics both within and between classes.
d. The linkages between or among various time-related naturally occurring influences on intra-individual as well as intra-group stability and change with regard to specified characteristics.
e. The relationships between or among time-based naturally occurring influences on interindividual and intergroup constancy and change with respect to certain specific cognitive and physical characteristics.

Generally, the advantages of time series longitudinal survey design far outweigh its financial cost implication. In fact, researchers should concern themselves with the accuracy of findings and appropriate generalization of the findings rather than with the financial cost implication of doing a good research. The time series longitudinal survey design that is highly recommendable was therefore adopted in this survey research.

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The number of secondary school students during the 2011/2012 academic year when a sample was drawn for this study was 11,841,692; of which 7,082,953 students were in Junior Secondary School and 4,758,739 students were in Senior Secondary School in Nigeria. The sample for this study was drawn only from JSS III students who were at the point of writing Junior Secondary Certificate Examination (JSCE); and they were made up of 1,660,984 students (Federal Ministry of Education, 2014; FRN National Population Commission, 2014). For the fact that intelligence is highly associated with age (Kpolovie, 2015; 2010), only 701,274 JSS III students who were aged 14 years constituted the actual population of the study from which a representative sample of 1000 was drawn with the aid of Table of Random Numbers (Kpolovie, 2011). This sample size latter got reduced to 637, because of experimental mortality as only 637 of the sampled 1000 students wrote both the JSCE in 2011/2012 and the SSCE in 2014/2015 academic years. That is, as much as 363 of the 1000 sampled students in JSS III in 2011/2012 academic session had dropped out of school before the time SSCE was written in 2014/2015 academic year. It must also be noted that it was only the 637 students who wrote the Culture Fair Intelligence Test (CFIT) both in 2011/2012 and 2014/2015 school years that were used as the sample of this time series longitudinal survey investigation.

The instruments for data collection in this investigation are the Culture Fair Intelligence Test (CFIT); the 2011/2012 Junior Secondary Certificate Examination (JSCE); and the 2014/2015 Senior Secondary Certificate Examination (SSCE) by the West African Examination Council (WAEC). The Culture Fair Intelligence Test (CFIT) has since been validated and standardized for use in Nigeria (Kpolovie, 2015; 2005; 2003; 1999). The CFIT has test-retest reliability of 0.92, equivalent forms reliability of 0.91, split-half reliability of 0.93, internal consistency reliability of 0.91 via KR20 and 0.87 via KR21 (Kpolovie, 1999). The CFIT has a high construct validity of 0.83 through subtest-total correlation, in addition to highly satisfactory developmental changes evidence as scores increased significantly from age 9 to 15 and flattened out thereafter strictly in accordance with the Fluid and Crystalized Theory of Intelligence (Kpolovie, 2005; Cattell, 1962). Further construct validity evidence of CFIT showed no significant difference in scores across the four cultural groups in Nigeria (Igbo, Hausa, Yoruba and Minority) indicating that the test is not culturally biased; in addition to overwhelmingly significant difference between mentally retarded students (MRS), normal students (NS) and gifted school students (GS) with the GS significantly higher than the NS, and the NS significantly higher than the MRS (Kpolovie, 2015; 2003). The established norms of CFIT in Nigerian were used for conversion of raw scores on the test to normalized (sigma) IQ score with a mean of 100 and a standard deviation of 16 (Kpolovie, 2005; 2015).

The JSCE and SSCE are externally conducted examinations in the Nigerian secondary education system. The validity of Mathematic and English Language JSCE and SSCE examinations were established by the examining bodies (NECO and WAEC), using content validation technique. To ensure uniformity in grading and equate these two different examinations scores for error-free comparison, the Mathematics and English Language JSCE and SSCE scores were first transformed into T-Score with the aid of SPSS Version 22. T-Score is a standard score with a mean of 50 and a standard deviation of 10 (Kpolovie, 2014).

Correlation and Partial correlation were employed for data analysis. While the first, second, third, fourth, fifth, and sixth research questions were answered with partial correlation

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coefficients; the seventh, eighth, and ninth research questions were answered with correlation coefficients. Similarly, while partial correlation was adopted for testing tenability of the first six null hypotheses, the remaining three null hypotheses were tested with correlation. A 0.05 alpha that best reduces Type I Error and Type II Error (Kpolovie, 2011a; 2011) was chosen as the basis for rejection or otherwise of each null hypothesis in this study. IBM SPSS Version 22 was adopted for the data analysis (Meyers, Gamst, & Guarino, 2013; Kpolovie, 2011; Warner, 2013; Field, 2013; George & Mallery, 2014; Brace, Kemp & Snelgar, 2012; Gray & Kinnear, 2012; Elliot & Woodward,2016; Aldrich, Cunningham, 2016).

RESULTS

Table 1: Descriptive statistics at JSS III IQ, Mathematics and English Language academic achievement in 2011/2012 academic year.

	Mean	Std. Deviation	N
IQ - CFIT	100.00	16.00	637
Maths Achievement	50.00	10.00	637
English Lang. Achievement	50.00	10.00	637

The descriptive statistics at Junior Secondary School level in ***Table1*** have shown that the 637 students' IQ as measured with the Culture Fair Intelligence Test has a mean of 100 and a standard deviation of 16.00. The students' Mathematics academic achievement as measured by JSCE with the scores transformed to T-Score has a mean of 50 and a standard deviation of 10. English Language academic achievement as measured by Junior Secondary Certificate Examination (JSCE) with each the 637 examinee's score transformed to T-Score, has a mean of 50 and a standard deviation of 10.

Table 2: Partial correlation between JSS III students' IQ and Mathematics academic achievement with English Language influence partialled out.

Correlations

Control Variables			IQCFIT	MathsJSIII	EnglishJSIII
-none-[a]	IQCFIT	Correlation	1.000	.536	.459
		Significance (2-tailed)	.	.000	.000
		df	0	635	635
	MathsJSIII	Correlation	.536	1.000	.226

		Significance (2-tailed)	.000	.	.000
		df	635	0	635
	EnglishJSIII	Correlation	.459	.226	1.000
		Significance (2-tailed)	.000	.000	.
		df	635	635	0
EnglishJSIII	IQCFIT	Correlation	1.000	.499	
		Significance (2-tailed)	.	.000	
		df	0	634	
	MathsJSIII	Correlation	.499	1.000	
		Significance (2-tailed)	.000	.	
		df	634	0	

a. Cells contain zero-order (Pearson) correlations.

The top side of ***Table 2*** (i.e., above the horizontal line that divides this Table into two) has shown that the zero-order correlations that CFIT IQ and JSS III Mathematics has a correlation coefficient of .536; CIFIT IQ and English Language has .459 correlation; and Mathematics and English Language has .226 correlation. Each of these correlations has 635 degrees of freedom; and is statistically significant at the chosen alpha of .05 and even at .01 alpha for a two-tailed test. In fact, each of these correlations is significant even at .001.

The bottom side of ***Table 2*** (i.e., the part below the horizontal line that separates Table 2) has shown the Partial correlation coefficient, also termed First-order correlation, as the influence of one variable (English Language) has been partialled out, adjusted or controlled for. It can be discerned from this part of ***Table 2*** that with the adjustment, the partial or first-order correlation between CFIT IQ and JSS III Mathematics academic achievement is .499 with 634 degrees of freedom. The answer to the first research question is therefore .499. This .499 partial correlation is statistically significant at the chosen .05 alpha, and even at .01 and .001 for a 2-tailed test. The first null hypothesis of "no significant relationship between IQ and Mathematics of JSS III students when the influence of English Language has been partialled out" is therefore rejected; partial r (634) = .499, $p < .05$. From this significant partial correlation of .499; a partial coefficient of determination of 24.90% (.499 x .499 x 100) can be derived. This means that intelligence (CFIT IQ) accounts for 24.90% of the variance in JSS III students' Mathematics academic achievement.

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Though zero-order correlation coefficient between the JSS III IQ and Mathematics academic achievement is 0.536 (df = 635, two-tailed, p < .001); the partial correlation between the two variables, when the influence of English Language has been removed, reduced to .499 that is still significant statistically (df = 634, two-tailed, p < .001). Overwhelming statistical evidence that there is indeed a significant relationship between JSS III students' intelligence (IQ) and their academic achievement in Mathematics when the influence of English Language is controlled, held constant or eliminated.

Table 3: Partial correlation between JSS III students' IQ and English Language academic achievement with the influence of Mathematics partialled out.

Correlations

Control Variables			IQCFIT	MathsJSIII	EnglishJSIII
-none-[a]	IQCFIT	Correlation	1.000	.536	.459
		Significance (2-tailed)	.	.000	.000
		df	0	635	635
	MathsJSIII	Correlation	.536	1.000	.226
		Significance (2-tailed)	.000	.	.000
		df	635	0	635
	EnglishJSIII	Correlation	.459	.226	1.000
		Significance (2-tailed)	.000	.000	.
		df	635	635	0
MathsJSIII	IQCFIT	Correlation	1.000	.411	
		Significance (2-tailed)	.	.000	
		df	0	634	
	EnglishJSIII	Correlation	.411	1.000	
		Significance (2-tailed)	.000	.	
		df	634	0	

a. Cells contain zero-order (Pearson) correlations.

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The top side of ***Table 3*** (i.e., above the horizontal line that divides this ***Table 3*** into two) has shown that the zero-order correlations that CFIT IQ and JSS III Mathematics has a correlation coefficient of .536; CIFIT IQ and English Language has .459 correlation; and Mathematics and English Language has .226 correlation. Each of these correlations has 635 degrees of freedom; and is statistically significant at the chosen alpha of .05 and even at .01 alpha for a two-tailed test. In fact, each of these correlations is significant even at .001.

The bottom side of ***Table 3*** (i.e., the part below the horizontal line that separates ***Table 3***) has shown the Partial correlation coefficient, also termed First-order correlation, as the influence of one variable (Mathematics) has been partialled out, adjusted or controlled for. It can be discerned from this part of ***Table 3*** that with the adjustment, the partial or first-order correlation between CFIT IQ and JSS III English Language academic achievement is .411 with 634 degrees of freedom. The answer to the second research question is therefore .411. This .411 partial correlation is statistically significant at the chosen .05 alpha, and even at .01 and .001 for a 2-tailed test. The second null hypothesis of "no significant relationship between IQ and English Language academic achievement of JSS III students when the influence of Mathematics has been partialled out" is therefore rejected; partial r (634) = .411, $p < .05$. From this significant partial correlation of .411; a partial coefficient of determination of 16.89% (.411 x .411 x 100) can be derived. This means that intelligence (CFIT IQ) accounts for at least 16.89% of the variance in JSS III students' English Language academic achievement.

Though zero-order correlation coefficient between the JSS III IQ and English Language academic achievement is 0.459 (df = 635, two-tailed, $p < .001$); the partial correlation between the two variables, when the influence of Mathematics has been removed, reduced to .411 that is still significant statistically (df = 634, two-tailed, $p < .001$). Overwhelming statistical evidence that there is indeed a significant relationship between JSS III students' intelligence (IQ) and their academic achievement in English Language when the influence of Mathematics is controlled, held constant or eliminated.

Table 4: Partial correlation between JSS III students' academic achievement in Mathematics and English Language with the influence of IQ partialled out.

Correlations

Control Variables			IQCFIT	MathsJSIII	EnglishJSIII
-none-[a]	IQCFIT	Correlation	1.000	.536	.459
		Significance (2-tailed)	.	.000	.000
		df	0	635	635
	MathsJSIII	Correlation	.536	1.000	.226
		Significance (2-tailed)	.000	.	.000

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		df	635	0	635
	EnglishJSIII	Correlation	.459	.226	1.000
		Significance (2-tailed)	.000	.000	.
		df	635	635	0
IQCFIT	MathsJSIII	Correlation	1.000	-.027	
		Significance (2-tailed)	.	.298	
		df	0	634	
	EnglishJSIII	Correlation	-.027	1.000	
		Significance (2-tailed)	.298	.	
		df	634	0	

a. Cells contain zero-order (Pearson) correlations.

The top side of ***Table 4*** (i.e., above the horizontal line that divides ***Table 4*** into two) has shown that the zero-order correlations that CFIT IQ and JSS III Mathematics has a correlation coefficient of .536; CIFIT IQ and English Language has .459 correlation; and academic achievement in Mathematics and English Language has .226 correlation. Each of these correlations has 635 degrees of freedom; and is statistically significant at the chosen alpha of .05 and even at .01 alpha for a two-tailed test. In fact, each of these correlations is significant even at .001.

The bottom side of ***Table 4*** (i.e., the part below the horizontal line that separates ***Table 4***) has shown the Partial correlation coefficient, also termed First-order correlation, as the influence of one variable (IQCFIT) has been partialled out, adjusted or controlled for. It can be discerned from this part of ***Table 4*** that with the adjustment, the partial or first-order correlation between JSS III Mathematics academic achievement and JSS III English Language academic achievement is as low as -.027 with 634 degrees of freedom. The answer to the third research question is therefore -.027. This -.027 partial correlation is not significant at the chosen alpha of .05 alpha, for a 2-tailed test. The third null hypothesis of "no significant relationship between JSS III students' academic achievement in Mathematics and English Language when the influence of IQ has been partialled out" is therefore retained; partial r (634) = -.027, p > .05. This means that Mathematics academic achievement does not significantly account for the variance in the students' English Language academic achievement meaningfully.

Even though zero-order correlation coefficient between the JSS academic achievement in Mathematics and English Language is .226 that is significant statistically (df = 635, two-tailed, p < .001); the partial correlation between the students' academic achievement, when the

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influence of intelligence (IQCFIT) has been removed, drastically reduced to -.027 that is not significant statistically (df = 634, two-tailed, p > .05). Therefore, overwhelming evidence has shown that indeed, there is no significant relationship between JSS III students' academic achievement in Mathematics and in English Language when the influence of the students' IQ is controlled, held constant or eliminated. The implication of the dramatic twist that is observed here is simply that in actual fact, without the influence of intelligence (IQ), there is no significant relationship between JSS III students' academic achievement in Mathematics and English Language. In other words, what made the students' academic achievement in Mathematics and English Language to be significant at the zero-order correlation (before the partial correlation or when IQ has not been partialled out) was neither their Mathematics achievement nor their English Language achievement, it was rather a different factor that was general to both of the variables. That factor is general intelligence, referred to as *gf* (fluid general intelligence) by Cattell (1987; 1982; 1971; 1966; 1941) which is measured with Culture Fair Intelligence Test in this investigation. That is, it is general intelligence that largely accounts for why some students who are good, average, and poor in Mathematics academic achievement are respectively good, average, and poor in English Language academic achievement.

Table 5: Descriptive statistics of Senior Secondary School III students' IQ, and academic achievement in Mathematics and English Language.

	Mean	Std. Deviation	N
IQ	100.00	16.00	637
Maths Achievement	50.00	10.00	637
English Lang. Achievement	50.00	10.00	637

The descriptive statistics at Senior Secondary School III students in ***Table 1*** show that the 637 students' IQ as measured with the Culture Fair Intelligence Test (CFIT) has a mean of 100 and a standard deviation of 16.00. The students' Mathematics academic achievement as measured by WAEC SSCE with the scores transformed to T-Score has a mean of 50 and a standard deviation of 10. English Language academic achievement as measured by Senior Secondary Certificate Examination (SSCE) with each of the 637 examinee's score transformed to T-Score, has a mean of 50 and a standard deviation of 10.

Table 6: Partial correlation between SSS III students' IQ and Mathematics academic achievement with English Language influence partialled out.

Correlations

Control Variables			IQCFIT	MathsSSIII	EnglishSSIII
-none-[a]	IQCFIT	Correlation	1.000	.550	.432

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		Significance (2-tailed)	.	.000	.000
		df	0	635	635
	MathsSSIII	Correlation	.550	1.000	.281
		Significance (2-tailed)	.000	.	.000
		df	635	0	635
	EnglishSSIII	Correlation	.432	.281	1.000
		Significance (2-tailed)	.000	.000	.
		df	635	635	0
EnglishSSIII	IQCFIT	Correlation	1.000	.495	
		Significance (2-tailed)	.	.000	
		df	0	634	
	MathsSSIII	Correlation	.495	1.000	
		Significance (2-tailed)	.000	.	
		df	634	0	

a. Cells contain zero-order (Pearson) correlations.

The top side of ***Table 6*** (i.e., above the horizontal line that divides ***Table 6*** into two) has unveiled that the zero-order correlations that CFIT IQ and SSS III Mathematics has a correlation coefficient of .550; CIFIT IQ and English Language has .432 correlation; and Mathematics and English Language has .281 correlation. Each of these correlations has 635 degrees of freedom; and is statistically significant at the chosen alpha of .05 and even at .01 alpha for a 2-tailed test.

The bottom side of ***Table 6*** (i.e., the part below the horizontal line that separates ***Table 6***into two) has shown the Partial correlation coefficient, also termed First-order correlation, as the influence of one variable (English Language) has been partialled out, adjusted or controlled for. It can be discerned from this part of ***Table 6*** that with the adjustment, the partial or first-order correlation between CFIT IQ and SSS III Mathematics academic achievement is .495 with 634 degrees of freedom. The answer to the fourth research question is therefore .495. This .495 partial correlation is statistically significant at the chosen .05 alpha, and even at .01 and .001 for a 2-tailed test. The fourth null hypothesis of "no significant relationship between IQ

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and Mathematics academic achievement of SSS III students when the influence of English Language has been partialled out" is therefore rejected; partial r (634) = .495, $p < .05$. From this significant partial correlation of .495; a partial coefficient of determination of 24.50% (.495 x .495 x 100) can be derived. This means that intelligence (CFIT IQ) accounts for 24.50% of the variance in SSS III students' Mathematics academic achievement.

Though zero-order correlation coefficient between the SSS III IQ and Mathematics academic achievement is 0.550 (df = 635, two-tailed, $p < .001$); the partial correlation between the two variables, when the influence of English Language has been removed, reduced to .495 that is still significant statistically (df = 634, two-tailed, $p < .001$). Overwhelming statistical evidence that there is indeed a significant relationship between SSS III students' intelligence (IQ) and their academic achievement in Mathematics when the influence of English Language is controlled, held constant or eliminated.

Table 7: Partial correlation between SSS III students' IQ and English Language academic achievement with the influence of Mathematics is partialled out.

Correlations

Control Variables			IQCFIT	MathsSSIII	EnglishSSIII
-none-[a]	IQCFIT	Correlation	1.000	.550	.432
		Significance (2-tailed)	.	.000	.000
		df	0	635	635
	MathsSSIII	Correlation	.550	1.000	.281
		Significance (2-tailed)	.000	.	.000
		df	635	0	635
	EnglishSSIII	Correlation	.432	.281	1.000
		Significance (2-tailed)	.000	.000	.
		df	635	635	0
MathsSSIII	IQCFIT	Correlation	1.000	.346	
		Significance (2-tailed)	.	.000	
		df	0	634	
	EnglishSSIII	Correlation	.346	1.000	

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		Significance (2-tailed)	.000	.	
		df	634	0	

a. Cells contain zero-order (Pearson) correlations.

The top side of ***Table 7*** (i.e., above the horizontal line that divides ***Table 7*** into two) has shown that the zero-order correlations that CFIT IQ and SSS III Mathematics has a correlation coefficient of .550; CIFIT IQ and English Language has .432 correlation; and Mathematics and English Language has .281 correlation. Each of these correlations has 635 degrees of freedom; and is statistically significant at the chosen alpha of .05 and even at .01 alpha for a 2-tailed test. In fact, each of these correlations is significant even at .001.

The bottom side of ***Table 7*** (i.e., the part below the horizontal line that separates ***Table 7***into two) has revealed the Partial correlation coefficient, also termed First-order correlation, as the influence of one variable (Mathematics) has been partialled out, adjusted or controlled for. It can be discerned from this part of ***Table 7*** that with the adjustment, the partial or first-order correlation between CFIT IQ and SSS III English Language academic achievement is .346 with 634 degrees of freedom. The answer to the fifth research question is therefore .346. This .346 partial correlation is statistically significant at the chosen .05 alpha, and even at .01 for a 2-tailed test. The fifth null hypothesis of “no significant relationship between IQ and English Language academic achievement of SSS III students when the influence of Mathematics has been partialled out” is therefore rejected; partial r (634) = .346, p < .05. From this significant partial correlation of .346; a partial coefficient of determination of 11.97% (.346 x .3461 x 100) can be derived. This means that intelligence (CFIT IQ) accounts for 11.97% of the variance in SSS III students’ English Language academic achievement.

Though zero-order correlation coefficient between the SSS III IQ and English Language academic achievement is 0.432 (df = 635, two-tailed, p < .05); the partial correlation between the two variables, when the influence of Mathematics has been removed, reduced to .346 that is still significant statistically (df = 634, two-tailed, p < .05). Overwhelming statistical evidence that there is indeed a significant relationship between SSS III students’ intelligence (IQ) and their academic achievement in English Language when the influence of Mathematics is controlled, held constant or eliminated.

Table 8: Partial correlation between SSS III students’ academic achievement in Mathematics and English Language with the influence of IQ partialled out.

Correlations

Control Variables			IQCFIT	MathsSSIII	EnglishSSIII
-none-[a]	IQCFIT	Correlation	1.000	.550	.432
		Significance (2-tailed)	.	.000	.000

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		df	0	635	635
	MathsSSIII	Correlation	.550	1.000	.281
		Significance (2-tailed)	.000	.	.000
		df	635	0	635
	EnglishSSIII	Correlation	.432	.281	1.000
		Significance (2-tailed)	.000	.000	.
		df	635	635	0
IQCFIT	MathsSSIII	Correlation	1.000	.058	
		Significance (2-tailed)	.	.103	
		df	0	634	
	EnglishSSIII	Correlation	.058	1.000	
		Significance (2-tailed)	.103	.	
		df	634	0	

a. Cells contain zero-order (Pearson) correlations.

The top side of ***Table 8*** (i.e., above the horizontal line that divides ***Table 8*** into two) has shown that the zero-order correlations that CFIT IQ and SSS III Mathematics has a correlation coefficient of .550; CIFIT IQ and English Language has .432 correlation; and academic achievement in Mathematics and English Language has .281 correlation. Each of these correlations has 635 degrees of freedom; and is statistically significant at the chosen alpha of .05 and even at .01 alpha for a two-tailed test.

The bottom side of ***Table 8*** (i.e., the part below the horizontal line that separates ***Table 8***) has shown the Partial correlation coefficient that is also referred to as First-order correlation, as the influence of one variable (IQCFIT) has been partialled out, adjusted or controlled for. It can be discerned from this part of ***Table 8*** that with the adjustment, the partial or first-order correlation between SSS III Mathematics academic achievement and SSS III English Language academic achievement is as low as .058 with 634 degrees of freedom. The answer to the sixth research question is therefore .058. This .058 partial correlation is not significant at the chosen alpha of .05 alpha, for a 2-tailed test. The sixth null hypothesis of “no significant relationship between SSS III students’ academic achievement in Mathematics and English Language when the influence of IQ has been partialled out” is therefore retained; partial $r\ (634) = .058,\ p > .05$.

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This means that Mathematics academic achievement does not meaningfully account for the variance in the students' English Language academic achievement.

Even though zero-order correlation coefficient between the SSS academic achievement in Mathematics and English Language is .281 that is significant statistically (df = 635, two-tailed, $p < .001$); the partial correlation between the students' academic achievement, when the influence of intelligence (IQCFIT) has been removed, drastically reduced to .058 that is not significant statistically (df = 634, two-tailed, $p > .05$). Therefore, overwhelming evidence has shown that indeed, there is no significant relationship between SSS III students' academic achievement in Mathematics and English Language when the influence of the students' IQ is controlled, held constant or eliminated. The implication of this dramatic twist that is observed here is simply that in actual fact, without the influence of intelligence (IQ), there is no significant relationship between SSS III students' academic achievement in Mathematics and English Language. In other words, what made the students' academic achievement in Mathematics and English Language to be significant at the zero-order correlation (before the partial correlation or when IQ has not been partialled out) was neither their Mathematics achievement nor their English Language achievement, it was rather a different factor that was common or general to both of the variables. That factor is general intelligence, referred to as fluid general intelligence (*gf*) by Cattell (1987; 1982; 1971; 1966; 1941) which is measured with Culture Fair Intelligence Test in this investigation. That is, it is general intelligence that largely accounts for why some students who are good, average, and poor in Mathematics academic achievement are respectively good, average, and poor in English Language academic achievement.

Table 9: Descriptive statistics of JSS III and SSS III intelligence (CFIT IQ)

Descriptive Statistics

	Mean	Std. Deviation	N
IQCFITJSIII	100	16	637
IQCFITSSIII	100	16	637

The mean, standard deviation and number of cases of JSS III and SSS III intelligence after a 4-year time interval are shown in Table 9. Recall that at each time (JSS III in during 2011/2012 academic session and SSS III during 2014/2015 academic session), the CFIT IQ scores were strictly based on a normalized or sigma score with a standard deviation of 16 and a mean of 100. This accounts for why the descriptive statistics of the 637 students' intelligence in JSS III and SSS III are the same.

Table 10: Correlation between JSS III and SSS III intelligence (CFIT IQ) with 4-year time interval

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Correlations

		IQCFITJSIII	IQCFITSSIII
IQCFITJSIII	Pearson Correlation	1	.702**
	Sig. (2-tailed)		.000
	N	637	637
IQCFITSSIII	Pearson Correlation	.702**	1
	Sig. (2-tailed)	.000	
	N	637	637

** The correlation is significant at .01 level of significance.

It can be discerned from Table 10 that the 637 students' intelligence, measured with Culture Fair Intelligence Test, when they were ending JSS III (2011/2012 school year) and when they were ending SSS III (2014/2015 school year) has a correlation coefficient of .702. Therefore, .702 is the answer to the seventh research question of this study. The seventh null hypothesis that "There is no statistically significant relationship between the intelligence of the students when they were in JSS III and in SSS III with a time interval of four years" is rejected as $r(635) = .702$, $p < .05$. The overwhelming preponderance of relationship between students' IQ in JSS III and SSS III with a 4-year time interval is an indication of the relative permanence of fluid general intelligence (gf) that the Culture Fair Intelligence Test measures in accordance with Cattell's theory of fluid and crystalized general intelligence that the fluid intelligence grows with age up to the age of 14 and flattens out thereafter (Cattell, 1987; 1971; 1941; Kpolovie, 2015; 2005; 2003; 1999).

Table 11: Descriptive statistics of JSS III and SSS III Mathematics academic achievement

Descriptive Statistics

	Mean	Std. Deviation	N
MathsJSIII	50	10	637
MathsSSIII	50	10	637

The mean, standard deviation and number of cases of JSS III and SSS III Mathematics academic achievement after a 4-year time interval are shown in ***Table 11***. It should be recall that at each time (JSS III in during 2011/2012 academic session and SSS III during 2014/2015 academic session), the Mathematics academic achievement scores were strictly based on a

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transformed score known as T-Score. T-Score has a standard deviation of 10 and a mean of 50 (Kpolovie, 2014; Shuitz, Whitney, & Zickar, 2014). This accounts for why the descriptive statistics of the 637 students' Mathematics academic achievement in JSS III and in SSS III are the same.

Table 12: Correlation between JSS III and SSS III Mathematics academic achievement with a 4-year time interval

Correlations

		MathsJSIII	MathsSSIII
MathsJSIII	Pearson Correlation	1	.231**
	Sig. (2-tailed)		.000
	N	637	637
MathsSSIII	Pearson Correlation	.231**	1
	Sig. (2-tailed)	.000	
	N	637	637

** The correlation is significant at .01 level of significance.

It can be discerned from ***Table 12*** that the 637 students' Mathematics academic achievement, measured with Junior Secondary Certificate Examination and Senior Secondary Certificate Examination when they were ending JSS III (2011/2012 school year) and when they were ending SSS III (2014/2015 school year), respectively, has a correlation coefficient of .231. Therefore, .231 is the answer to the eighth research question of this investigation. The eighth null hypothesis that "there is no significant relationship between the Mathematics academic achievement of the students when they were in JSS III and in SSS III with a time interval of four years" is rejected as $r(635) = .231$, $p < .05$. Perhaps, this highly significant correlation is because students who performed very high in Mathematics in JSS III most often became science students in SSS III and eventually performed better in the subject than their counterparts, students with low Mathematics scores in JSS III who most often ended up as arts students in SSS III and eventually made relatively low scores in Mathematics.

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Table 13: Descriptive statistics of JSS III and SSS III English Language academic achievement

Descriptive Statistics

	Mean	Std. Deviation	N
EnglishJSIII	50	10	637
EnglishSSIII	50	10	637

The mean, standard deviation and number of cases of JSS III and SSS III English Language academic achievement after a 4-year time interval are shown in ***Table 13***. It should be recall that at each time (JSS III in during 2011/2012 academic session and SSS III during 2014/2015 academic session), the English Language academic achievement scores were strictly based on a transformed score known as T-Score. T-Score a standardised score with a standard deviation of 10 and a mean of 50 (Kpolovie, 2014; Shuitz, Whitney, & Zickar, 2014). This accounts for why the descriptive statistics of the 637 students' English Language academic achievement in JSS III and in SSS III are the same.

Table 14: Correlation between JSS III and SSS III English Language academic achievement with a 4-year time interval

Correlations

		EnglishJSIII	EnglishSSIII
EnglishJSIII	Pearson Correlation	1	.201**
	Sig. (2-tailed)		.000
	N	637	637
EnglishSSIII	Pearson Correlation	.201**	1
	Sig. (2-tailed)	.000	
	N	637	637

** The correlation is significant at .01 level of significance.

It can be discerned from ***Table 14*** that the 637 students' English Language academic achievement, measured with Junior Secondary Certificate Examination and Senior Secondary Certificate Examination when they were ending JSS III (2011/2012 school year) and when they were ending SSS III (2014/2015 school year), respectively, has a correlation coefficient of .201. Therefore, .201 is the answer to the ninth research question of this investigation. The eighth null hypothesis that "there is no significant relationship between the English Language academic achievement of the students when they were in JSS III and in SSS III with a time interval of four years" is rejected as $r(635) = .201$, $p < .05$. Perhaps, this highly significant correlation is because students who performed very high in English Language during JSS III

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most often became arts students in SSS III and eventually performed better in the subject than their counterparts, students with low English Language scores in JSS III who most often ended up as science students in SSS III and eventually made relatively low scores in English Language.

PRACTICAL IMPLICATIONS OF THE FINDINGS

The findings of this investigation that:

1. IQ and Mathematics academic achievement at Junior Secondary School III have a .536 correlation and .499 Partial correlation (influence of English controlled);
2. IQ and English Language academic achievement at JSS III have .459 correlation and .411 partial correlation (influence of Mathematics held constant);
3. Mathematics and English Language at JSS III have .226 correlation and -.027 Partial correlation (IQ partialled out);
4. IQ and Mathematics academic achievement at SSS III have .550 correlation and .495 partial correlation (English Language influence controlled)
5. IQ and English Language at SSS III have .432 correlation and .348 partial correlation (Mathematics influence held constant)
6. Mathematics and English Language academic achievement at SSS III have .281 correlation and .058 partial correlation (role of IQ held constant)
7. Students’ IQ in JSS III and in SSS III with four-year interval is .702.
8. JSS III and SSS III students’ Mathematics academic achievement have a .231 correlation.
9. English Language academic achievement in JSS III and in SSS III have a correlation of .201.

The findings this time series longitudinal survey research denotes that both at Junior Secondary and Senior Secondary levels of schooling, a student’s academic or cognitive achievement on one subject matter (Mathematics for instance) tends to be comparable to that student’s academic achievement on other cognitive tasks like English Language; though these are two completely different subject areas (Kpolovie, Ololube, & Ekwebelem, 2011; Kpolovie &

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Obilor, 2013). Intelligence is the general mental ability factor that accounts for the significant correlation that exists between the two subject areas as intelligence overwhelmingly correlates with each of the subjects ranging from .432, .459, and .536 to .550. This explanation is unquestionably so because when intelligence is held constant or partialled out, academic performance in Mathematics and English Language no longer correlates significantly. These findings corroborate scientific discoveries that students' academic achievement ratings, across seemingly unrelated school subjects, are positively correlated as a reflection of the influence of an underlying general intelligence as postulated by Charles Spearman (Spearman, 1904; 1927) and confirmed by results from works of other researchers (Plomin, 2003; 2004; Horn McArdle, 2007; Hunt, 2011; Johnson, Nijenhuis & Bouchhard Jr, 2008; Kamphaus, Winsor, Rowe, Kim, 2005; Mackintosh, 2011; Davidson & Kemp, 2011; Deary, 2012; 2000; Flynn, 2011; Gottfredson, 1998).

Findings of the current study are absolutely in support of previous research works which showed that general intelligence that Culture Fair Intelligence Test measures is a significant predictor of individual differences in academic attainment, successful educational endeavours, employment and social outcomes (Kpolovie, 2015; Raaijmakers, 2006; Kvist & Gustafsson, 2008; Lautrey, 2002; Kovas & Plomin, 2006). Put differently, findings of the current work have revealed that the general mental ability or general intelligence factor, g or gf, which CFIT measures most conspicuously predicts academic achievement or scholastic performance as the g is concerned with ability to learn novel material and understand concepts and meanings (Kpolovie, Joe & Okoto, 2014). Recall the operational definition of intelligence in this work as: 'the general mental ability to quickly learn, solve novel problems, educe relationships, quickly process information accurately, think rationally, act purposefully, and most effectively adapt to one's environment as measured by Culture Fair Intelligence Test that has been validated and standardized for use in Nigeria'.

Profound evidence of correlation and partial correlation between students' IQ and their academic achievement of this study is in support of the results of Kaufman, Reynolds, Lui, Kaufman, and McGrew (2012) who examined whether cognitive g and academic achievement g are one and the same thing, using Woodcock-Johnson and Kaufman test with a sample 2,520 students. Their investigation that covered four age groups between 5-6 and 14-19 years found tenability of invariance generally, which allowed for valid comparisons of second-order

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general cognitive ability (the g factor) and academic achievement in mathematics, English Language, reading and writing were not isomorphic as they substantially correlated. They found correlation coefficients that ranged from .77 to .94. The cognitive general ability (general intelligence) g and academic achievement g were very strongly associated just as in the results of the current work.

The present study's findings equally confirm the findings of Jonsdottir (2012) on academic achievement in 4^{th} and 7^{th} grade; Veltmann, Raudsepp and Pullmann (2011) on general mental ability predicting achievement in mathematics; Lipi (2013) on students' intelligence and academic achievement in Albanian Universities; and Deary, Stand, Smith and Fernandes (2007) on intelligence and educational achievement that all indicated statistically significant relationship between intelligence and academic achievement in such a way that IQ accounted for a large portion of the variance in students' educational or academic achievement. Mathematics and English Language achievements were significantly predicated on an intelligence factor, the general mental ability or general intelligence as demonstrated in the present investigation.

Jensen (1992; 1998; 2000; 2002; Sackett, Borneman & Connelly, 2008) have in their investigations, arrived at findings similar to the ones in the current investigation that in elementary and Junior Secondary School, IQ and academic performance in various subjects correlate very highly, about .60 to .70. At Senior Secondary School and tertiary education levels, more students from the lower end of the IQ distribution drop out of their education programs, which restricts the range of IQs and results in lower correlations between IQ and academic achievement. For instance, correlation coefficients of about .59 to .50, .49 to .40, and .39 to .30 exists between IQ and academic achievement respectively in senior secondary school students, undergraduates, and postgraduates. Each of the academic achievements (in Mathematics and in English Language) correlates more highly with intelligence, the general mental ability, than with academic performance in each of the subjects in the current investigation. Sackett, Borneman and Connelly (2008) in an investigation that used 65,000 college students in the United States of America, found that Scholastic Aptitude Test (SAT) has .47 correlation with IQ during their first year in tertiary institution.

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In an investigation of cognitive predictors of achievement growth in Mathematics that longitudinally covered five years with a sample of 177 first graders by Geary (2011) revealed that primarily, intelligence; and secondarily, processing speed and central executive component of working memory significantly predict academic performance in Mathematics from the year the investigation started till the end of five years covered by the study. It clearly demonstrated that general cognitive ability predicts outcomes across academic domains, particularly the mathematical cognitive domain. The findings of the present study that general intelligence which includes the ability to think logically and systematically is the single best predictor of achievement across Mathematics and English Language academic domains from JSS III to SSS III corroborates the findings of Geary (2011). Results of the present study equally confirms those of Kovas, Harlaar, Petrill & Plomin (2005); Egan; Gibson; Austin; Kellaghan, (1996); Deary; Spinath; Bates, 2006) that over .51% of the variation on national mathematics tests at ages of 11 to 16 are explained by general intelligence.

The irrepressible fact that intelligence has overwhelming significant correlation and partial correlation as well as coefficient determination and coefficient of partial determination demand that intelligence testing be incorporated in the Nigerian Educational System. It is only when intelligence testing typically becomes an integral part of the Nigerian Educational System that the system can favourably compete with the educational systems in the developed world that intelligence testing has ever being part and parcel of the education system. According intelligence testing a central attention in the Nigerian system of education is a necessary intervention that the nations' education demands instantly for eminent quality and standards improvement. It must also be emphasized that it is only with the use of IQ tests that the generally gifted, prodigiously gifted, the average students and those who are low on IQ as well as the mentally retarded can be identified timely and accorded requisite instructional methods that is best for each learner (Kpolovie, 2012a).

Intelligence is health cognitively. It is only by incorporation of intelligence testing in the educational system in Nigeria that the tens of millions of Nigerians who are in the various institutions of learning, or who will pass through them, will have the much needed opportunity to know their IQ and take all necessary steps to improve it, or at least maintain it. The policy of 'education for all' in the country implies that every individual is bound to have certain level of education; and having intelligence testing as a core part of the education system will enable

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a great majority of individuals to know their intelligence for taking of certain important decisions in life. To know their health status, people generally take certain tests to have a good knowledge of their blood group, genotype, HIV; and exclude the taking of intelligence test as though intelligence which is a most central trait in every human is completely irrelevant in the Nigerian setting. This anomaly urgently demands to be stopped. Let every student at least know his/her intelligence because IQ plays a significantly pivotal role in an individual's academic achievement in Mathematics and English Language as revealed by findings of this study, and perhaps in the other school subjects.

REFERENCES

Aldrich, JO; Cunningham, JB (2016). *Using IBM SPSS statistics; second edition*. Los Angeles: SAGE Publications, Inc.

Aquinas, T (1981). *The Summa Theologica of St Thomas Aquinas*. Albanian: Christian Classics.

Balchin, J (2010). *Quantum leaps: 100 scientists who changed the world*. London: Arcturus Publishing Limited.

Brace, N; Kemp, R; Snelgar, R (2012). *SPSS for psychologists; fifth edition*. Hampshire, UK: Palgrave Macmillan.

Buzan, T (2003). *The power of creative intelligence: 10 ways to tap into your creative genius*. India: Gramedia Pustaku Utama

Carlson, JF; Geisinger, KF; Jonson, JL (2014). *The Nineteenth Mental Measurement Yearbook*. Nebraska: University of Nebraska Press.

Carnegie, D (2002). *How to enjoy your life and job*. London: Vermillion.

Carter, P (2005). *The complete book of intelligence tests: 500 exercises to improve, upgrade and enhance your mind*. Minnesota, USA: Capstone Press.

Carter, P; (2011). *IQ and psychometric test workbook: Essential preparation for verbal, numerical and spatial aptitude tests and personality tests*. London, UK: Kogan Page.

Carter, P; Russell, K (2009). *The ultimate IQ test book: 1000 practice test questions to boost your brain power*. London, UK: Kogan Page.

Carter, PJ; Russel, KA (2007). *Maximize your IQ*. New York City: Sterling Publishing.

Cattell, RB (1941). Some theoretical issues in adult intelligence testing. *Psychological Bulletin.* (38), 592.

ISSN 2055-0057(Print), ISSN 2055-0065(Online)

Cattell, RB (1966). *Handbook of multivariate experimental psychology; second edition*. Chicago: Rand McNally.

Cattell, RB (1971). *Abilities: Their structure, growth, and action*. Boston: Houghton Mifflin.

Cattell, RB (1982). *The inheritance of personality and ability: Research methods and findings*. New York: Academic Press.

Cattell, RB (1987). *Intelligence: Its structure, growth, and action*. New York: Elsevier.

Coon, C (2001). *On human intelligence: Progressive humanism; globalization and Social Darwinism*. Retrieved from http://www.progressivehumanism.com/proressive-humanism/on-human-intelligence

Copernicus, N (1543). *De revolutionibus orbium coelestium (On the revolution of the celestial spheres)*. Nuremberg: Johannes Petreius

Darwin, C (1998). *The origin of species (Wordsworth Edition)*. Ware, Hertfordshire: Wordsworth Edition Ltd Publishers.

Darwin, C. (1871). *The descent of man. Amherst*. New York: Prometheus Books.

Davidson, JE; Kemp, IA (2011). Contemporary models of intelligence. In R. J. Sternberg and S. B. Kaufman (Eds.). *The Cambridge Handbook of intelligence*. New York: Cambridge University Press.

Deary IJ (2000). *Looking down on human intelligence: from psychometrics to the brain*. Oxford, England: Oxford University Press.

Deary, IJ (2012). Intelligence. *Annual Review of Psychology*. (63), 453-482.

Deary, IJ; Egan, V; Gibson, GJ; Brand, CR; Austin, E; Kellaghan, T (1996). Intelligence and the differentiation hypothesis. *Intelligence*. (23), 105-132. Retrieved from http://dx.doi.org/10.1016%2FS0160-2896%2990008-2

Deary, IJ; Spinath, FM; Bates, TC (2006). Genetics of intelligence. *European Journal of Human Genetics*. (14), 690-700. Retrieved from https://doi.org/10.1038%2Fsj.ejhg.5201588

Deary, IJ; Strand, S; Smith, P; Fernandes, C (2007). Intelligence and educational achievement. *Intelligence*. (35), 13-21.

Dilalla, LF (2000). Development of intelligence: current research. *Journal of Psychology*. (38), 3-7.

Drummond, RJ; Sheperis, CJ; Jones, KD (2015). *Assessment procedures for counsellors and helping professionals; eighth edition*. New Jersey: Pearson.

Ebel, RL; Frisbi, DA (1991). *Essentials of educational measurement; fifth sub edition*. New Jersey: Prentice-Hall, Inc.

ISSN 2055-0057(Print), ISSN 2055-0065(Online)

Elliot, AC; Woodward, WA (2016). *IBM SPSS by example; second edition*. Los Angeles: SAGE Publications, Inc.

Emery, NJ; Clayton, NS (2004). The mentality of crows: Convergent evolution of intelligence in corvids and apes. *Science*. (306), 1903-1908.

Esters, IG (1999). Contemporary theories and assessment of intelligence. *Professional School Counselling*. (2), 373-375.

Federal Ministry of Education (2014). *Staff and students data in our educational institutions*. Abuja: FME press.

Field, A (2013). *Discovering statistics using IBM SPSS Statistics; fourth edition*. Los Angeles: SAGE Publications, Inc.

Fischman, J (1993). New clues surface about the making of the mind. *Science*. (262), 1517-1532.

Flynn, J (2011). *Secular changes in intelligence. In R.J. Sternberg and S. B. Kaufman (Eds.). Cambridge Handbook of Intelligence*. New York: Cambridge University Press.

FRN National Population Commission (2014). *Nigeria Demographic and Health Survey 2013*. USA: ICF International.

Funder, DC (2012*). The personality puzzle; sixth edition*. New York: W. W. Noton & Company.

Galton, F (1865). Heredity, talent and character. *Macmillan's Magazine*. (12), 157-166; 318-327.

Galton, F (1869). *Heredity, genius: An enquiry into its laws and consequences*. London: Macmillan.

Geary, DC (2011). Cognitive predictors of achievement growth in mathematics: A five year longitudinal study. *Developmental Psychology*. 47(6), 1539-1552.

George, D; Mallery, P (2014). *IBM SPSS Statistics 21 step by step: A simple guide and reference; thirteenth edition*. Boston: Pearson Education Inc.

Glendenning, KK (1998). Thalamic inhibition in the evolution of human intelligence: evolutionary pressure for cortical inhibition. *The Mankind Quarterly*. (4), 319-335. https://www.questia.com/library/journal/1P3-32132452/thalamic-inhibition-in-the-evolution-of-human-intelligence

Goldman, D (2007). *Social intelligence*. New York: Bantam Books.

Gottfredson, LS (1998). The general intelligence factor. *Science American Presents*. 9(4), 24-29.

Gray, CD; Kinnear, PR (2012). *IBM SPSS Statistics 19 made simple*. New York: Psychology Press Taylor & Francis Group.

ISSN 2055-0057(Print), ISSN 2055-0065(Online)

Henderson, RD'A (2013). *Brassey's international intelligence yearbook*. Washington, D.C.: Brassey's Inc.

Herrnstein, R J; Murray, C (1994). *The bell curve intelligence and class structure in American life*. New York: The Free Press.

Horn, JL; McArdle, JJ (2007). Understanding human intelligence since Spearman. In R. Cudeck & R. MacCallum, (Eds.). *Factor Analysis at 100 years*. Mahwah, NJ: Lawrence Erlbaum Associates, Inc. 205-247.

Hunt, E (2010). *Human intelligence*. Cambridge, England: Cambridge University Press.

Hunt, EB (2011). *Human intelligence*. Cambridge, UK: Cambridge University Press.

Jensen, AR (1992). Understanding g in terms of information processing. *Educational Psychology Review*. (4), 271-308.

Jensen, AR (1998). *The g factor: The science of mental ability*. Retrieved http://emilkirkegaard.dk/en/wp-content/uploads/The-g-factor-the-science-of-mental-ability-Arthur-R.-Jensen.pdf

Jensen, AR (1998). *The g factor: the science of mental ability*. Westport, CT: Praeger Publishers.

Jensen, AR (2000). A Nihilistic Philosophy of Science for a Scientific Psychology? *Psycoloquy, 11*. Issue 088, Article 49. http://www.cogsci.ecs.soton.ac.uk/cgi/psyc/newpsy?11

Jensen, AR (2002). Psychometric g: Definition and substantiation. In R. J. Sternberg and E. L. Grigorenko (Eds.). *General factor of intelligence: How general is it?* Mahwah, NJ: Erlbaum. 39-54.

Joe, AI; Kpolovie, PJ; Osonwa, KE; Iderima, CE (2014). Modes of admission and academic performance in Nigerian universities. *Merit Research Journal of Education and Review*. 2(9), 203-230. Retrieved from http://meritresearchjournals.org/er/content/2014/September/Kpolovie%20et%20al.pdf

Johnson, W; Nijenhuis, J; Bouchhard Jr, T (2008). Still just 1 g: Consistent results from five test batteries. *Intelligence*. (36), 81-95.

Joint Committee of American Association of School Administrators (1962). *Testing, testing, testing*. Washington, D.C.: American Association of School Administrators.

Jonsdottir, GA (2012). *Academic achievement in 4th and 7th grade: The contribution of gender, parental education, achievement goals and intelligence*. Haskoli Islands: Universutis Islandiae Sigillum.

Kamil, AC (2004). Sociality and the evolution of intelligence. *Trends in Cognitive Science*. (8), 195-197. http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1043&context=bioscibehavior

ISSN 2055-0057(Print), ISSN 2055-0065(Online)

Kamphaus, RW; Winsor, AP; Rowe, EW; Kim, S (2005). A history of intelligence test interpretation. In D. P. Flanagan and P. L. Harrison (Eds.). *Contemporary intellectual assessment: Theories, tests, and issues; second edition*. New York: Guilford.

Kanazawa, S (2004). General intelligence as a domain-specific adaptation. *Psychological Review*. (111), 512-523.

Kantowitz, BH; Roediger III, HL; Elmes, DG (2015). *Experimental psychology; tenth edition*. California, USA: Wadsworth Thomson Learning.

Kaufman, SB; Reynolds, MR; Lui, X; Kaufman, AS; McGrew, KS (2012). Are cognitive g and academic achievement one and the same g? An exploration on the Woodcock-Johnson and Kaufman tests. *Intelligence*. Doi:10.1016/j.intell.2012.01.009. 1-16.

Keeves, J. P. (1990), *Educational Research, Methodology and Measurement: An International Handbook.* Oxford: Pergamum Press.

Kirk, SA; Gallagher, JJ; Anastasiow, NJ; Colman, MR (2015). *Educating exceptional children; fourteenth edition*. Boston, Massachusetts, USA: Houghton Mifflin Company.

Kovas, Y; Harlaar, H; Petrill, SA (2005). Generalist genes and mathematics in 7-year-old twins. *Intelligence*. (33), 473-489.

Kovas, Y; Plomin, R (2006). Generalist genes: Implications for the cognitive sciences. *Trends in Cognitive Sciences*. (10), 198-203.

Kpangban, E; Eya, PE; Igbojinwaekwu, PC (2013). *Reforms and innovation in Nigerian education*. Lagos: West and Solomon Publishing Coy. Ltd.

Kpolovie, PJ (1999). Reliability of the Culture Fair Intelligence Test in Nigeria. *Journal of Education in Developing Areas (JEDA)*. XIII, 18-24.

Kpolovie, PJ (2003). Construct validity of Culture Fair Intelligence Test (CFIT) in Nigeria. *Nigerian Journal of Research and Production*. A Journal of the Nigerian Research Forum. 2(5), 130-139.

Kpolovie, PJ (2005). Nigerian norms of Culture Fair Intelligence *Test. International Journal of Communication and Humanistic Studies*. ISSN 1597-1716. 2(1), 1-16.

Kpolovie, PJ (2010). *Advanced research methods*. Owerri, Imo State: Springfield Publishers Ltd.

Kpolovie, PJ (2011). *Statistical techniques for advanced research*. Owerri, Imo State: Springfield Publishers Ltd.

Kpolovie, PJ (2011a). Hypothesis postulation: The what, why, how and which? *Journal of Education in Developing Areas*. 19(1), 1-16. Retrieved from https://www.scribd.com/doc/59132454/KPOLOVIE-Hypothesis-Postulation

ISSN 2055-0057(Print), ISSN 2055-0065(Online)

Kpolovie, PJ (2012). *Education reforms without evaluation designs: Nigeria at risk*. Owerri, Imo State: Springfield Publishers Ltd.

Kpolovie, PJ (2012a). Lumosity training and brain-boosting food effects on learning. *International Research Journals*. 2(6), 217-230. ISSN: 2026-6332. www.resjournals.com/ERJ/Pdf/2012/June/Kpolovie.pdf

Kpolovie, PJ (2013a). Quality assurance in the Nigerian Educational system: Matters arising. *Academia Edu*. Retrieved from https://www.academia.edu/12958955/QUALITY_ASSURANCE_IN_THE_NIGERIAN_EDUCATIONAL_SYSTEM_MATTERS_ARISING

Kpolovie, PJ (2014). *Test, measurement and evaluation in education; second edition*. Owerri, Imo State: Springfield Publishers Ltd.

Kpolovie, PJ (2015). Indispensability of intelligence testing in the repositioning and revitalization of Nigerian education. *Global Academic Journal*. http://globalacademicgroup.com/journals/nard/Kpolovie.pdf (9), 1-13

Kpolovie, PJ (2016). *Excellent research methods*. Indiana, USA: Partridge Publishing.

Kpolovie, PJ (2016a). Single-subject research method: the needed simplification. *British Journal of Education.* 4(6), 68-95. http://www.eajournals.org/wp-content/uploads/Kpolovie-Peter-James.pdf

Kpolovie, PJ; Emekene, CO (2016). Item Response Theory validation of Advanced Progressive Matrices. *British Journal of Psychology Research*. 4(1), 1-32. http://www.eajournals.org/wp-content/uploads/Item-Response-Theory-Validation-of-Advanced-Progressive-Matrices-in-Nigeria1.pdf

Kpolovie, PJ; Iderima EC (2016). Learners' readiness for xMOOCs: Inequity in Nigeria. *European Journal of Computer Science and Information Technology*. 4(3), 16-46. http://www.eajournals.org/wp-content/uploads/Learners----readiness-for-xMOOCS-Inequity-in-Nigeria.pdf

Kpolovie, PJ; Joe, AI & Okoto, T. (2014). Academic Achievement Prediction: Role of Interest in Learning and Attitude towards School. *International Journal of Humanities, Social Sciences and Education (IJHSSE)*. 1(11), 73-100. http://www.arcjournals.org/pdfs/ijhsse/v1-i11/10.pdf

Kpolovie, PJ; Joe, AI; Okoto, T (2014). Academic achievement prediction: Role of interest in learning and attitude towards school. *International Journal of Humanities, Social Sciences and Education*. 1(11), 73-100. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.686.1998&rep=rep1&type=pdf

Kpolovie, PJ; Obilor, E (2013). Higher education for all in need through the National Open University of Nigeria: A paradox in policy practice. *Merit Research Journal of Education* *and Review*. 1(8), 172-180. http://www.meritresearchjournals.org/er/content/2013/September/Kpolovie%20and%20Obilor.pdf

Kpolovie, PJ; Obilor, IE (2013). Adequacy-inadequacy: Education funding in Nigeria. *Universal Journal of Education and General Studies. Universal Journal of Education and General Studies*. 2(8), 239-254.

Kvist, A; Gustafsson, JE (2008).the relation between fluid intelligence and the general factor as a function of cultural background: A test of Cattell's Investment theory. *Intelligence*. (3), 422-436.

Langer, J (2004). The evolution of cognitive development: Ontogeny and Phylogeny. *Human Development*. (47), 73-77. https://www.karger.com/Article/Pdf/75372

Laster, D (2011). *How they started Global Brands: How 21 good ideas became great global businesses*. Benin City, Edo State: Beulahland Publications.

Lautrey, J (2002). Is there a general factor of cognitive development? In R. J. Sternberg and E. L. Grigorenko (Eds.). *The general factor intelligence: How general is it?* Mahwah, NJ: Erlbaum.

Lipi, I (2013). Student intelligence and academic achievement in Albanian Universities. Case of Vlora University. *Acta Universitatis Danubiu Administratio*. 5(2), 48- 58.

Littrell, JJ; Lorenz, JH; Smith, HT (2009). *From school to work*. TinleyPark, Illinois: The Goodheart-Willcox Company, Inc.

Mackay, H (n.d.). Complex relationships. *BrainyQuote.com.* Retrieved from http://www.brainyquote.com/quotes/quotes/h/hughmackay231481.html

Mackintosh, N (2011). *IQ and human intelligence; second edition*. Oxford, UK: Oxford University Press.

Mackintosh, NJ (2011). IQ and human intelligence. Oxford, UK: Oxford University Press.

Maxwell, JC (2002). *The power of thinking big*. Tulsa, Oklahoma, USA: RiverOak Publishing.

Maxwell, W (2014). *The first public proclamation of "The Genius Principle."* Port Harcourt, Nigeria: University of Port Harcourt Printing Press.

MEMSA (2003). *How to excel at IQ tests*. London, UK: Carlton Publishing Group.

Meyers, LS; Gamst, GC; Guarino, AJ (2013). *Performing data analysis using IBM SPSS*. Hoboken, New Jersey: John Wiley and Sons.

Mingat, A; Tan, J-P; Sosale, S (2003). *Tools for education policy analysis*. Washington, D.C.: The World Bank.

Munroe, M (2003). *The principles and power of vision*. Pennsylvania, USA: Whitaker House.

Nwana, EOC (2008). *University academics in Nigeria*. Lagos: Peacewise.

ISSN 2055-0057(Print), ISSN 2055-0065(Online)

Ololube, NP; Kpolovie, PJ (2012). Approaches to conducting scientific research in education, arts and the social sciences. *Online Journal of Educational Research*. 1(3), 44-56. http://onlineresearchjournals.org/IJER/pdf/2012/june/Ololube%20and%20Kpolovie.pdf

Oramah, EU (2012). *Mastering intervention strategies in counselling and psychotherapy: Basic text for undergraduate and graduate students*. Abuja: Mindex Publishing.

Paul, AM (2005). *The cult of personality*. New York: Free Press.

Plomin, R (2003). Genetics, genes, genomics and g. *Molecular Psychiatry*. (8), 1-5.

Plomin, R; Spinath, FM (2004). Intelligence, genetics, and genomics. *Journal of Personality and Social Psychology*. 86(1), 112-129. http://psych.colorado.edu/~carey/pdfFiles/IQ_Plomin02.pdf

Raaijmakers, MEJ (2006). A dynamic model of general intelligence: The positive manifold of intelligence by mutualism. *Psychological Review*. http://wicherts.socsci.uva.nl/maas2006.pdf. (13), 842-860.

Reisberg, D (2015). *Cognition: Exploring the science of the mind; sixth edition*. New York: W. W. Norton & Company.

Renzulli, JS; Reis, SM (2004). *Identification of students for gifted and talented programs*. USA: Corwin.

Salny, AF; MENSA (1989). *The Mensa genius quiz*. A. Day book. Boston, Massachusetts, USA: Da Capo Press.

Shaughnessy, J. J., Zechmeister, B. E. and Zechmeister, J.S. (2000), *Research Methods in Psychology*. Boston: McGraw Hill.

Shuitz, SS; Whitney, DJ; Zickar, MJ (2014). *Measurement theory in action: Case studies and exercises; second edition*. New York: Routledge.

Siemes, G (2005). *Connectivisim: Learning as network creation. E-Learning Space.org Website*. Retrieved from http://www.elearnsspace.org/Articles/networks.htm

Skottke, KR (2005). *The evolution of human intelligence: Increasing importance of domain-specific intelligence in the modern environment*. Retrieved from http://personalityresearch.org/papers/skottke.html

Spearman, C (1904). General intelligence, objectively determined and measured. *American Journal of Psychology*. (15), 201-292.

Spearman, CE (1904). General intelligence, objectively determined and measured. *American Journal of Psychology*. (15), 201-293. Retrieved from https://archive.org/stream/jstor-1412107/1412107#page/n1/mode/2up

Spearman, CE (1927). *The ability of man*. London: Macmillan.

ISSN 2055-0057(Print), ISSN 2055-0065(Online)

Spinatha, B; Spinatha, FM; Riemann, R (2003). Implicit theories about personality and intelligence and their relationship to actual personality and intelligence. *Personality and Individual Differences*. (35), 939-951.

Sternberg, RJ (2016). *Cognitive psychology; seventh edition*. Australia: Thomson Wadsworth Publishing.

Sternberg, RJ; Davidson, JE (2005). *Conceptions of giftedness*. New York: Cambridge University Press.

Sternberg, RJ; Reis, SM (2004). *Definitions and conceptions of giftedness (Essential readings in gifted education series)*. Thousand Oaks CA, USA: Corwin.

Swerdlik, ME; Sturman, E; Cohen, RJ (2012). *Psychological testing and assessment: An introduction to tests and measurement; eighth edition*. USA: McGraw-Hill Education.

Tomlinson, CA; Reis, SM (2004). *Differentiation for gifted and talented students (Essential readings in gifted education series)*. Thousand Oaks, CA, USA: Corwin.

Totton, N (2006). *The politics of psychotherapy: New perspectives*. Berkshire, England: Open University Press.

Tracy, B (2004). *Success is a journey: Make your life a grand adventure*. Benin City, Edo State: Beulahland Publications.

VanTassel-Kaska, JL; Reis, SM (2003). *Curriculum for gifted and talented students (Essential readings in gifted education series)*. Thousand Oaks, CA, USA: Corwin.

Vaughn, S; Bos, CS (2009). *Strategies for teaching students with learning and behaviour problems*. New Jersey: Pearson.

Veltmann, M; Raudsepp, L; Pullmann, H (2011). General mental ability predicting achievement in mathematics. *Tripod Presented at the 11th European Conferenceon Psychological Assessment*.

Vikoo, BV (2015). *Learning theories and instructional processes; third edition*. Port Harcourt: Pearl Publishers International Ltd.

Warner, RM (2013). *Applied statistics from bivariate through multivariate techniques; second edition.* Los Angeles: SAGE Publications, Inc.

ISSN 2055-0057(Print), ISSN 2055-0065(Online)