British Journal of Education

Vol.7, No.9, pp.59-64, September 2019

Published by European Centre for Research Training and Development UK (www.eajournal.org)

DETERMINE AND ESTIMATE THE NUMERICAL APTITUDE OF DELTA STATE SENIOR SECONDARY SCHOOL STUDENTS

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ABSTRACT: *In order to determine and estimate the numerical aptitude of Delta State Senior Secondary School Students, the researcher developed a Numerical Aptitude Test (NAT). The design of the study was instrumentation research design based on the Classical Test Theory. From a population of 4,379 senior Secondary School Students in Delta State, 576 students were drawn from Senior Secondary School I & II as sample for the study. Three research question were proposed and answered. Three hypothesis were formulated and tested at 0.05 alpha levels. Data were analyzed using Kuder-Richardson formula 20, descriptive statistics and t-test. The findings showed reliability coefficient of 0.66. The result also showed that NAT items are valid and did not differentiate between genders. Based on the findings from this work, the researcher made the following recommendations: the Ministry of Education Delta State should use the developed NAT as a tool for selecting students, also school administrators should use the developed test to get valid, reliable and usable relevant information about Senior School Student's numerical aptitude for administrative functions.*

KEYWORDS: determine, estimate, numerical aptitude, Delta State, secondary school, students

INTRODUCTION

There are three types of tests most commonly used by psychologists: these are: Achievement test, Aptitude test and intelligence test. Achievement Test refers to a test to evaluate what the person taking the test has learnt earlier, it has to do with previous learning. Aptitude test refers to a test to evaluate a person's ability to learn or acquire a given skill, while, on the other hand an intelligence test refers to a test to measure a person's general ability to solve problem, adapt to changing conditions, think abstractly and profit from experience, (Kaplen and Saccuzzo, 2009).

The Federal Republic of Nigeria (FRN) (2014) stated that; Nigerian students who complete Junior Secondary School may proceed to Senior Secondary School or Technical College. This simply means that the Junior Secondary School Examination (JSCE) should be an aptitude test which will indicate the ability of the child to perform in the technical college or for academic work in the Senior Secondary School (SSS). But, on the contrary the implication of this is that all the students in the Senior Secondary Schools in Nigeria have the aptitude for Mathematics and/or have numerical aptitude, since after the JSCE re-sit examination, all or most students are promoted to Senior Secondary School One (SS I) for academic work which demands some level of numerical knowledge. High percentage of these promoted students from my personal observation cannot perform simple commercial mathematics without the use of a scientific tool (calculator). To further complicate this situation, the various SSS examinations conducted by National Examination council (NECO), West African Examination Council (WAEC) and so on are also based on

achievement tests as against aptitude test. The effect therefore, is that any certificate acquired at the secondary school level (JSCE or SSCE) cannot predict what the holder can do with training (aptitude).

'*All fields of human endeavour demand some level of mathematical (numerical) aptitude and some level of verbal aptitude for presen- tation, interpretation and reporting' (Abdul-Rahool & Adewale 2010 and Saville Consulting (2011).*

The above quote indicates the usefulness of numerical aptitude to learners mostly at the Senior Secondary School stage. This becomes more evident when one looks into the conditions set out to pass in the First School Leaving Certificate (FSLC) and the Junior School Certificate (JSC) examinations, though; numerical or any other subjects/courses are not offered in aptitude form. Their presence is implicated in form of knowing the learner's latent trait in profiting from the subject with training.

Statement of Problem

Students do not perform well in mathematics in Senior School Certificate Examinations (SSCE) conducted by West African Examinations council (WAEC), National Examinations Council (NECO) and the Unified Tertiary Matriculation Examination (UTME), {See: Vanguard 17/04/2014}. Private employers of labour who engage senior secondary school (SSS) graduates as office clerks, personal assistants, store keeper and so on report of their inefficiency in writing different reports as relates to their places of work. Most employers' negative complains have to do with inability to quickly and correctly resolve mathematical issues. In the market /trading stores, it has also been observed that most SSS graduates are unable to resolve simple problems of addition /subtraction in relation to buying and selling in the absence of a scientific tool (calculator), (See: Miles, 2008), All the above may be as a result of lack of proper teaching of the subject in the SSS classes or lack of proper evaluation of their numerical aptitude (NAT) in the SSS which are rudiments and fundamental aspects of all education training as educational training is rooted in numeral, language knowledge and other skills. As a result of the above the researcher set out to validate a culturally unbiased and well develop Numerical aptitude test for Senior Secondary School Students in Delta State to determine their Numerical Aptitude.

Scope of the Study

This study was carried out to construct, determine and estimate the numerical aptitude (NA) of Senior Secondary School (SSS) Students in Delta State of Nigeria. The subjects comprise of male and female students of age thirteen (13) to nineteen (19) years. The test involves the development of multiple choices in numerical aptitude. The test items were taken from the general school Mathematics curriculum/secondary school Syllabuses. In terms of topics, contents or themes; the test covers: commercial mathematics (buying and selling), number and numeration (whole numbers and transaction in the homes/offices) and basic operations (multiplication and division of directed numbers / approximations).

Research Questions

The following research questions were posed to guide the study:

1. What is the reliability index of the NAT items?

2. What is the difference between the mean scores of the male and female students in NAT?
3. What is the mean score of students in NAT?

Hypothesis

The following hypotheses were formulated and tested at 0.05 level of significance ($p < 0.05$)

1. The reliability index of NAT is not greater than zero.
2. There is no significant difference between the male and female students' mean scores in NAT.
3. The mean score of students in NAT does not differ significantly from the expected mean.

Research Design

The design of this study involved the development of an instrument and correlation (Instrumentation/Correlation Research Design) for determining /estimating the numerical aptitude of Senior Secondary School students in Delta State.

Area of the Study:

This research work covered all the senior secondary schools in Delta State. Delta State is a state in Nigeria which comprises of the Urhobo, Isoko, Ukwuani, Itsekiri, Izon, Enuani-Igbos and Ika ethnic nationalities. The state is divided into three educational zones in line with each senatorial district: Delta North, Delta Central and Delta South with twenty-five local Government Areas. Delta State has a landmass of about 18.050km^2 lying approximately between longitude 50.00 and 60.45 East and latitude 50.00 and 60.30 North. It is bounded in the North and West by Edo State, in the East by Anambra, Imo and River State, South-East by Bayelsa State, and on the Southern flank is the Bight of Benin which covers about 160 kilometers of the State coastline. Delta State has it's headquarter at Asaba. The state is an agricultural and oil producing State. In terms of education Delta state is not left out, it has four hundred and sixty six (466) Senior Secondary Schools; three Polytechnics and one State University having three Satellite Campuses.

Population of Study

The target population for this study was all the Senior Secondary School (SSS) students in all the public Senior Secondary Schools in Delta State. From this target population, the population of this study was 4,379, which comprised of all the 466 Public Senior Secondary School students in year two and three (SSS 2 and SSS 3 students) - this two classes are preparatory classes for employment and admission into tertiary institutions. The population of four thousand three hundred and seventy nine (4,379) students was made up of: two thousand three hundred and fourteen (2,314) male students and two thousand and sixty five (2,065) female students subdivided into SSSI: two thousand three hundred and thirty four (2,334) students and SSS2: two thousand and forty five (2,045) students, **Note:** As at the time of study the students in the various classes had been promoted to upper classes and those in SS class 3 had graduated. Therefore the SS class 1 represents SS 2 while the SS 2 represents SS class 3

Sample and Sampling Techniques

The sample for this study was 576 SSS students. This sample was obtained through cluster sampling, purposive random sampling and stratified sampling procedure. The State was divided into three educational zones (this is Delta North, Delta South and Delta Central). From each of the zones, six senior secondary schools were purposively selected (most accessible six Senior Mixed

Secondary Schools in each zone). This resulted to a cluster of 18 senior secondary schools in Delta State. The third stage involved was the stratified sampling of students from each of the sampled schools. In each school 8 girls and 8 boys were sampled from SS 2 and same number was (8 girls and 8 boys) sampled from SS 3. This resulted in a sample of 32 students in each school. The final sample therefore was 576 students.

Instrument for Data Collection

The basic instrument which was used for this study was a numerical multiple choice aptitude test instrument which was developed by the investigator. The test was made up of one hundred and fifty (150) test items. The one hundred and fifty (150) tests items contain four options lettered A-D, but, only one option is correct and the remaining three options served as distracters. The Numerical Aptitude Test Instrument was used by the researcher for data collection in the eighteen (18) selcted secondary schools in the three Educational Zones in Delta State. The instrument for this research work was developed by the researcher and it is called NAT. The researcher considered the aptitude to be tested (Numerical) and the six levels of the cognitive domains and constructed a test blue print to guide the development of the instrument. The NAT was made up of one hundred and seventy (170) test items which was first duly edited by the researcher and then given to specialists in measurement and evaluation in the department of Education, School of Physical Sciences (Imo State University, Owerri , Nigeria) for face and content validation. Subject to recommendations from the specialists' validation, some of the items constituting the test instrument were discarded and others were added. After this a second review and editing of test instrument was made, the instrument was then pretested on a representative sample of one hundred (100) students on the basis of which further items were discarded, revised or left in their original form. At this stage the researcher selected the final form of the test based on the result from the pretested items. The final selected items were proportionate to the conditions set out in the test blue print. These final selected items were again given to the person/persons that initially validated the work for certification before administration.

Analysis Concerning Research Question 1 and Hypothesis 1

{**RQ 1:** What is the reliability index of the NAT items?}

{**Ho 1**: The reliability index of the NAT is not greater than zero.}

Table 1: Reliability index of NAT

no of items	no of students	$\overline{x}$	S	α	$t_{cal.}$	$t_{tab.}$	Decision
36	312	59.56	6.14	0.66	5.21	2.03	reject

Note- S = Standard deviation, α = K-R_{20} reliability

The table 1, shows item mean of 59.56, a standard deviation (S) of 6.14 with correlation coefficient of 0.66. The t-cal. is 5.21 and the t-tab. is 2.03. Since the t-cal is greater than t-tab, the null hypothesis (Ho1) is rejected. The alternative hypothesis (Ha 1) which states: The reliability index of the NAT is greater than zero is accepted.

Analysis Concerning Research Question 2 and Hypothesis 2

{RQ 2: What is the difference between the mean scores of the male and female students in NAT?}
{**Ho 2:** There is no significant difference between the male and female students' mean scores in NAT}

Table 2: Mean score difference of male and female students in NAT.

ni	ns	$\overline{x}m - \overline{x}f$	S	α	$t_{cal.}$	$t_{tab.}$	Decision
36	288	0.4	7.14	0.66	0.33	2.03	accept

ni = number of items, ns = number in each gender, $\overline{x}m$ = mean of males
$\overline{x}$f = mean of females S = standard deviation, α = alpha reliability

The table 2, shows that the males and females in the numerical aptitude test have a mean difference of 0.4, the coefficient of correlation is o.66, t-calculated is 0.33 while the t-table is 2.03. Since the t-tab is greater than t-cal, the null hypothesis (Ho 1) is therefore accepted. It states: there is no significant difference between the male and female students' mean scores in NAT.

Analysis Concerning Research Question 3 and Hypothesis 3
{**RQ 3**: What is the expected mean score of students in NAT?}
{**Ho 3**: the mean score of students in NAT do not differ significantly from the expected mean}

Table 3: The expected mean and actual mean scores of students in NAT

n	μ	$\overline{x}$	$t_{cal.}$	$t_{tab.}$	Decision
36	18	18.87	5.15	2.03	rejected

n = number of items, μ = expected mean, $\overline{x}$ = actual mean
The table 3, shows that the selected good items of NAT are 36 with a mean of 18.87, the expected mean (μ) is 18, t-calculated is 5.15 while the t-table is 2.03.
Since the t-cal is greater than t-tab, the null hypothesis is rejected; the alternative hypothesis which states that the mean score of students in NAT differ significantly from the expected mean is therefore accepted.

CONCLUSION:

Subject to the findings from this study the following conclusions were made:

- There is no significant difference in the performance of male and female students in numerical skills in Delta State.
- Delta State Senior Secondary School Students (males/females) have Aptitude for Numerical Skills

RECOMMENDATIONS:

Subject to the findings from this research work, the researcher made the following recommendations:
***Numerical Aptitude Test such as developed in this work be employed as a NON-GENDER BiASED test to admit Delta State Students into higher Institutions of learning.**

***Numerical Aptitude Test such as developed in this work be used as a NON-GENDER BiASED test by employers of labour in Delta State for Senior Secondary School Graduates for employment.**

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