

## RELIABILITY OF THREE INSTRUMENTS FOR IDENTIFYING GIFTED PUPILS IN NIGERIAN PRIMARY SCHOOLS

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### **Abstract**

*A reliability and validity index of instrument and techniques used for identifying and selecting upper primary school pupils for giftedness education in Nigeria are doubtful. These researchers constructed and preliminarily validated test instrument (called Giftedness Identification Instrument). The instrument test pupils in the area of Mathematics, Science and Technology (MST), Language arts (LA). Another non-test instrument in the area of peer nomination (PNS) and teacher nomination scale (TNS) were also used for identifying the gifted pupils in primary school. The researchers used instrumentation method cum correlational research design. The study was carried out in Imo and Abia State with a total population of 70517 made up of 47011 pupils and 23506 teachers. Multi-stage sampling technique involving cluster, stratified and purposive sampling were used in selecting the participants in the study. The sample size used for the study was 200 pupils and 100 teachers. The test instrument is made up of 50 items in mathematics, 30 in Science and Technology and 50 items in language art. Kuder Richardson formular  $[K-R_{21}]$  was used to determine the reliability coefficients of the MST and LA which indexed 0.88 and 0.76 respectively. Means and standard deviation were used in answering the six research questions. The pairwise concurrent validity indices and the t-test statistical analysis were done using Statistic Package for Social Science (SPSS). Five null hypotheses were tested at p-value 0.05 level of significant. The instruments have high reliability and concurrent validity indices. These instruments are recommended for use in identifying and selecting pupils for giftedness education.*

## **Introduction**

It is very vital that the society identifies these young gifted and talented members and as such nurture and harness their potentials for further productivity in the society. In a situation the school system fails to offer the kind of education that is relevant or equivalent to their abilities the highly gifted children might become delinquent, dropout, intelligent robbers and metropolitan criminals. In the present Universal Basic Education, (UBE) there is need to properly identify the gifted, be it at the middle UBE or upper UBE. Since the gifted who are wrongly placed in the normal school system may tend to become a nuisance to the society. Right use of the right instruments for the pre-selection of the gifted will enhance identification process. This according to Coleman (2003) is the first and critical step in the process of ensuring that students who need gifted education are recognized and matched with appropriate service so they can thrive in school. The validity of these instruments depends on ascertaining their reliabilities and some indices of validity. The term validity implies the extent to which a test is free from both chance and systematic errors. One can say that a test is free from chance errors if it is reliable, which means it measures what ever it measures consistently. Being free from systematic errors implies it is relevant to the object it is supposed to be used for. In all one can say a test is valid if it is free from all measurement errors. Such valid tests are likely to accurately identify giftedness in children.

A gifted child is defined by the British school's council as one who is outstanding in either general or specific ability in a relatively broad or narrow field of endeavour representing the top most two to six percent. In other words, they are people with I.Q scores of 130 to 140 or greater and are labeled as superior or genius. The gifted children are those who excel in all areas of development and who are motivated, self reliant and obtain high scores in intelligence and achievement test. From these definitions it can therefore be deduce that those who manifest giftedness obviously has some inherent or inborn traits plus motivation and stamina to learn from and cope with rigours of living. They therefore need differentiated educational programmes or services which are beyond the normally provided ones by the regular school programmes. The gifted children left behind may become complacent and when they get to work along with intellectual equals, they lack the vital drive.

Stenberg and Wagner as cited in Ogomaka, Onah and Okwa (2017) suggested that giftedness is a kind of mental self management of one's life in a constructive and purposeful way which has three basic elements of adapting to environment, selecting new environments and shaping new

environment. In effect they say that the key psychological basis of intellectual giftedness resides in skills that include three main processes thus separating relevant from irrelevant information, combining isolated pieces of information into a unified whole and relating newly acquired information to information acquired in the time past. They further emphasized the problem-solving abilities and viewed the gifted students as one who processes information rapidly and uses insightful abilities. Renzulli as cited in Ogomaka et al. (2017) in his three-ring conception of Giftedness Stated that gifted behaviour reflects an interaction among 3 characters of human traits of above average not necessarily superior general and or specific abilities, high level of task.

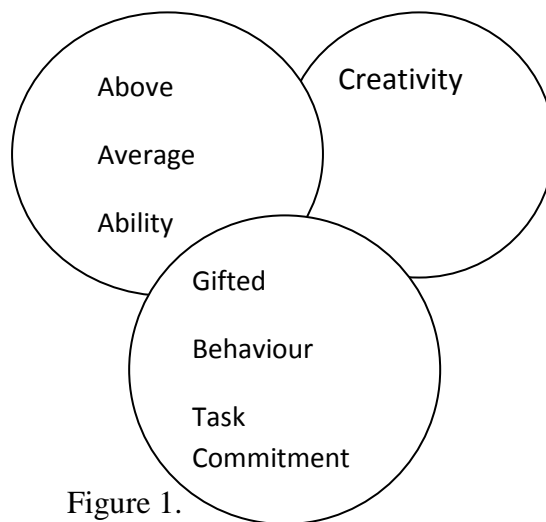


Figure 1.

Within the above average abilities Renzulli makes a difference between general abilities (like processing information, integrating experiences, and abstract thinking) and specific abilities (like the capacity to acquire knowledge, perform in an activity). By creativity Renzulli understands the fluency, flexibility, and originality of thought, an openness to experience, sensitivity to stimulations, and a willingness to take risk under task commitment he understands motivation tuned into action (like perservance, endurance, hard work, but also self-confidence, perceptiveness and a special fascination with a special subject).

Giftedness according to Eric as cited in Ogomaka et al (2017) is the precious endowment of potentially outstanding ability that allows a person to interact with the environment with remarkable high level of achievement and creativity. This view tries to see giftedness as being as a result of a

conferment by nature (i.e. innate behaviour) and that one's environment is the arena in which the gifted come into play and are developed. It is therefore reasoned that remarkably high levels of achievement creativity results from continuous and inherent and acquired abilities and characteristics. Those who manifest giftedness obviously has some inherent or in born facts plus motivation and stamina to lean from and cope with the rigours of living. According to Mankind as cited in Uzoma (2008) the gifted and talented children are those indentified by professionally qualified persons who by virtue of outstanding abilities are capable of high performance.

The researchers are bothered that the present use of children's school based continuous assessment for the pre-selection identification process do not fully showcase the two main aim of giftedness education in Nigeria. In the sense that giftedness involves much more than exceptional performance in ability tests. It also involves an outstanding performance in test of general intellectual ability and cognitive ability. Moreover, there has been a rapid growing interest in gifted children and their education by the society and the government as shown in the National Policy of Education (2004). It is therefore vital to include the area of science and technology in the test instrument presently used for identification of the gifted children at the state level, since determining the eligibility to participate in the entrance examination, involves the teacher using pupil's academic performance to determine the eligibility of pupils in participating in the selection process. Could some non-test instruments like peer and teacher nomination be used in the identification process? Since the purpose of the gifted programme is to increase the size of the society's stock of potentially creative and productive adults.

Moreso Renzuilli as cited in Ogomaka, et al (2017) posits that the most efficient lesson learners are not necessarily those who go on to make important contributions in the realms of creative productivity. Should one therefore consider a model that focuses on how our most able persons, access and make use of information rather than relying on how they gather and store it? The strategies of teacher nomination and peer nomination should be included in other to have a proper identification process. The teachers have better opportunity to compare the ability of children and the child's peers also know the ability of each other. Since children that move together know the ability of each other, could the child's peers also be involved in this process of identification?

This study is concerned with improving the process of identifying children who are eligible to benefit from the giftedness education programme in Nigeria. Specifically, the researchers:

1. Constructed instruments in the areas of mathematics, science, technology and language arts, non-test instruments in the areas of peer and teacher nominations.
2. Establish the reliability coefficients of the instruments.
3. Compute the pair wise correlation coefficient of pupils scores from the test and non-test instruments.
4. Test the level of significance of some of the correlation coefficients.
5. Determine if there is a significant difference between the correlation coefficients of scores in (MST+LA) and their status in peer nomination and that of teacher nomination.

The following research questions and hypotheses were posed and they include;

1. What are the mean and standard deviation of the scores and status of the pupils in each of GIN, TNS and PNS?
2. What is the reliability coefficient of Test 1 and Test 2?
  1. Each of the coefficients of pair wise correlation between scores/ status in Test 1, Test 2, Test 1&2, TNS and PNS is not significant ( $P < 0.05$ ).
  2. Each of the regression coefficients of the regression of Y ( status on PNS) on students' scores in test 1 ( $X_1$ ) and test 2 ( $X_2$ ) is not significant ( $P < 0.05$ ).
  3. The multiple regression coefficient ( $R^2$  of the regression of Y on both  $X_1$  and  $X_2$  is not significant ( $P < 0.05$ ).

### **Method**

The study is an instrumentation research since it produced new instruments or improved instruments for identifying gifted children. The design is also correlational because children's performance scores in the various instruments were correlated taking the instruments in pairs. The study was carried out in two states within the South-East zone of the federation (Imo and Abia State).

The population of the study was 70517 made up of 47011 pupils and 23506 teachers from both states. The sample was drawn from the target population by selecting schools from each of the two states of the study. Most of the schools were selected from the urban towns and state capitals as well as rural. Twenty-five schools were selected from each state, 4 pupils

were selected from each school. Two teachers from each school were used and they were the class teachers of the selected pupils, the sub-sample size was 100 pupils and 50 teachers from 25 schools for Abia and same size for Imo. The total sample size used is therefore 200 pupils and 100 teachers. A two-stage cluster and stratified purposive sampling technique was used in selecting the participants in the study. States and schools formed the clusters while teachers, primary six and primary five pupils formed the strata. Primary six and five pupils were involved since some primary five pupils (especially or most probably the gifted) sometimes transit to the secondary schools from that level.

The study estimated and measured the extent to which the performance of gifted pupils in mathematics, science and technology (MST) Test1- related with their performances in language arts (LA) Test 2. It established the extent of relationship between their combined scores in MST Test 1 and LA Test 2 and their statuses in peer nomination. The reliability of the instrument of MST and LA was determined, the rater reliability coefficient of the peer nomination instrument was also determined. Test instruments in the area of MST and LA were developed which were used by peers and teachers to identify the gifted pupils and as a result, the study is also an instrumentation design.

4-point likert type rating scale was used by teachers to indicate their gifted pupils and the instrument used in this study are ability/aptitude tests in the area of MST and language arts. The test instrument of MST which is test 1 comprising of Mathematics, Science and Technology is made up of 80 items test, 50 items in mathematics and 30 in Science and Technology, most of the items in Science and Technology are objective test items while in the area of mathematic the pupil were expected to supply most of the answers. Language art, which is test 2, 33 tests are objective test items while in 17 items they are expected to supply the answer. Some items of the instruments (test & non-test) were adapted from Uzomah (2004). The non-test instrument, teacher nomination instrument is sub-divided into four sections A to D. Section A involves personal relationship (10 items) Section B involves items related to the peer and Sensitivity of thought (10 Items). Section D involves child's curiosity and drive (15 items). In all there are a total of 53 items in the teacher nomination instrument. The four item response options of this instrument are strongly agreed (SA), Agreed (A) Disagreed (D) and strongly disagreed (SD) and the teachers were instructed to choose the options as they relate to each of the pupil they are rating. Sixteen items out of these 53 are negatively keyed items while the rest are positive. For the positively keyed options SA, A, D, SD are scored 4,3,2,1

respectively while the negatively keyed ones the options are scored 1,2,3,4 respectively.

The instrument used by peers to identify the gifted has 14 items. Here the pupils are asked to indicate from among the gifted, the one who best suites each of the items. Three experts in the area of Educational Evaluation and specialists in the subjects involved were used to validate the achievement tests in the MST and language art. After ensuring the validity of the items, the instruments were found to be appropriate. The Kuder Richardson formular [K-R<sub>21</sub>] method was used to determine the reliability coefficients of the achievement/ aptitude tests of MST and language arts which are 0.88 and 0.76 respectively.

Means and standard deviation were used in answering research question one. The reliability coefficients of Test 1 and 2 were determined using the Kuder Richardson K-R<sub>21</sub> method. The pair wise concurrent validity indices were determined electronically while hypotheses 1 and 2 were tested using t-test.

## Results

**Table 1; Means, Standard deviations of scores of students & their statuses in the Tests.**

Instruments	Highest N	Mean score	Std Dev.	
T <sub>1</sub> (Maths)	50	38.17	8.07447	200
T <sub>2</sub>	30	22.555	4.62970	200
T <sub>1</sub> & T <sub>2</sub>	80	60.7250	10.87570	200
TNS	53	64.89	10.14210	200
PNS	56	33.785	7.70360	200

The table above shows the means score of the participants on the different test instruments and their corresponding highest score. Their respective standard deviation scores are also included in the table.

**Table 2; Means, variances & reliability coefficient of T<sub>1</sub> and T<sub>2</sub> statistics**

Test	No. of participants	Mean Score	Standard Deviation	Variance	Reliability Coefficient
Test 1	50	38.17	8.074	2.84	0.88
Test 2	30	22.56	4.63	2.15	0.76

Table 2 indicates that the mean responses to Test 1 and Test 2 are respectively 38.17 and 22.56. The Kuder-Richardson coefficients are indicated to be 0.88

and 0.76 respectively. The results therefore show that the two instruments are internally consistent given that the coefficients of reliability are relatively high with such values as 0.88 and 0.76.

**Table 3;** Analyses and results concerning the statistical significance of the coefficients of pair wise correlation between scores/status of students in T<sub>1</sub>, T<sub>2</sub>, T<sub>1</sub> & T<sub>2</sub> and PNS.

Instrument	Statistics	Instruments			
		T <sub>1</sub>	T <sub>2</sub>	T <sub>1</sub> & T <sub>2</sub>	TNS
<b>PNS</b>					
T <sub>1</sub> 200	N	200	200	200	200
0.340	Pearson r	1.00	0.423	0.923	0.621
0.000	P-value	0.000	0.000	0.000	0.000
T <sub>2</sub> 200	N	200	200	200	200
0.071	Pearson r	0.423	1.00	0.740	0.395
0.318	P-value	0.000	0.000	0.000	0.000
T <sub>1</sub> & T <sub>2</sub> 200	N	200	200	200	200
0.283	Pearson r	0.923	0.740	1.00	0.630
0.000	P-value	0.000	0.000	0.000	0.000
TNS 200	N	200	200	200	200
0.326	Pearson r	0.621	0.395	0.630	1.00
0.000	P-value	0.000	0.000	0.000	0.000
PNS 200	N	200	200	200	200
1.00	Pearson r	0.340	0.071	0.283	0.326
0.000	P-value	0.000	0.318	0.000	0.000

As shown in table 3 all pair wise correlation coefficient is significant beyond ( $P < 0.000$ ) using the two tailed t-test. Thus, the hypothesis that says each of the coefficient of pair wise correlation between scores/status in Test 1, Test 2, Test 1 & 2, TNS and PNS is not significant ( $P < 0.05$ ) is rejected. However, the correlation coefficient between students scores in Test 1 & Test 2 and status in PNS is not significant the hypothesis is accepted in that wise.

**Table 4; sample size (n) / Number of testes, reliability of coefficients of test 1 and test 2 calculated t – values tabulated t- values and remarks of the tests.**

Test Remark	N	df	R	t <sub>cal</sub>	t <sub>tab</sub>
1 Significant	50	48	0.88	18.23	1.67
2 Significant	30	28	0.76	8.54	1.70

From table 4 each of calculated t is greater than t. tabulated. So the null hypothesis is rejected for each case, that is each of the reliability coefficient or Test 1& Test 2 is highly significant.

**Table 5; Result concerning the multiple regression PNS (Y) on MST (T<sub>1</sub>), X<sub>1</sub> and LA (T<sub>2</sub>), X<sub>2</sub>.**

Variable	Dependent PNS (Const)	Indep. MST (X1)	Indep. LA (X2)	Sample Size (n)	R <sup>2</sup>	F-cal
Coefficients	16.309	0.138	0.238	200	0.130	14.712

$$Y = 16.309 + 0.138 X_1 + 0.238 X_2.$$

The multiple regression equation of Y on X<sub>1</sub> and X<sub>2</sub> is given as  $Y = 16.309 + 0.138X_1 + 0.238X_2$ . This indicates that the constant of regression is 16.309 while the partial coefficients of regression are: 0.138 for X<sub>1</sub> and 0.238 for X<sub>2</sub>. The multiple coefficient of relationship R<sup>2</sup> is 0.130, though this coefficient R<sup>2</sup> is apparently low, it is statistically significant. As shown in Table 5 the R<sup>2</sup> is 0.130 and the f-cal value is 14.712 the findings indicate that the multiple R value, though low, is highly significant ( $P < 0.000$ ) so the null hypothesis that the multiple regression coefficient (R<sup>2</sup>) of the regression of Y on both x<sub>1</sub> and x<sub>2</sub> is not significant, is rejected.

## **Discussion**

The results indicated that the mean scores of the pupil's performances in Mathematics, Science and Technology and LA are above average. Their mean status in peer and teacher nomination instruments is also on the high side. Probably the test instrument on language arts is above the standard of the level of the target group or the pupils are more deficient in language ability than in MST. It could be that the performance of the pupils in language art was influenced by the mother tongue of area of study.

The reliability coefficients of Test 1 and Test 2 are 0.88 and 0.76 respectively. Whereas the reliability coefficient of Test 1 is very high, that of Test 2 is high. These results can be said to be good given that a relatively accessible approach to the understanding of the importance of reliability may be achieved by considering the estimation of 95% confidence intervals for a particular score derived from a test. It therefore follows that Test 1 is a better consistent strategy given that it is more reliable.

The coefficient of correlation between MST and LA shows that there is a positive relationship between the scores of pupils in MST and language arts. The results show that pupils who do well in (MST) Test 1 to a moderate extent do well in test 2 (LA). It follows that the range of abilities of these pupils is wide and not restricted therefore there could be a low correlation coefficient between Test 1 and Test 2.

Given that the sample used are the best according to their performances in the subject areas of study, that means none of the areas can be said to be redundant. Pupils could be gifted more in one area and less in another and therefore the use of both MST and language arts is vital in determining gifted children because those children who are proficient in the various areas stick to it to the neglect of those areas for which they do not focus on very well. The correlation Coefficients as show in table 3 are positive which are also indicated in the results. This entails that a child who scores highly in combination of MST and LA (Test 1 & 2) also has high status as rated by his/her peers and teachers using each of the two respective non-test instruments. The correlation coefficients between the pupils scores in Test (1&2) and Teacher nomination (TNS), Test (1&2) and peer nomination (PNS) are both significant that of Test (1&2) and TNS is however higher. This indicated that the teachers and pupil's nomination strategies are both necessary if a gifted child should be identified. However, there is a need to use these strategies in addition to or even without the performance in class continuous assessments which can conveniently be replaced by the teacher nomination strategy in identifying those eligible to take the selection examination. This is in agreement with Uzoma (2008) who suggests peer and teacher nominations

(could serve) as strategies for identifying giftedness adding that classmates perceive the abilities of their peers with clarity and they can be accurate predictors of giftedness in fellow students. The result indicates that the correlation coefficient between Test (1&2) and PNS 2 is relatively not so high. This implies that on the average any child who score highly in Test (1&2) will also score highly in PNS even though there might still be some exceptions. The south Australian Association for gifted and talented children reports that peer's nomination is increasingly seen as a promising method of identifying other gifted children specially to supplement information obtained from other sources.

The reliability coefficient of MST is very high, that of Language arts is high. These results can be said to be good given that Peterson as cited in Ogomaka et al (2017) a relatively accessible approach to the understanding of the importance of reliability may be achieved by considering the estimation of 95% confidence intervals for a particular score derived from a test. It therefore follows that MST is a better consistent strategy given that it is more reliable. A combination of Language arts and Mathematics Science and Technology improved the reliability coefficient of the combination over and above each of the individual instruments. Renzulli, Reis and Smith as cited in Ogomaka et al (2017) however suggests the use of average ability tests in areas such as Mathematics which they added represents a generally stable set of characteristics. Callahan et al (1995) posit that the science scale is sufficiently reliable for individual use whereas peer and teacher nominations have high reliability and validity for group use. Roid & Miller (2004) also found out that Leiter-R a non-verbal intelligence test shows an internal consistency of between 0.88 and 0.93. Plucker as cited in Okwa (2016) on the other hand said that instruments based on multiple intelligence theory suggest an acceptable evidence of reliability.

As shown on table 5, the coefficient of the multiple regression and the regression coefficients are found to be significant beyond ( $P < 0.05$ ). The significant t-values for the coefficients of regression equation and relatively low coefficient of multiple determination and corresponding significant F-critical values show that there is significant relationship between the pupils' scores in MST and LA and their statuses in PNS. This implies that a significant portion of the total of variability of peer nomination (PNS) is concurrently accounted for by the variabilities in pupils set of scores in MST and LA thus the regression equation gives an evidence of a linear relationship between the criterion variable and concurrent variables. The coefficient of determination of 0.130 which is reasonable means that the regression equation has more accuracy because a larger portion of variability in PNS is being

explained by the variations in both MST and LA hence the correlation coefficient obtained between test (1& 2) and PNS as in table 5 is not by chance. It can therefore be said that based on the gifted pupil's performance in Test (1&2) adequate concurrence of their statuses in peer nomination scale can be made and vice versa. It therefore follows that the peer nomination strategy can be conveniently used to identify gifted pupils with or without the use of test instruments.

### **Conclusion**

The current use of school-based assessment as the pre-selection identification process cannot highlight and identify the gifted child therefore some other instrument can substitute or aid in the identification process. The researchers ascertained the validity of the use of test instruments of MST and LA, non-test instruments of peer nomination and teacher nomination as strategies to identify a gifted child in primary school. The pair wise coefficients of correlation between the test MST, LA, (MST +LA), Peer nomination and teacher nomination were all positive and significant with the exception of correlation between PNS and Test 2. MST and LA were found to be relatively reliable. The rater reliability of the coefficient of Peer nomination instrument was also reasonable but not so high as to suspect that the ratings of the pupils were contaminated. The results were interpreted based on the finding and some recommendations were given. The study will help the school administration in the identification process of gifted children. This study will bridge the gap in identification process of gifted children in Nigeria, with the use of MST, LA, PNS and TNS.

### **Recommendations**

1. To be able to accommodate those who as a result of the mother tongue will not be good in language arts, assessments should be based on MST and other non-test instruments after which those finally selected but have problems in language arts will be exposed to classes that will improve their standing on the national language.
2. Teacher education programmes in general should be made to include special education areas that will expose the teachers to how best to identify the gifted. This will make the teachers an informed person in the area of giftedness identification.
3. The initial selection of those to take the pre-selection examination should be based on centrally set pre-entrance examination with adequate supervision from the national examination body.

4. Most of the brilliant and probably gifted pupils leave primary schools for secondary schools from primary 5 (especially in the urban areas). These ones are not given the opportunity to take the entrance examinations. This study recommends that the pupils in primary 5 be given opportunity to take part in entrance examination and be given admission to Abuja gifted Academy if they qualify. It is therefore recommended that school administrators and authorities who conduct the selection examination accommodate a wider range of pupils to be considered.
5. The use of continuous assessment of pupils as calculated by the teachers to nominate pupils from the different schools who are qualified to take the pre-selection examination to Abuja Academy should be looked into. The class continuous assessment results can be combined with nominations by the peers so as to cushion the effect of the negative influence on the results by the continuous assessment.
6. The findings imply that the practice of using pupils' class continuous assessment to identify those, who are eligible to participate in the gifted children's selection examinations can be supplemented or even substituted with nominations by peers and teachers. Thereby accommodating the gifted who could have been edged out based on their performances in class work. The peers have known the gifted pupils in their classes all through their years in school and can therefore give a better assessment about them based on their capabilities in class and outside the class.
7. The results of the pre-selection examination in '5' should be combined with the statuses of the pupils' based on both teacher and peer nomination scales.

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