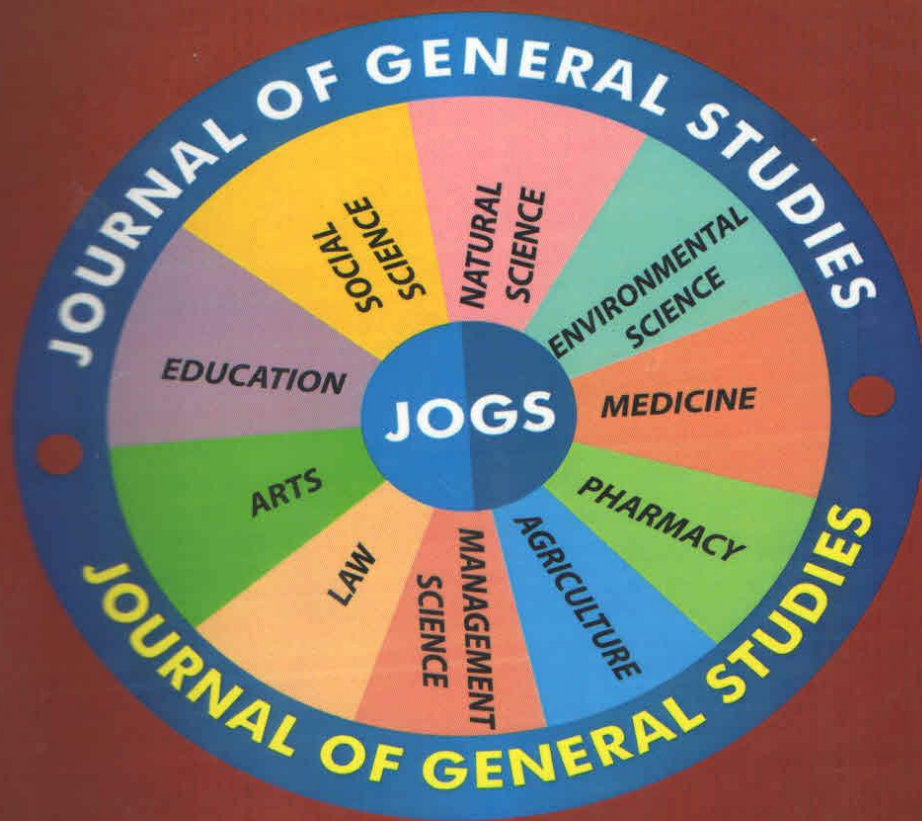


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RELIABILITY OF SECONDARY SCHOOL SURDS AND QUADRATIC EQUATIONS TEACHER-MADE TEST (SAQET)

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Abstract

The research examined the reliability of Surd and Quadratic Equation Test (SAQET) constructed by the researchers. Three research questions and three hypotheses guided the study. Instrumentation research design was used. The study population was 5,828 SS2 students in the 35 secondary schools in Enugu Education zone of Enugu State. A sample of 583 SS2 students, drawn from 10 sampled secondary schools, were used. SAQET contained 50 multiple choice achievement test items on surds and quadratic equations. Kuder-Richardson formula 20 (K-R 20) was used to compute the reliability indices of SAQET. The results show that the reliability indices of SAQET and its two subsections were 0.78, 0.84 and 0.75 respectively. K-R 20 reliability indices for SAQET and its two subsections were each statistically significant at 0.05 level of significance. It was therefore recommended that teachers should at least determine the reliability of their classroom tests before administering them.

Introduction

Education has been variously defined by different and relevant experts. For instance, Toppins (2009) defined education as the process of socialization, enculturation and transformation of what is worthwhile to those who are committed to it, whether children or adults. Edel (2012) defined education as an aggregate of all the processes by means of which an individual develops abilities, attitudes and other forms of behavior of positive value in the society in which he lives. Wevgin (2008) noted that education is a dynamic instrument per excellence for effecting national development and a potent means of ensuring the welfare of the people and the equalization of life chances. Therefore, for education to be meaningful in any nation, it has to be functional. At the centre of effective functional education in any nation is the teacher. One of the factors that are malicious against the actualization of effective and functional education system, which can enhance national development, is the problem of determining the extent to which students have acquired expected knowledge. This is known as evaluation. Evaluation involves analysis and assessment. Thus, according to Suiniki (2011), evaluation is the systematic process of collecting and analyzing data so as to ascertain whether, and to what extent, objectives have been or are being achieved by the learner. In a broader view however, evaluation is the process of seeking, obtaining and quantifying data with a view to make value judgment about objects, events or other characteristics (Crooks, 2008). The major instrument known and used most often by classroom teachers in schools to evaluate students' achievement is the test. Obodo Eze and Anigbo (1999) defined a test as any standardized situation designed to elicit a sample of an individual behavior. It may also be regarded as a structural situation that comprises a standard set of questions to respond with a view to ascertaining the existence of psychological attributes. There are broadly two kinds of tests used in our schools in Nigeria. They are objective and essay tests. Secondary school teachers have an obligation to provide the students they teach with the best possible instrument. This means that classroom teachers have the need to devise effective evaluation procedures/test instruments for the assessment of learning outcomes. These classroom achievement tests are technically known as teacher-made tests. Wevgin (2008) observed that teacher-made tests assess the extent of students' progress with reference to specific class room content.

For Classroom tests to properly assess student's knowledge of what they have learnt in the classroom, it must satisfy the three qualities of a test. The three qualities are reliability, validity and usability of the test results. Ekwoye and Eguzo (2010) defined reliability of the test scores as the consistency with which a test measures what it is designed to measure. It shows the extent to which a test repeats itself or is stable across time, forms, or part of times. Simply put, Gronlund (1976) in Obodo, Eze and Anigbo (1999) defined reliability as consistency of results. When classroom tests are constructed by classroom teachers, there is need to ascertain the reliability of such an instrument. This is therefore why the purpose of this study was for the researchers to examine the reliability of the Surd and Quadratic Equation Test (SAQET) constructed by the researchers themselves.

Purpose of Study

The main purpose of the study was to investigate the reliability of Surds and Quadratic Equation Test (SAQET) constructed by the researchers. Specifically, the study sought to find out:

1. the extent the Surd and Quadratic Equation Test (SAQET) is reliable.
2. the extent the Surd section of SAQET is reliable.
3. the extent the quadratic equation section of SAQET is reliable.

Research Questions

The following research questions guided the study;

1. To what extent is the Surd and Quadratic Equation Test (SAQET) reliable?
2. To what extent is the Surd section of SAQET reliable?
3. To what extent is the quadratic equations section of SAQET reliable?

Hypotheses

The following three formulated hypotheses guided the study, and were tested at 0.05 level of significance;

1. The K-R 20 reliability index of SAQET is not statistically significant
2. The K-R 20 reliability index of the surd section of SAQET is not statistically significant.
3. The K-R 20 reliability index of the quadratic equation of SAQET is not statistically significant.

Method

The research design for the study was instrumentation research design. The researchers designed an instrument that contained 50 multiple choice items and had three sections. Sections A, B and C. Section 'A' contained instructions and timing for the test. Section 'B' contained 15 items on surd, while section C contained 35 items on quadratic equations. There were more test items on quadratic equations than surds because the content coverage of quadratic equation in the senior secondary class 2 (SS2) is more than that of surds. There were 4 response options for each item lettered from A to D. A table of specification was used to prepare/construct the test items. The items in SAQET were constructed in the ratio of 60:40 for higher order and lower order questions respectively. SAQET was validated by 5 experts (2 in measurement and evaluation, 2 in mathematics education and one SS2 mathematics teacher, teaching SS2). Their comments were used to revise the test items. After the revision, SAQET was given again to another three experts different from the five experts mentioned above (one in measurement and evaluation, one in mathematics education and one SS2 mathematics teacher). Their comments were used to revise SAQET a second time, after which, SAQET was ready for administration. The population for the study was 5,828 SS2 mathematics students in Enugu Education Zone of Enugu State. The sample for the study was 10% of the population which was 583 mathematics students sampled randomly from the 10 selected secondary schools, using balloting method. These 10 secondary schools were also sampled randomly out of the 35 secondary schools in the said zone using balloting with replacement method.

The SAQET was thereafter administered to all the sample mathematics students in their respective schools. Item analysis was conducted, after which 50 items were finally selected as described above. Kuder Richardson formula 20 (K-R 20) was used in answering all the research questions. The hypotheses were tested using the t-test formula for testing the significance of correlation coefficient (r), that is, $t = r \sqrt{\frac{N-2}{1-r^2}}$ where N=Sample size, r= correlation coefficient.

Results of the Study

The Results for the Research Questions 1, 2 and 3 are shown below;
The reliability index of the 50-item Surd and Quadratic Equation Test (SAQET) was 0.78 using K-R 20 formula. This provided the answer to research question 1. For research question 2, the reliability index of the 15-item surd section of SAQET was found to be 0.84 using K-R 20 formula. For research question 3, the reliability coefficient for the 35-item quadratic equations section of SAQET was 0.75. However, the results for hypothesis 1, 2 and 3 are shown in the Table 1 below;

Table 1: Results from Testing the Hypotheses at Significance of 0.05 level

S/N	HO	r	r ²	N	df= N-2	1-r ²	$\sqrt{\frac{N-2}{1-r^2}}$	$\frac{N-2 = t - cal}{1-r^2}$	t-crit.	Dec
1.	HO ₁	0.78	0.6084	583	581	0.3916	38.5183	23.43	1.96	Sig
2.	HO ₂	0.84	0.7056	583	581	0.2944	44.4242	31.35	1.96	Sig
3.	HO ₃	0.75	0.5625	583	581	0.4375	36.4417	20.50	1.96	Sig

The t-calculated values of 23.43, 31.35 and 20.50 are each greater than the t-critical values of 1.96. Hence, each of the three null hypotheses is rejected. In other words, the K-R 20 reliability indices for SAQET (0.78), surd selection (0.84) and quadratic equation (0.75) sections are each significant at 0.05 significance.

Discussion on Findings

The results for research questions 1, 2 and 3 show that the reliability indices using K-R 20 are 0.78, 0.84 and 0.75. According to Obodo (2014), correlation coefficient is interpreted as follows:

- ± 0.00 to ± 0.20 is observed as negligible or very low relationship.
- ± 0.20 to ± 0.40 is observed as fair or slight or low.
- ± 0.40 to ± 0.60 is observed as average or moderate or fairly high.
- ± 0.60 to ± 0.80 is observed as high.
- ± 0.80 to ± 1.00 is observed as very high.

Using the above criteria to interpret the above correlation indices, one can conclude that the correlation indices for research questions 1 (0.78) and 3 (0.75) are of high relationship while the correlation coefficient for research question 2 (0.84) is of very high relationship. This simply means that SAQET and each of its two subsections are highly reliable. The results obtained from SAQET and its subsections can be trusted when administering it to proper respondents. Consistency of the test results will be obtained to a high extent if SAQET or its subsections are properly administered. It is a reliable instrument, because the instrument can therefore measure what you purport it to measure consistently. The results of the hypotheses show that the K-R 20 reliability coefficient of 0.78, 0.84 and 0.75 are each significant. This means that there is a real relationship between the sample of the study and the population from which the sample was drawn. In other words, the sample of the study was a very good representative of the population of the study.

Conclusion

From the findings of the study, the researchers conclude that the reliability of SAQET and its subtests are high. Thus, the instrument and its two subtests are highly reliable. Again, there is a real relationship between the study sample and population from which it was drawn.

Recommendations

Based on the findings, the researchers recommend the following;

1. Efforts should be made by classroom teachers at all levels to, at least determine the reliability index of their question papers before administering them.
2. Government should recruit many measurement and evaluation experts in various subjects to construct test items per subject and per class and store them in item banks for teachers to pick from such item banks.

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