VALIDATION OF OSBORN'S SCALE FOR MEASURING THE RELATIVE DIFFICULTY OF SECONDARY SCHOOL SUBJECTS

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Abstract

The study investigated the validity and reliability of Osborn's scale and also examined the influence of gender, class and age on the scale's reliability with a view to developing a student-friendly method of determining test validity by classroom teachers. The population for the study comprised senior secondary school students in Kwara State. The sample for the study consisted of 450 students and 30 school heads. Three Local Government Areas (LGAs) were selected from the state. Ten secondary schools were randomly selected from the LGAs. These were 450 students and 30 heads selected from these 10 secondary schools. They were selected using purposive sampling technique. A questionnaire eliciting information on respondents' personal data was developed to accompany the 31 items of the Osborn's scale and used for data collection. The responses of 389 students and 30 heads that completed the questions and rating scale were analyzed using appropriate statistics The results showed that the Osborn's scale is valid for use in measuring subject difficulty among the school students in Kwara state with a concurrent validity of 0.89 and Cronbach's alpha of 0.55. All subjects were rated as either not difficult or just difficult. Mathematics was rated by secondary school students as the most difficult subject while religion was rated the least difficult. Among the science subjects, Agricultural science was rated as the least difficult subject. Generally, science subjects were rated more difficult than arts and commercial subjects. Moreover, gender was significantly related to students' ratings in Mathematics and Economics while it had no significant relationship with students' ratings of Physics, English, Biology, Geography, Agricultural Science, Chemistry and Religion. In conclusion, the Osborn's scale is valid and effective for determining the difficulty of school subjects and is suitable for use in Nigerian secondary schools.

Keywords: Subject Difficulty, Item Difficulty, Validity, Reliability, Psychometric Properties.

1. INTRODUCTION

1.1 Item and Subject Difficulty

Difficulty as a term is relative, what a student refers to as been difficult may not be difficult to another student. Estimating the item parameters of a test i.e. item difficulty and item discrimination cannot be over-emphasised as it has almost served as a routine for test developers. In classical test theory, item difficulty is the percentage of pupils who answer an item correctly. The larger the percentage of testees who get an item right, the easier the item. By implication, the higher the difficulty index the easier the item is understood to be. The difficulty index of items constituting a test, thus determines the difficulty of such a test. A simple test therefore tends to contain items with high difficulty index, while a difficult test has low difficulty index. Item difficulty is particular to tests and each of the items. It has a profound effect on both the variability of test score and the precision with which test scores discriminate among different groups of examinees (Thorndike, 1991). When all of the test items are extremely difficult, the great majority of the test scores will be very low. When all items are extremely easy, most test scores will be extremely high. In either case, test scores will show very little variability.

Subject difficulty on the other hand is a rating that combines the ease with which curriculum content in each subject is learned and how easily students pass such a subject. It could be inferred from the failure rate recorded in each subject, that is, if more students fail Mathematics than English, then Mathematics is regarded as more difficult. A subject could be regarded as difficult if students are unable to understand its contents, leading to low test scores or failures. In another vein, students might consider a subject difficulty if they have to spend a long time studying it. Some students find it difficult to devote enough time to study certain subjects and they conclude that it's difficult. To others it may be because they find it difficult to lay hands on good materials on the subjects or they find such materials difficult to understand.

Although, this may not necessarily be so as research has linked large number of factors with students' failure. This informs the popularity of some subjects and thus students register for them en masse at both school and external examinations. These factors cover teachers' instructional practices and students' classroom and related experiences, personality characteristics of learners, school and home factors as well as other psycho-social factors. Instructional practices of teachers may vary according to the school subject they teach. Students tend to find some of these practices as helping them to learn than others in the classroom, difference also exist in standard and goals set for the teaching/learning process. The way school subjects are taught has the power to influence how students react to learning. Another factor that may make students to think that a subject is difficult or easy is the relationship with the teacher or the way the subject is being taught i.e. the teachers' styles may go a long way to influence how students think about learning the subjects they teach. It is observed that teachers do more than teaching subjects, what they actually do is something far more important in the long run. They are actually instilling or teaching attitudes to subjects (Ahtee and Tella, 1995).

There is also the issue of differentially ability among students. While some students are good in all school subjects, others find that they are good only with calculation, practical-oriented,

literacy, technical or numerical subjects. This may develop into fear of certain subjects. For instance, the phenomenon called mathphobia is borne out of the dread of numbers and calculation (Adedayo, 1995). On the other hand, are those who have fear for lengthy notes and books and thus run away from subjects like history or literature which require much reading and writing. Daramola (1982) also found out that those who did not register for Physics in secondary schools in Kwara state considered it to be difficult. It has also been gathered that students usually find out from their colleagues or family members about subjects that are difficult or easy. It is not unlikely that information they receive may affect their choice of subjects. Ahtee and Tella (1995) have also discovered that some of the students they interviewed saw Mathematics text as exclusive sources for problems while History text contained information that could be discussed among them and that are related to their experiences.

1.3 Measuring Subject Difficulty

Osborn's scale is an instrument developed to measure the relative difficulty of secondary school subjects. The scale is in two forms; each consists of 31 statements descriptive of subject difficulty. These statements assign scale placements from the combined rankings of 131 judges. The statements range in approximately equal intervals form the statement representing the simplest (a dumb-bell could pass this subject) to the most difficult (if my life depended on it, I could not get this subject) other statements are arranged between the two extremes in the order of difficulty level. This scale was developed to find out from students which school subjects are hard and which ones are easy. Students are expected to mark one or more of the statements that best described the subject for which difficulty ratings are desired. Osborn reported that items with inter-quartile range of 2.6 or less on a nine-point placement by these 131 judges were used to develop the scale. Average P.E of 0.07 indicated that the relative placement of items on the scale obtained when rank order of subject difficulty from students' sample was correlated with the high schools' principals. Quartile range of the Osborn's scale within which students ranking of each subjects falls was used to classify each subject into levels of difficulty. Ratings that fall within the first quartile (1-7) are regarded as not difficulty. Ratings within the second quartile (8-15) are classified to be just difficulty. Ratings within the third quartile (16-23) are classified to be fairly difficulty while ratings within the fourth quartile are regarded as very difficulty. Table 1 summarises the classification.

Table 1: Quartile Ranges of Difficulty

Quartiles	Classification
1st quartile (1-7)	Not difficulty
2nd quartile (8-15)	Just difficulty
3rd quartile (16-23)	Fairly difficulty
4th quartile (24-31)	Very difficulty

2.1 Statement of Problem

The difficulty of a subject has traditionally been measured using only its intellectual requirements. Unlike the difficulty level of tests items that has a generally accepted formula, there is no known formula for determining the difficulty level of subjects. Osborn (1939) developed a scale for measuring the difficulty of secondary school subjects and there is the need for carrying out confirmatory studies on the validity and reliability of the instrument as well as advancing evidence to support its suitability for use in Nigerian secondary schools.

2.1 Objectives

The main objective of the study was to determine the construct validity of Osborn's scale for measuring the relative difficulty of secondary school subjects particularly among secondary schools in Kwara state of Nigeria. The specific objectives of the study are to:

1. determine the validity of the Osborn's scale in measuring the relative difficulty of secondary school subjects;
2. examine the difficulty level of the compulsory subjects in secondary schools;
3. investigate the difficulty levels of Arts, Science and Commercial subjects in secondary schools;
4. examine the relative difficulty of secondary school subjects in terms of the students' sex, class and age.

2.2 Research Questions

Arising from above, the following questions were raised:

1. Is the Osborn's scale for measuring the relative difficulty of secondary school subjects valid for use among secondary school students in Kwara state?
2. To what extent do students find the compulsory subjects difficult?
3. To what extent do students find Art, Science and Commercial subjects' difficulty?
4. Are there differences in the responses of male and female secondary school students to the Osborn's scale for measuring the relative difficulty of secondary school students?
5. Does subject difficulty pattern vary among students of different classes at the secondary level of education?

2.3 Research Hypotheses

Subsequently, the following corresponding hypotheses were postulated:

1. There is no significant relationship in subject difficulty between male and female
2. There will be no significant relationship in subject difficulty between students in different classes of senior secondary school
3. There is no significant relationship in subject difficulty and student age
4. There is no significant relationship in subject difficulty among Science, Art and Commercial student.

3.1 Methodology

The population for the study comprised senior secondary school students in Kwara State. A total of 450 students constituted the sample for the study. The 3 LGAs were selected using purposive sampling technique; these were Ilorin east, Ilorin west and Ilorin south. Three secondary schools were randomly selected from each of the 3 LGAs while the only Federal Government College in the LGAs was purposively selected. A total of ten secondary schools were selected for the study. Forty-five students were sampled from each school with an equal distribution of fifteen students from SS1, 2 and 3 to make up the fifteen from each class, each of Arts; Science and Commercial classes had five students in the sample. This was done to ensure that each stratum had equal representation in the sample. Two versions of background questionnaire to which thirty one statements of the Osborn's scale for indicating the difficulty of nine secondary school subject were designed. The first version was designed for use among the sampled students while the second version was for use among school heads and counselors. Each version was therefore divided into two sections. Section B of both versions have the same set of thirty one item response format against the nine selected secondary school subjects. The statements described the difficulty of subject arranged from the simplest to the most difficulty. The nine subjects covered are: Physics, English, Mathematics, Biology, Economics, Geography, Agricultural Science, Chemistry and Religion (Christian and Islamic Studies) section A of the students' was deigned to capture background information while the school heads and counsellors' version required similar information from the school heads and counselors. The reliability indices of 0.78 and 0.87 were reported for forms A and B of the scale.

Four hundred and fifty questionnaires were distributed personally. Four hundred and thirteen were returned which accounted for 92.22% return rate. Three hundred and eighty nine questionnaires were found to be useful and this formed 86.44%. Twenty four of four hundred and thirty that were returned were disqualified because they were not properly filled and thirty seven out of the four hundred and fifth given out were not returned. Data analysis techniques ratings by students and schools heads (Vice Principals and Counsellors) were correlated to establish the validity of the Osborn's scale for use in Nigeria secondary schools. To determine the relative difficulty of each subject, the median of students' rating of the subjects were obtained while the Cronbach's alpha was used to determine the reliability of the scale.

4.1 Results

Research Question 1: Is the Osborn's scale valid for measuring subject difficulty?

To answer this research question, the median of the ratings of the difficulty of nine secondary school subjects by students and school heads were obtained. The ratings, which are rank orders of the perceived difficulty of these subjects by students and school heads, were subjected to the spearman's correlation computation and a coefficient of 0.85 was obtained`. This concurrent validity index was found to be significant at 0.05 level of significance. And it was concluded that the Osborn's scale is valid for use among secondary school students in Kwara state. A cronbach's alpha coefficient of 0.55 was also obtained on the students' ratings.

Table 2: Ranking of Subject Difficulty by Students and School Heads

Students	Student's Ratings	School Heads' Ratings
Physics	14	17
English	6	8
Mathematics	15	15
Biology	13	8
Economics	10	7
Geography	12	8
Agricultural science	9	7
Chemistry	14	15
Religion	3	3

Research Question 2: To what extent do students find the compulsory subjects difficulty?
To answer this research question, students' ratings of the compulsory subjects, English, Mathematics and Biology were obtained. These are presented in Table 3

Table 3: Students Ratings of the Difficulty of the Compulsory Subjects

Subjects	Students' Ratings
English	6
Mathematics	15
Biology	13

Using the quartile range of the Osborn's scale as mentioned above. From this classification, English is rated as not difficulty while Mathematics and Biology are rated as just difficulty.

Research Question 3: to what extent do students find Arts, Science and Commercial subjects difficult?
To answer this question, students' ratings of the subjects were obtained and checked with the quartile classification of subject difficulty in Table 4

Table 4: Students' Ranking of Subject Difficulty

Subjects	Students' Ratings
Physics	14
English	6
Mathematics	15
Biology	13

Economics	10
Geography	12
Agricultural Science	9
Chemistry	14
Religion	3

Checking data in table 4 in line with table 3 above, the students' ratings of science subjects, which are Physics, Mathematics, Biology, Chemistry and Agricultural Science, are classified to be just difficult. Two Arts subjects, English and Religion are rated as not difficult while they rate Geography as just difficult. A commercial subject represented with only Economics is rated to be just difficult.

Research Question 4: there is any relationship between students' gender and their ratings of subject difficulty. This research question is parallel to hypothesis 1, which states that there is no significant relationship between students' rating of subject difficulty and their gender. Ratings of subjects difficulty by male and female students was subjected to the chi-square test and the Pearson's contingency coefficients of these were calculated. Pearson contingency coefficient is used to measure degree of relationship or association between two variables when measuring at the nominal level of measurement. It is interpreted the same way as the Pearson's r except that it ranges between 0 and 1 (Runyon, Haber, Pittenger and Coleman 1991). The result is presented in Table 5

Table 5: Contingency Coefficient Students' Gender and Subject Difficulty Rating

Subjects	Pearson's Contingency Coefficient	Significance
Physics	0.26	NS
English Language	0.28	NS
Mathematics	0.34	S
Biology	0.30	NS
Economics	0.33	S
Geography	0.30	NS
Agricultural Science	0.30	NS
Chemistry	0.27	NS
Religion	0.30	NS

0.05 level of Significance

This shows that students' gender is not significantly related to their rating of subject difficulty in all the nine subjects except mathematics and Economics.

Research Question 5: there is a relationship or association between students' classes and their subject difficulty ratings. This question is also parallel to the second hypothesis which states that

there is no significant relationship between students' class and their ratings of subject difficulty. The ratings of subject difficulty by SS I, II and III students used in the study was subjected to chi-square test. The results are presented in Table 6

Table 6: Pearson's Contingency Coefficient Students' Class and Subject Difficulty Rating

Subjects	Pearson's contingency coefficient	Significance
Physics	0.40	NS
English language	0.40	NS
Mathematics	0.39	NS
Biology	0.38	NS
Economics	0.37	NS
Geography	0.38	NS
Agricultural science	0.40	NS
Chemistry	0.39	NS
Religion	0.36	NS

0.05 level of Significance

From Table 6, no significant relationship was found between students' class (i.e SS I, II, III) and their ratings of subject difficulty. The second hypothesis is therefore not rejected.

Hypothesis 3: there is no significant relationship between age and subject difficulty.

Ratings of subject difficulty by the different age categories (i.e 13 yrs-15yrs, 16-18yrs, 19-21yrs and above 21yrs) were subjected to the chi-square test and the results are presented in Table 7

Table 7: Pearson's Contingency Coefficient Students' Age and Subject Difficulty Rating

Subjects	Pearson's Contingency Coefficient	Significance
Physics	0.45	NS
English Language	0.57	S
Mathematics	0.52	S
Biology	0.53	S
Economics	0.53	S
Geography	0.40	S
Agricultural Science	0.48	NS
Chemistry	0.45	NS
Religion	0.41	NS

0.05 level of Significance

From Table 7 it is shown that students' age is significantly related to their rating of 5 subjects i.e English, Mathematics, Biology, Economics and Geography while it is not significantly related to their rating of 4 subjects which are Physics, Agricultural Science, Chemistry and Religion.

4.2 Discussion

Of all the subjects covered in this study, none was rated above 15. By implication, students' ratings fall within the 2nd quartile of the 31 alternative statements. Most students do not therefore see subjects they offer in secondary schools as very difficulty. Out of the three compulsory subjects, Mathematics and Biology were classified as just difficult while English was rated as not difficult. Mathematics is a numerate subject which students considered abstract and difficult while those in Arts and Commercial classes tend to see biology as an imposed subject who bears little or no relevance to their career or academic aspirations. As for English which students do not see as difficult serves as the medium of instruction in the school system right from the primary education level and tus students seem to have become more familiar with it and such are not in any way threatened it.

The science subjects have the highest ratings of difficulty compared to the other entire subject studied in this study. Mathematics was rated 15, Physics and Chemistry 14 and Biology 13. Agricultural Science, which was rated 9, came as the science subject considered least difficult by secondary school students. Its low rating may be as a result of the fact that most students are already familiar with agricultural practices since most Nigerian families are farmers. Also, Agricultural implements and method of farming are not strange to the students. Generally speaking, the students did not rate the subjects as fairly or very difficult which suggests that they have a feeling that they are able to cope to a good extent.

Religion is the second arts subject covered in this study and its rated 3 by the students and classified as not difficult. The low difficulty rating of religious knowledge may be because most Nigerian secondary school students are from homes that practice the tenets of what the school teaches. Homes ensure that religious knowledge is taught for observance and school learning complements this. Students therefore tend not to see it as a difficult subject. In fact, it came lowest in its rating of difficulty.

Gender is significantly related to students' ratings in Mathematics and Economics. From a general observation, it is discovered that females tend to dread mathematics than males. This may also apply to Economics because of the mathematical aspects of the subject. However, gender has no significant relationship or association with students' ratings of Physics, English, Biology, Geography, Agricultural Science, Chemistry and Religion. It is safe to conclude that sex is not related to the difficulty ratings of most secondary school subjects if this is true of seven out of the nine subjects covered by this study.

No relationship was found between students' class and their ratings of all nine subjects. This implies that the ratings of subject difficulty are not significantly different for students in either SS I, II or III. This may not be unconnected with the fact that students go through similar treatments at

the end of their junior secondary school certificate examination at the point of selecting their subjects. There is also the tendency that attributes held about certain subjects have the tendency of being generalized like the Arts students feeling they might not be good in Mathematics. While age was found to be significantly related to students' ratings of English, Mathematics, Biology, Economics and Geography, it has no significant relationships with the ratings of Physics, Agricultural Science, Chemistry and Religion. As a result of this, there is no clear conclusion as to the relationship between age of secondary school students and their ratings of subject difficulty.

In conclusion, the Osborn's scale validly measured the relative difficulty of secondary school subjects in Kwara State, Nigeria.

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