

# **DEVELOPMENT AND VALIDATION OF INSTRUMENT FOR STUDENTS' EVALUATION OF INSTRUCTIONAL EFFECTIVENESS OF MATHEMATICS TEACHERS IN SECONDARY SCHOOLS IN NIGERIA**

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*The purpose of this study was to develop and validate an instrument for students' evaluation of instructional effectiveness of mathematics teachers in secondary schools in Nigeria. The research design adopted was survey. The sample consisted of 200 mathematics teachers' drawn from a population of 410 in Central Senatorial District of Abia State of Nigeria. Six students rated each teacher. The instrument used for data collecting was a 48-item questionnaire with 6 items measuring each of the 8 selected dimensions of instructional effectiveness. Cronbach alpha and factor analysis were the statistical technique applied on the data. It was found that the reliability coefficients for the dimensions, the contribution of items under each dimension, and the contribution of the dimensions to the overall teaching effectiveness were significant .*

## **INTRODUCTION/BACKGROUND OF THE STUDY**

Evaluation is an indispensable tool in any aspect of life's endeavour as it gives direction to someone engaging in an activity. It provides relevant and accurate information that facilitates wise decisions making. No matter how efficient the teacher is , how intelligent the students are, how adequate the instructional materials are, if no provision is made for the monitoring of the teaching-learning process, the teaching effort may miss the target and therefore become completely invalidated. Evaluation data collected allow school administrator to consider the direction of developing in-service training programs that build on the required behaviours and skills of teachers. Also performance deficiencies are identified and the teacher helped to focus on specific behaviours that can be improved through training as well as comparing of groups of teachers whose entering behaviours and skills are at different levels of proficiency.

In education, instructional effectiveness is gaining a major attention, as teachers' tend to see evaluation mostly in terms of giving examination to students and scoring them to decide who passed or failed. Little attention may be given to the evaluation of how well the students have been taught, whereas the quality of education depends on the quality and effectiveness of the teachers and the instructional process. Ukeje (1983) opines that no educational system can rise above the quality of its teachers. The instructional effectiveness of the teachers in any system invariably needs to be evaluated so as to know the quality of education that the system is operating on.

Freeman (1979) found common dimensions which students often use as yardstick in perceiving and rating their teachers to include the instructors' subject matter competence, ability to relate materials and quality, fairness of feedback, evaluation procedure and the degree of instructor-student rapport.

He further found that some students place relatively greater importance in associating with a teacher because of the teacher's personality characteristic, which is an important value in the whole process of teacher evaluation, and that it affects students' academic achievement.

How to define operationally and promote instructional effectiveness is still a problem for educators and researchers. There is also the problem of instrumentation (nature of instrument, reliability and validity). However, according to Doman and Arbon (2001), instrument validation and reliability is guided by four basic criteria: first the instrument should provide a good coverage of instructional effectiveness of teachers' and concerns of the students; second, the instrument's structure should be consistent with general psychometric principles in that it should possess several internally consistent, mutually exclusive scales; thirdly, individual scale items should be sensitive to different levels of concerns of students in the study; and fourthly, the instrument should be relatively economical to administer, answer, score and analyse.

In order to operationalize the four criteria, it is necessary to employ both intuitive-rational and factor analytic approaches to scale development. This involves identification of salient dimensions, writing tentative scale items, and conducting field-testing and applying factor analysis to group items into scales (Harse & Goldberg, 1967). This was essentially followed in this study.

## **STATEMENT OF THE PROBLEM**

Because of the importance of mathematics in the Nigerian school system and in Nigeria's developmental needs, it is necessary and very important that teachers of this subject are roundly effective. But how is this effectiveness identified or measured? Many institutions in the Central Senatorial District of Abia state organize end of year ceremonies and would always want to motivate teachers by naming the best teacher of the year. This has always been done through sentimental or political procedures. Therefore, a scientifically constructed and validated instrument of this nature will serve so many of such purposes in our secondary schools. It is for this reason that these researchers found it necessary to construct and validate an instrument for the evaluation of instructional effectiveness of mathematics teachers in the Central Senatorial District of Abia State of Nigeria.

To carry out this research, the following research hypotheses were formulated and tested.

- (i) The contribution of each of the items to the dimensions of teaching effectiveness as assessed by the students is not significant.
- (ii) The contribution of each of the selected major dimensions to the overall teaching effectiveness is not significant.
- (iii) The reliability of teaching effectiveness is not significant.

## **THEORETICAL FRAMEWORK**

To provide the theoretical bases for this study, Jerome Bruner's theory of instruction and Okpala's model of evaluating teaching effectiveness were considered. Jerome Bruner's Theory of Instruction states "any subject can be taught effectively in an intellectually honest form to any child at any stage of development". Bruner's contention is that the old concepts of readiness, where both the nature of the child and subject matter must not be tempered with, should be discarded. Rather the

concept of readiness should be modified to include not just the child but also the content of the subject matter (Bruner, 1977).

Bruner's theory of instruction is based on four major principles, namely:

- (i) Predisposition
- (ii) Structure and form of knowledge
- (iii) Sequence
- (iv) Reinforcement or feedback.

There are certain variables, which predispose a child to learn. Some of these variables are motivational, cultural as well as personal. Motivation is a psychological construct that affects learning generally. Cultural variables that predispose a child to learn mathematics include language, gender stereotyping, and the nature of the authority exhibited by the teacher or parents and the attitudes of parents towards mathematics as an intellectual activity. Some personal variables that predispose a child to learn include anxiety, ability and attitude towards mathematics. In the view of Bruner, the mathematics instructor must know how best to utilize different cultural patterns to achieve particular instructional objectives. A general awareness of how these variables affect the teaching and learning of mathematics is necessary if the mathematics teacher is to be effective in his/her teaching.

In Africa, particularly in Nigeria, Okpala (1999) developed the first indigenous model for evaluating teaching effectiveness. Okpala opines that evaluation of teaching effectiveness is an integral part of teaching-learning process and that each stage of the teaching-learning process is subject to evaluation, and that the evaluation data from each Stage could be used to influence decision-making at other stages. Okpala's model suggests eight components of teaching-learning process, which were adopted in this study as the eight dimension of teaching effectiveness.

Research evidence (e.g. Rosenshine, 1971) currently justifies observing and judging the following teacher behaviours; clarity of presentations and explanation, enthusiasm, variety in use of instructional materials and techniques, task orientation and "business like" behaviour in provision of ample learning opportunities. The research suggests observation of much other potentially important teachers' behaviour: teacher's use of student ideas, use of multiple level of discourse, absence of negation and probing. Each characteristic can be precisely defined and can be reliably measured through training, and using observational judgmental method most of the time. This method involves the collection of pupils' evaluation of their teachers. The data collected from students are of several types but include information to corroborate outside observers' rating of their teacher behaviours. Involvement of students in the observational-judgmental model may form an important contribution in the teacher evaluation process.

## **RESEARCH DESIGN**

The survey research design was found suitable in determining and collecting data from the subjects. This study was carried out in the Central Senatorial District of Abia State, Nigeria. Abia State is one of the 36 States that make up the Federal Republic of Nigeria. This State is divided into 3 Educational zones. The Central Senatorial District comprises a total number of sixty-five public

secondary schools. Abia State is located in the rain forest zone of West Africa. It lies between longitudes 6° and 8° east of the Meridian and latitudes 4° 30 to 6° 30 North of the Equator. The people of the state are predominantly farmers, traders and fishermen. Employment for adults in the state is mostly at the public service, especially teaching.

The population for this study consisted of all mathematics teachers in the study area numbering 410 from all the secondary schools in the area. The researchers used the stratified random sampling technique to select 10 schools from five Local Government Areas that make-up the Central Senatorial District. Fifty secondary schools were therefore selected. From each of the secondary schools, the purposive sampling technique was used to select 4 mathematics teachers. This gave a total number of 200 teachers that were used in the study. From each of the classes taught by the selected teachers, six students were selected using the simple random sampling, to rate the teachers. In all, 1200 students took part in rating the 200 teachers.

The researchers constructed an instrument named “Instrument for Evaluation of Instruction in Mathematics (IEIM)”. The instrument had forty-eight (48) items with six (6) items measuring each dimension. The students were required to rate their teachers on the perceived level of instructional effectiveness in eight (8) different dimensions derived from Okpala’s model. A rating scale scored 1 to 10 was used for the rating. ‘1’ represented the lowest level of instructional effectiveness and ‘10’ represented the highest level of instructional effectiveness. The dimensions of instructional effectiveness used for this study were: Knowledge of subject matter, classroom communication, classroom management, motivation and reinforcement, use of variety of teaching methods, effective use of instructional materials, teacher’s technique of evaluating students, and students/teacher relation.

## **RESULTS AND DISCUSSION**

The contribution of each of the items to the dimensions of teaching effectiveness as well as the contribution of the selected major dimensions to the overall teaching effectiveness as assessed by students were analysed using factor analysis. The reliability of the items in measuring the eight dimensions was determined using the Cronbach Coefficient Alpha.

### **Hypothesis one**

The contribution of each of the items to the dimension of teaching effectiveness as assessed by students is not significant.

The inter-correlations of each item with the extracted factor (dimension) were treated separately to form the correlation matrix. This correlation matrix provided an initial indication of the relationship between the items and the extracted factor (dimension) of teaching effectiveness. Also a Varimax rotation was applied on the eight extracted factors of instructional effectiveness to determine how each item under a dimension correlated with the factor (dimension) extracted.

For all the eight factors (dimensions), the six items used to measure each of the eight dimensions were significantly interrelated. Each of the set of six items extracted was treated for just the factor it as measuring. The result of inter-correlations for each set was well above 0.50. The result of the correlation of each of the items with its extracted dimension were 0.70 and above for each dimension. The eigenvalues showed significant values as shown in Table 1.

Dimensions of instructional effectiveness	No of items	Eigenvalues	Cronbach alpha coefficient
Knowledge of subject matter	6	68.882	.91
Classroom communication	6	71.543	.92
Classroom management	6	67.585	.90
Motivation and reinforcement	6	77.768	.94
Use of variety of teaching methods	6	66.288	.90
Effective use of instructional materials	6	67.069	.90
Technique of evaluating students	6	74.773	.93
Teacher/students relationship	6	67.959	.91
Overall instrument	48	78.542	.98

**Table 1: Eigenvalues and Cronbach alpha coefficients for the eight dimensions of teaching effectiveness tested in the study**

Considering these significant eigenvalues for all the dimensions, the null hypothesis was rejected with respect to all eight dimensions of teaching effectiveness. This means that each of the six items constructed to measure a particular dimension of teaching effectiveness significantly contributed to measure the dimension.

## **Hypothesis Two**

The contribution of each of the selected major dimension to the overall teaching effectiveness is not statistically significant.

The variables in this hypothesis are the major dimensions of teaching effectiveness. Orthogonal (Varimax) rotated component analysis was applied on the eight extracted factors (dimensions) of instructional effectiveness to determine how each items correlate on eight different factors of effective teaching. The results indicated that extracted factors rotated correlated with the overall dimension at 0.500 and above. The communality estimates showed that well above 60% of the variance was accounted for by total factor solution. The output of the component matrix (correlation between items and extracted factors) implies that most items are correlated at 0.700 levels except for seven items. This therefore means that the selected major dimensions significantly contribute to the overall teaching effectiveness. The null hypothesis was therefore rejected.

### **Hypothesis Three**

The reliability coefficient of each of the dimensions of teaching effectiveness is not significant.

The variable in this hypothesis is the reliability of each of the dimensions of teaching effectiveness. The reliability of each of the eight dimensions of instructional effectiveness was treated separately as well as the overall reliability of the instrument using the Cronbach Coefficient alpha. The result indicated that all the calculated Cronbach alpha values were very high and ranged from .90 to .98 (as shown in Table 1). The null hypothesis was therefore rejected. This means that the items comprising the instrument for evaluation of instruction in mathematics are inter-correlated. Thus all the items under each dimension measure the same characteristic as well as the entire instrument.

### **CONCLUSION/RECOMMENDATION**

In essence, the instrument is valid and reliable enough to be used for measuring teaching effectiveness of mathematics teachers. It is recommended for academic/ research community for use, and or for further refinement.

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