CHAPTER - 1

PROBLEM, ITS SCOPE AND IMPORTANCE

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CHAPTER - 1

PROBLEM, ITS SCOPE AND IMPORTANCE

1.1 Introduction

In the field of education, the teacher and student are the main two factors for the educational process. A teacher teaches and a student learns in the class different subjects. The role of a teacher in the field of education is very much important.

“What is the secret of your success, Hardik Vyas ?”

“No doubt, I owe my achievement to my teachers.”

“Do you recognize (acknowledge) the contribution of all your teachers?”

“Oh no! I could achieve this success due to my torchbearers - Mr. X, my class teacher and Mrs.Y, my science teacher.”

This dialogue highlights the importance of the teacher as a vital agent in the education system. The students recognize the contribution of the teachers to their achievement.

In the modern age too it is realized more and more that the teacher has a great role to play in the educational, social and even political situation of the country. He directs stand executes the whole process of education which ultimately affects greatly the all-round growth of the country. He is essentially a nation builder. On him, depends the future of the school, the village, the country and in fact the future of mankind. No amount of spacious buildings, costly equipment and sound syllabus will serve any useful purpose unless there are teachers who are fully alive in the mobility of the profession and its accompanying responsibilities.
The teacher plays an important role in shaping and moulding the habits, tastes, manners and above all the character of students. In his hands, has been entrusted the supreme task of the care and guidance of children.

Dr. Radhakrishna points out the importance of teachers –

"The teacher's place in society is of vital importance. He acts as the pivot for transmission of intellectual traditions and technical skills from generation to generation, and helps to keep the lamp of civilization burning. He not only guides the individual, but also so to say, the destiny of the nation."¹

The teacher is being recognized as the most vital factor in any educational system. He is the key to the quality of the education. All significant changes in the educational process are governed by the extent of his receptivity and initiative. The reputation of the school and its influence on the life of the community invariably depends on the kinds of teachers working in it. The teacher is directly connected with learning process.

In the field of education, learning is a very important process. This process is having some objectives of education. The teacher and the pupil are the two important factors of the teaching learning process.

According to Mr. Khan –

"The school may have an excellent Principal. It may have a magnificent building. Its curriculum may be perfect. It may believe in most modern methods of teaching and evaluation. But all these provisions may be of no these things is not good. There is no substitute to a good teacher."²

However, essential the building, library or laboratory may be in the educational field, the teacher and his professional efficiency are a must.
In the field of education, the teacher's role is very important for improvement in the achievement of the pupils also.

He is vividly described as "a maker of man", "the real maker of History"\(^3\), "the key person", "The main architect", "The creator of ethos", "the gardener of human plants", "the builder of the new generation"\(^4\) and so on.

Robert M.W.Travers writes about teacher's responsibility as under –

"It is the teacher who must eventually bear the main responsibility for appraising the outcomes of teaching. While it is hoped that consultants will be available to teachers who want to conduct studies of their own teaching, much of the work of evaluation must still be done by the teacher himself. However, it is important that evaluations made by teachers of their own work should become less informal and more systematic."\(^5\)

Robert M.W.Travers further gives comment about the evaluation of education as under –

"The evaluation of education in terms of outcomes is not merely a process of determining what the actual outcomes are, but it also involves a judgement of the desirability of whatever outcomes are demonstrated to occur. Suppose it can be shown that students in a certain educational program become more favourable in their attitudes towards certain racial minorities as a result of that program. The measurement of these changes in attitude does not constitute an evaluation. The process of making an evaluation consists not in measuring the change but in judging whether the change is or is not desirable."\(^6\)

In the world of education, ceaseless efforts for development and improvement in the teaching learning process are being made from time to
time by the researchers of education. As a result of this, revolutionary changes have taken place in the teaching learning process in the last two decades. Along with this, the resultant achievement of measurement of the teaching learning process is gradually becoming more microscopic, reliable and valid.

Various experiments such as Programmed Instruction, Computer Assisted Instruction, Project Method, Micro-teaching etc. are being tried to measure learning. How to make learning fruitful and effective is the problem which the educationists are trying to solve.

If the masses are to be educated the educationists have to recognize the importance of individual differences. The genius, the normal, the intelligent and the dull cannot be treated in the same ways. A well trained psychologist can differentiate among the children very easily with the help of scientifically developed instruments and help the teacher in doing his best. Educationists in India have now realized the importance of consideration of child's interests, aptitudes, personality traits and abilities in its developmental stages while planning the educational programmes for the child.

M.B Buch also writes as under –

“Educational Research should aim at obtaining by experimental methods knowledge about the educational practices and processes which could be used for reconstructing the educational programmes of our country.”

As a result of this, many educationists have suggested different types of teaching methods, learning situations of the pupils in the class. Various experiments are carried out by the researchers to measure the achievement of the student. It is very important to measure that educational objectives are fulfilled or not at the end of teaching.

It has been noted that most of the tests measure the achievement of the pupils. These tests require some change after some time. Hence the
researcher has decided to prepare a test to measure the achievement of students of Std. X.

1.2 Statement of the Problem

After making a comprehensive study of different types of test, the researcher found that to measure achievement or learning of different subjects two types of tests are used. They are the Norm-Referenced Tests and the Criterion-Referenced Tests. They are denoted as NRT and CRT in short. In the field of education CRT is a new research field. Therefore, the researcher has decided to prepare a CRT in Mathematics subject for the students of Std. X, and gave the following title to the problem:

Subject

“The Preparation and Standardization of a Criterion-Related Test in Mathematics for the pupils of Std. X in the Gujarat State.”

1.3 Definitions of the Terms

It is essential for the researchers to clarify the meanings and concepts of certain significant terms in the research problem with reference to the present study. They are

* Preparation
* Standardization
* Criterion-Referenced Test

More over, there are a few implied terms, which need clarification. They are:

* Achievement
* Domain
* Domain Score
* Cut off Score
* Grade (Std.)
Preparation

The dictionary defines it as –

(1) “a step in Herbart’s five normal steps in which the instructor motivates the subject or unit by appropriate historical or other data calculated to arouse interest in the unit;

(2) a step in a directed study plan in which the teacher attempts to set the stage or arouse an interest in something that is to be studied.”

According to Hambelton (1985) –

“it includes the twelve steps of the development of CRT.”

Standardization

According to the dictionary it is defined as:

(1) “the establishment of fixed procedures for administering and scoring a test;

(2) the establishment of norms for a test.”

Criterion-Referenced Test

According to Robert M. Goldenson (ed.), the term is defined as –

“It is an approach of testing based on the comparison of a subject performance with an established standard or criterion. The criterion is fixed; that is, each subject score is measured against the same criterion and does not influence the relative standing of others. CRT is associated with the assessment of mastery of subject content, e.g., the score reveals what percentage of terms the testee can answer correctly.”

The researcher has given operational definition for the present study of CRT as below:
"A CRT is a test which shows domain score through the examinee's score obtained from the items randomly selected from the universe of items written on the basis of well-defined behavioural domains and is capable of classifying examinees into mastery-nonmastery states on the strength of cut-off score"

Achievement

According to Collins Dictionary –

"An achievement is something which someone did or caused to happen especially after a lot of effort," 12

Longman Dictionary states –

"In educational psychology the term is applied to a specified level of proficiency in academic work in general or in a specific skill such as reading or arithmetic" 13

Domain

A domain is a well-defined set of tasks based on a chunk of a course content called out of a particular topic or unit of learning

Domain Score

Domain Score is the preparation of items in a well-defined domain of content that can examinee answer correctly

Cut-off Score

Cut-off score is a score showing the maximum probability of the correct decision of classification of examinees into master and non-masters for each behavioural domain of a CRT
Grade (Std.)

Grade indicates a class of persons or things of the same rank, quality etc. In the field of education grade is an yearly stage in a child’s school career. In the school grade is a class or a group of classes in which all the children are of a similar age. When you are five years old you go into the first grade and you leave school after twelfth grade.

In the present study, only 10th grade (Std.) have been studied.

1.4 Objectives of the study

The researcher undertook the present study keeping the following objectives in view:

(1) To prepare a criterion-referenced test.

(2) To standardize i.e. validate the criterion-referenced test.

(3) To determine the cut off scores of the test.

(4) To determine the reliability of the test.

(5) To determine the validity of the test.

(6) To prepare a manual of directions for the future use of the test.

1.5 Limitations of the study

Limitation consists of making choices from a number of alternatives such as coverage by geographical area, type of school system, and time period.

Francis J.Rummel says –

"When we delimit a study, our attention is focused on valid objectives and we keep ourselves away from the dangers of over generalization."
and we keep ourselves away from the dangers of over generalization.

(1) The present study is limited to the new course of Mathematics of Std. X approved by Govt. of Gujarat from the academic year 1993-94.

(2) The criterion-referenced test in Mathematics of Std. X for the present study is limited to 'Trigonometry' unit only.

(3) The present study is limited to the students of Std. X studying in Gujarati medium (government recognized) school of the urban area of Sidhpur town of North Gujarat.

(4) Conclusions of the study cannot be generalized for the universe but are limited to the population, from which the sample is selected.

1.6 Importance of the study

Criterion-referenced test is an uncultivated field as far as India concerned. There is a wide scope for the development of CFTs for different subjects of all standards at all levels of education. Hence, the present study can be considered as a useful step in the same direction. The importance of the present study of a CRT in Trigonometry can be realized when the following points are taken into consideration:

(1) The present CRT, prepared on Trigonometry can prove to be an effective achievement in Mathematics.

(2) The present CRT, diagnoses very clearly the non-masters examinees in various behavioural domains and can enable a subject-teacher to detect those particular aspects of Trigonometry in which the non-masters are deficient. Consequently, it can provide a definite direction for that kind of remedial instruction which is necessary to be given to each of the non-masters examinees. Thus, the test under reference can become the important tool for the diagnosis and remedy.
(3) The present study of CRT can provide feedback to the students in their learning as well as to the teachers to their day to day instruction and thus it can improve the entire teaching-learning process. "A relatively new dimension of student feedback is the use of a criterion-referenced response items. Criterion-referenced items are those that make specific reference to course objectives (Content and Methodology Gerald D. Bailey")\(^1\)

(4) The present CRT can reveal those particular reforms which are necessary is be made in the plan implicated by the teachers for teaching Trigonometry unit.

(5) The present CRT can enable a teacher to evaluate his/her teaching work.

(6) The present CRT can be helpful in examining the effectiveness of the learning literature such as the text-books and other references regarding Trigonometry.

(7) The present CRT can classify the examinees into masters and non-masters with the help of cut-off scores for each behavioural domain.

(8) The present CRT can be used as a mastery test. Such type of tests are used in mastery learning.

(9) The test developed for the present study can be useful in the beginning, middle and at the end of the teaching of Trigonometry unit in Mathematics.

(10) The Government of India has given more importance for child-centered education in the New Education Policy. The present CRT can be capable by keeping the students in the centre through unit and constant evaluation.
1.7 Design of the study

The design of the present study is decided according to Hambleton's 12 steps for development and standardization. Some of these steps had to be specified more detailed way and the serial order of the steps had to be changed in view of the position of CRT in India.

1.7.1 Preliminary Considerations

(a) Test purpose: It was decided in view the following two fold purpose of the present CRT:

(i) To estimate examinees' domain score

(ii) To allocate examinees' to mastery states.

(b) Specification of content area

After the review of CRTs developed in the Gujarat, the researcher has decided to prepare the CRT in Mathematics for Std. X. From the curriculum as well as the text-book of Mathematics prescribed for Std. X, it was decided to prepare CRT on a new concept of Trigonometry. The topic of Trigonometry is very useful for future study of the course of Mathematics for higher-secondary section. Trigonometry is a very useful aspects in New Mathematics.

(c) Identification of groups to be measured

It was decided to select the students (boys and girls) studying in standard X of Gujarati Medium schools of urban area of Sidhpur town.

(d) Identification of qualified staff
It was decided to get opinion from six subject-matter experts regarding the domain specification, logical review and content validity.

1.7.2 Domain Specification

After the decision of test purpose and specification of content area, it is necessary to specify the domains related to the unit of the present study.

Baker illustrates the domain as under:

"Domain refers to the specifically circumscribed universe from which performance is sampled and to which performance is expected to generalize." 15

It is very easy to write items if domains are specified according to the content area. Hambleton writes that:

"Well-defined objectives make the task of writing test items easier and improve the quality of test score interpretations. Item writing is easier because appropriate content is spelled out. The quality of test score interpretations is improved because of the clarity of the content or behavior domains to which test scores are referenced." 16

The researcher has classified the unit of Trigonometry in twelve domains. After the domains' decision, the objective for each domain was formed on the basis of content of the standard X. These domain and their objectives for the test were reviewed by the subject matter experts whether they are appropriate or not.

1.7.3 Item-Writing

The main task of CRT is to measure the achievement of a student and improvement of education. This measurement becomes scientific and reliable...
when item-writing should be carefully undertaken. According to Haladyna.T.M. and Roid G.H.17 (1981) the following item-writing techniques are very useful to remove subjectivity of item-writers.

(a) Item for prose learning

(b) The mapping sentence method/facet Design.

(c) Item-form

(d) Domain based concept testing

(e) Logical Operations for generating intended questions.

(f) Instructional quality inventory.

1.7.4 Logical Review of Test Items

The researcher has adopted item objective congruence index (IOCI) for the logical review of items for the following reasons:

(a) The most important characteristic is item objective congruence.

(b) IOCI is widely used by the researchers.

The logical review of test items consisted of the following steps:

(i) selection of subject-matter experts

(ii) collection of rating of items and

(iii) calculation of IOCI.

1.7.5 Revision of Test Items

It was decided to revise the item/items found faulty by the subject-matter experts.

1.7.6 Empirical Review of Test Items
It was decided to adopt the instructional sensitivity approach for the empirical review of CRT items in the light of Berk's\textsuperscript{18} (1984, chap-5) recommendation that the instructional sensitivity is considered to be the best approach for empirical review. When working with CRT, it seems clear that instructional sensitivity is a worthy replacement for discrimination. Instructional sensitivity is a useful and unique CRT item characteristic. It was decided to adopt the method of pre-to-post difference index (PPDI) out of the three methods viz. (a) PPDI; (b) percentage of possible gain (PPG) and (c) Brennan index suggested by Roid and Haladyna\textsuperscript{19} (1982). From the study made by Crehan\textsuperscript{20} (1974), Herbig (1976)\textsuperscript{21} and Thrash\textsuperscript{22} (1978), it was found that PPDI item analysis technique is more suited to the CRT.

The present empirical review was done by PPDI technique due to the following reasons:

(i) PPDI is the simplest and probably the most effective technique.

(ii) The interpretation of PPDI is quite direct and does not require the assumption of a complex mathematical model.

The present empirical review consisted of the following steps:

(i) Selection of criterion groups;

(ii) Pretest, instruction and post test;

(iii) Collection of student feedback;

(iv) Calculation of the difficulty level of the items and

(v) Calculation of PPDI.

1.7.7 Revision of Test Items
It was decided to revise the empirically reviewed item/items if any deficiency was found in them.

1.7.8 Test Assembly

After the logical and empirical reviews, the final form of the CRT was prepared. For this the following aspects were taken into consideration:

(a) It was decided to have at least eight items per domain in the final form.

(b) It was decided to assign one mark for each correct answer and a zero for an incorrect one.

(c) It was also decided to keep a common sheet for questions and answers.

(d) It was decided to get the personnel data of the students and to give necessary instruction as well as sufficient time for the test.

(e) The present study of CRT have one form for the pretest and post test.

(f) Items for the final form were selected by random sampling model.

Haladyna and Roid (1983) observes that:

"Random sampling is prominent in discussing of generalizability theory and CR Testing. When the items have been randomly sampled from a domain, the observed proportion of correct items provides an unbiased, maximum likelihood estimate of student's domain score." 23

From the final form, researcher decided to collect and analysis data in the form of response of examinees of the establishment of validity and reliability as well as for the determination of the cut-off scores.

1.7.9 Validity
It was decided to establish three types of validity viz. content, construct and criterion related.

The establishment of content validity consisted of the following points:

(i) selection of subject-matter experts;
(ii) collection of rating of items;
(iii) collection of indicatory signs made by the panel of subject-matter experts and
(iv) calculation of IOCl.

Thus content validity was decided as recommended by Hambleton\(^2\) (1984).

It was decided to adopt the graph theory for establishing the construct validity by Tatsuoka\(^2\) (1986). The establishment of construct validity consisted of the following steps:

(i) Collection of posttest responses;
(ii) Preparation of person x item matrix;
(iii) Arrangement of items into descending order—from difficult to easy;
(iv) Preparation of item dominance matrix and
(v) Calculation of unidimensionality index.

It was decided to establish criterion-related validity of CRT score based on comparison of examinees’ performance on the final test before and after instruction as recommended by Hambleton\(^2\) (1984).

The establishment of criterion-related validity consisted of the following steps:

(i) Collection of pre-post test responses of examinees;
1.7.10 Reliability

It was decided, in the light of Hambleton's (1976) suggestion, to adopt the method of proportion correct score estimate for estimating the domain score as another purpose of the present test was to estimate examinees' domain score of each behavioural domain. In this connection, Roid's following remark is not-worthy :

"Precise estimates of domain score can be derived under two conditions: (a) where the domain is sufficiently specific such that all items can be generated or listed; and (b) items composing a test for the domain are selected by random or stratified-random sampling from the domain." 27

It was decided to calculate the standard error of measurement for examining the reliability of the domain score. The method suggested by Millman was adopted for this purpose (cited by Hambleton, 28 1985).

The establishment of reliability consisted of the following steps:

(a) Collection of examinees' responses;
(b) Calculation of proportion correct score estimate and
(c) Calculation of standard error of measurement.

To classify examinees into mastery-nonmastery states on each of the behavioural domains included in the test was one of the purposes of the present test. It was decided to adopt Swaminathan et al.'s (1974,) approach and Cohen's Kappa index within that approach for establishing the reliability of mastery classification decision. This approach involved the following steps:

(i) Administration of the form as the pretest and post test;
(ii) Collection of examinees' responses;
(iii) Classification of examinees into four categories and
(iv) Calculation of 'K' index.

1.7.11 Selection of standard

It was decided to set cut-off scores on the basis of Berk's \(^{31}\) (1976) method which falls within the empirical category to classify the examinees into master nonmaster categories.

As Berk observed that the method that employed mutually opposite groups such as instructed-uninstructed groups or pre-post test responses was the best. The probability of correct decision method in determining cut-off score involves the following steps:

(a) instructed-uninstructed groups

(b) collection of examinees' responses

(c) preparation of frequency based distribution based on pre-post tests,

(d) calculations (probabilities of correct decision, misclassification errors and base rate) and

(e) determination of optimal cut-off score.

1.7.12 Test Manual

It was decided to prepare a test administrator's manual and a technical manual for the test.

1.8 The Plan of the Succeeding chapters

The succeeding chapters No 2,3,4,5 and 6 deal with the following points:
(a) Chapter 2 contains Criterion Referenced Test Theory.

(b) Chapter 3 Contains Review of Literature regarding CRTs.

(c) Chapter 4 is designed for the construction and Try-out of the CRT. In this chapter, preliminary considerations, domain specification, review of domain specification, item-writing, items' review by logical review an empirical review, preparation of final form, administration of the final test.

(d) Chapter 5 is designed to find reliability and validity of the present CRT score.

(e) Chapter 6 is devoted for summary, findings, recommendations and suggestions for future research.
FOOTNOTES


6 Ibid., p-7.


