

CHAPTER 4

METHODOLOGY

4.0 DATABASE AND DEVELOPMENT OF TOOLS

The interest in conducting evaluation is to determine whether the curriculum as designed, developed and implemented is producing the desired results (Ornstein & Hunkins, 1988). Evaluation thus serves to identify the strengths and weaknesses of a curriculum.

The review presented in the earlier pages showed that the process of evaluation involves

- Understanding of curriculum objectives
- Determining and gathering data about the curriculum in action.
- Interpreting the data/evidence collected
- Using the information gained to make decisions about the curriculum

The present study endeavours to evaluate the science curriculum through seeking the data from classroom observation, questionnaire and interviews with secondary school teachers working in schools at Vadodara about

Appropriateness of the curriculum (with reference to Scientific literacy).

The curriculum as it was planned and as it developed, including examining of curriculum transaction.

The underlying principles of the subject matter.

The correlation between the planned and transacted curriculum.

The opinion of the users (teachers) of the curriculum.

The relevance of the curriculum to STS issues.

The extent of the attainment of the goals of the science curriculum.

The present study comprises of investigation in the naturally occurring contexts i.e., the classroom situation in the secondary schools at Vadodara as well as data obtained through survey of schoolteachers.

4.1 DEVELOPMENT OF DATABASE

This study is based on the collection of data necessary to seek answers in tune with the research questions and objectives formulated for interpretation. Participation in class room sessions for observation of the transactions by the investigator were supplemented with

- (i) follow up interviews and
- (ii) a questionnaire circulated to the teachers (including teachers from schools other than those where class room observations were made) to elicit their opinion on different aspects of science curriculum both in its intended objectives and realisation in the operational mode or in its operation in the classroom.

(a) Classroom observations

A curriculum gets operationalised in the classroom through its transaction. Its study, as it manifests in the actual setting, that is the classroom, was the major source for preparing database for further analysis.

The points considered about the classroom observation were:

- Description of the nature of classroom interactions (instructional process)
- Method of teaching
- Nature of type of questions raised by the teacher in the classroom.
- Use of Teaching aids
- Organisation of co-curricular activities in science
- Nature of assignments, if any
- Assessment procedures adopted

Sample :

The sample for actual classroom observation consisted of 16 secondary schools in Varodara city, covering 50 teachers and 240 classroom sessions in science for 8th, 9th and 10th standards.

4.2 FRAMEWORK FOR CLASSROOM OBSERVATION

Based on the review of literature (Wiles and Bondi 1989, Walberg and Haertel 1990), a preliminary set of parameters covering the different aspects of curriculum

evaluation was evolved to systematise the observation and data collection.

The framework for classroom observation was evolved by actually listing down the general classroom practices and review of pertinent literature (Hawthorne, 1992, Goodlad, 1984). After observing a few sessions in the classroom, inter-rater reliability was established through discussion with the teachers. The framework was then revised, improved upon to rationalise and integrate the parameters both for classroom observation and their later analysis.

The aim of observing the science classes was two fold:

- (i) To study the transaction of science curriculum in the classrooms, the main focus being the pedagogic practices.
- (ii) How far the objective of imparting scientific literacy is being realised.

This framework is described as follows :

Milieu : This refers to the classroom environment and focuses on the physical aspects such as:

where the class was conducted, laboratory /field/classroom

the type of displays in the classroom

displays prepared by the students

The *second aspect* of the framework pertains to the pedagogical aspects. In this section the focus was on gathering information on the following :

Instructional activity : This refers to as how the teacher conditions the pupils towards the subject matter. How does the teacher introduce the lesson; does the teacher act as a facilitator of learning or a source of knowledge. Do the learners participate in the instructional activity by initiating discussions, asking relevant questions and spend time in seeking information. Other factors are :

How the teacher initiates a topic

Methodology adopted to convey the subject matter

The type of examples referred

The extent of use of the textbook

The use of methods of science

The use of teaching aids

The organisation of activities within the classroom

The nature of assignments given to the students

The questions asked or generated

The assessment procedures adopted

The *third aspect* relates to nature of teacher-pupil interaction in the classroom.

Teacher pupil interaction :

Whether the classroom environment is lively

Whether there is enthusiasm for learning

Whether the environment is democratic and the students are allowed to express their ideas and opinions

The co-curricular activities organised in science

Classroom observations were noted down and presented in anecdotal form and reproduced verbatim to illustrate and discuss points with reference to the goals/objectives of different aspects of science curriculum.

This type of observation provides information which cannot be reflected in a check list (Goodlad, 1984) and according to Miles and Huberman, 1984) it provides a straight description of concrete happenings as an additional information to the investigator. Its description value is greatly enhanced when the case can be located as an instance of a more 'general class of events'. To achieve this the investigator treats the case in point as either a representative of or a departure from a particular type. This method gains credibility when it contains both subjective and objective methods. This anecdotal form of recording the classroom observation and follow up interviews was followed for this investigation.

4.2.1 Interviews

Classroom observations are not easily subject to public scrutiny. The process of supplementing observations with interviews, and documentary evidence such as the school routine, note books, helps to validate the data (Miles and Huberman, 1984) and was followed.

Nature of Interviews : the interviews conducted were semi-structured with a view

- i. to seek information independently about the science curriculum
- ii. as a follow-up on classroom observations, and

iii. to seek clarification on the response to questionnaires.

1. Interviews about science curriculum

The interview pertained to seeking opinion of the teachers about :

the objectives of teaching science, (clarity and feasibility of objectives),

the coherence of the objectives and the nature of science

the instructional strategies used

the availability of resources. (Time and material)

the appropriateness of the curriculum material, primarily, the prescribed text book.

the assessment methods used

strengths and weaknesses of curriculum.

2. As a follow-up of classroom observation, these interviews sought information about

what the teacher perceives about the objectives of instruction

what factors were considered by the teacher while choosing the instructional strategy

Use of text book and

Constraints in terms of time

3. Seeking clarification on the response to questionnaires

The responses of the teachers were clarified where and necessary through interviews.

4.2.2 Analysis of the data from interview

The data was content analysed and wherever there were agreements or common opinion among teachers interviewed, it was converted into percentages. The data was used to supplement the basic information obtained from classroom observations and questionnaire.

4.3 SUPPLEMENTARY DATA SOURCES

Further data was gathered from documents and other published sources.

4.3.1 Official documents and reports on science education

These have been used to describe the intentions and the rationale and expectations from the present science education in general and the science curriculum at the secondary level in particular. Information on the structural aspects was gathered from these sources. This helped in identifying and understanding the objectives of science education, the status of science in the scheme of studies, the trends in science education, the recommendation about instructional strategies, textbooks and methods of assessment. The official documents used have been listed in the Bibliography and include documents such as National Curriculum Framework for

Elementary and Secondary Education, National policy on Education, Learning without Burden etc.

4.3.2 The Questionnaire

A questionnaire was prepared in order to gather the opinion of the teachers in the schools at Baroda about the various aspects of science curriculum at the secondary level. The items in the questionnaire sought the opinion of the teachers on all aspects of the science curriculum such as objectives, textbooks, resources, co-curricular activities and the strengths and weaknesses of the curriculum.

4.3.3 Data Sample

The questionnaire was circulated among 240 teachers in the secondary schools at Baroda and responses were received from 120 teachers.

4.3.4 Construction of the questionnaire

The first step in the construction of the questionnaire was to identify all those components of the curriculum about which the opinion of the teachers was to be obtained. A review of documents such as National Curricular Framework for Ten Year Schooling, Guidelines for Teaching Science and also review of literature on curriculum evaluation were kept in view in framing the items for the questionnaire.

The questionnaire was subdivided into the following five sections for convenience.

- TEACHERS PROFILE
- SCIENCE CURRICULUM OBJECTIVES
- TEXTBOOK CONTENT
- TEACHING-LEARNING ACTIVITIES
- OVERALL ASSESSMENT OF THE CIRRUICULUM BY TEACHERS

The first draft of the questionnaire had sixty five items in all. This was then referred to five experts in order to obtain their opinion about the validity of the items in the questionnaire as well as the clarity of items and their comprehensibility (Hammersley, 1981, Cohen and Manion, 1981). The feedback obtained from the experts was utilised for revising the tool. The revision was mainly in terms of deleting ambiguous items, rephrasing double-barrelled items and refining the language of certain items. Keeping in view the above points, a second draft of the questionnaire was prepared and referred to five experts to examine their agreement about the semantic and conceptual qualities of the items. The second draft was also used for conducting a pilot study.

4.3.5 Pilot Study

For conducting the pilot study the second draft was circulated to ten secondary school teachers at Vadodara. The results of the pilot study indicated that the questionnaire had adequate clarity in terms of comprehension; responses to the

items indicated that the objectives for which the tool was prepared would be realised. This draft was finally utilized for developing data base from wider circulation of the questionnaire for evaluation of the curriculum in science.

4.3.6 Description of the Questionnaire

The final form of the questionnaire is reproduced in the appendix (IV). Following is the description of this tool.

The questionnaire was preceded by spelling out the objectives of science curriculum at the secondary level and general instructions about the manner of responding to the items on the questionnaire.

Section 1 : Teachers Profile

Information was collected about the respondent teachers on the following points:

Educational qualifications

Teaching experience

Classes taught

In-service training

Section 2 : Science Curriculum Objectives

This section was aimed at gathering the opinion of teachers about the objectives of science teaching in terms of :

Their feasibility

Their clarity

Whether they take into consideration the nature of scientific knowledge and scientific literacy.

Section 3 : Text Book Content

Textbooks form an integral part of any curriculum. Opinion of the teachers was gathered about the textbooks in science at the secondary level on the following aspects.

Correlation of the objectives and textbook content

Presentation of concepts which included the sequencing of topics and also the explanation of concepts.

Areas of content/topic and also the explanation mentioned in the syllabus but not represented in the prescribed textbook, if any.

Factual errors in the content, if any

The nature of illustrations and representation of diagrams and

The general layout of the textbooks

Section 4 : Teaching-Learning Activities

In this section the focus was on gathering information about the curricular transaction in schools on the following aspects:

Number of periods allotted for science per week

Teaching methodology

Scope for laboratory work and nature of experiments conducted

Activities arranged to develop skills related to critical thinking and problem solving.

Activities provided for understanding the instructional process of science

Scope and provision for project work

Scope and provision for science based hobbies

Organisation of co-curricular activities related to science.

Adequacy of reference materials and books in library

Adequacy of audio-visual teaching aids and frequency of their use

Project work assigned to the learners

Section 5 : Overall Assessment of the Curriculum by the Teachers

This section pertains to the teacher's overall opinion about the science curriculum at the secondary level.

Information was sought on:

The capabilities expected to be developed in a learner at the end of the secondary stage of science education.

The strengths and weaknesses of the present science curriculum and classroom practices.

The suggestions for the improvement of science curriculum at the secondary level.

4.4 EVALUATION OF THE CURRICULUM MATERIAL

THE TEXT BOOK

Teaching means implementing curriculum and curriculum comes to the classroom mainly through textbooks. The textbooks act as *de facto* curriculum (Kumar, 1992). In a curriculum evaluation textbook review acquires an important role.

The textbooks at the secondary level (grades 8 to 10) prescribed for study in schools at Vadodara were examined on the following aspects:

Whether the guidelines suggested by NCERT (1990) document have been considered about:

- i. The objectives of science and the content and the dimension of scientific literacy.
- ii. The organisation of the content.
- iii. Explanation of terms, concepts.
- iv. Suggested activities.
- v. Illustrations.
- vi. End-of-the chapter exercises.

4.5 QUESTION PAPERS

Examinations have been an important tool for assessing learners. Any assessment should reflect the nature of subject matter (Collins, 1992). In the present study the analysis of question papers was included. The purpose was to examine the type of questions used for assessing the learner's understanding of science.

Sample : Question papers were collected from the various schools where classroom observations were done. The question papers were those which had been used in the examination in the preceding two years.

Analysis : The questions were analysed to determine whether they tested the information acquired by the learner and the process skills as intended in the objectives.