CHAPTER 1
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1.1.0 BACKGROUND OF STUDY

Curriculum is the heart of any educational system. The central role which the curriculum plays in the educational process makes it important that we should know as much as possible about how curricula function. In recent years there is a growing concern to improve the curriculum of various courses.

Curriculum as a field of study is defined by the range of subject matters with which it is concerned (i.e., the substantive structure) and the procedures of inquiry and practice that it follows (i.e., the syntactical structure.) (Zais, 1976, p.3-4).

Tanner and Tanner (1980) have observed that curriculum has a long past but a short history. Curriculum as a field of systematic inquiry emerged only during the early 1920s. (Foshay, 1969, p.275).

Curriculum research enables educationists to explicate, understand and guide the context, purposes, planning, delivery and acquisition of the subject matter of education in classrooms and related learning environments.

Curriculum research can be classified into four major categories as suggested by Tyler (1949): (i) Research on curricular purposes, (ii) Research on content or "Learning experiences" (iii) Research on "curricular organization" and (iv) Curriculum evaluation.
Curriculum evaluation studies constitute a very important segment of curriculum research. Curriculum evaluation can be defined as the collection and provision of evidence, on the basis of which decisions can be taken about the feasibility, effectiveness and educational value of curricula (Technical Teachers' Training Institute (Western Region), 1977, p1). It can take place during the time the curriculum is developed for the purpose of guiding the developmental process (formative evaluation) or, it can take place after the new curriculum has settled down for the purpose of making an overall assessment or decision with regard to the curriculum (summative evaluation).

We can think of curriculum as a document or as a cluster of phenomena in a live classroom situation. Taylor and Colin (1979) have distinguished between "intended curriculum" and the curriculum in operation or "operational curriculum".

Intended curriculum refers to the curriculum document which embodies educational intentions—knowledge to be understood, skills to be learned and attitudes and values to be acquired. For these intentions to be realized teaching and learning have to take place — the intended curriculum (resulting from curriculum development) has to be operationalized.

The operational curriculum deals with the process of teaching and learning, organization of the class and the milieu in which instruction takes place. Many factors influence/hinder the translation of intended curricula into operational curricula. An understanding of what happens to the intended curricula as they are worked upon in schools and classrooms and the factors which affect them is very much useful in curriculum evaluation.
There are two distinct types of strategies used in curriculum evaluation. One is the scientific/Quantitative approach based on tests of achievement and behavioural criteria. The other is Qualitative approach which is based on informed judgements resulting from observations, interviews, questionnaires and the like. While the first strategy tends to be restricted to only those outcomes which can be objectively assessed the second strategy tends to be subjective. In many cases a hybrid strategy called 'eclectic approach' is necessary. Eclectics draw on both styles at appropriate times and in appropriate amounts.

The best measure of curriculum effectiveness is the percentage of students achieving the course objectives. Criterion referenced tests provide the kind of test score information needed to make a variety of individual and programmatic decisions arising in objectives-based curricular programmes.

Assessment of academic achievement alone can not give a complete picture of the 'operational curriculum'. Many researchers (Fraser, 1981; Walberg & Moos, 1980) have highlighted the need for supplementing achievement measures with classroom environment variables while studying curricular effectiveness.

Student and teacher perceptual measures of the instructional environment in the classrooms have several advantages over observational techniques.

The changes in the educational system like changes in curricula should be based on research results.
According to Desai and Roy (1974, p.269) "it is urgently needed that fundamental research should be emphasised and executed to provide empirical foundations to curricular changes."

As observed by Roy (1979, p.283) although curriculum research in India has started with the dawn of Independence, only in the last ten years the major bulk of the research has been done. Most probably this is the impact of the strong plea for research in this area made by the Education Commission (1966).

Clearly revealing the position of curriculum research in India, Roy (1979, p.283) writes:

"When we look into the studies under review .... quantity and quality of research in the area (viz., curriculum research) for the last three decades do not seem to be very much encouraging. Very few of these studies delved deep into the problems of general curriculum development. Most of them touched the surface problems, and that too covering the middle and secondary school stages ...... . In respect of components of the curriculum, there was a definite lack of attention on knowledge subjects such as Mathematics, Science, History, Geography, Social Studies, etc."

Most of the curriculum research in India has been carried out by institutions like National Council of Educational Research and Training (N.C.E.R.T), Technical Teachers' Training Institutes (TTTIs), Central Institute of English and Foreign Languages (CIEFL) and Central Institute of Indian Languages (CIIL).

Compared to the research conducted by these institutions, studies on 'curriculum research' carried out by individual research scholars in the departments of Education in the Indian Universities is disproportionately smaller. Relative importance given in the past surveys of educational research (Buch, 1974 and 1979) makes this evident.
1.2.0 NEED FOR THE STUDY

Polytechnics in India are offering Diploma courses in Engineering in order to prepare technicians for employment in industries and public services. The term 'technician' is applied to a wide range of responsible jobs involving a higher level of scientific and technical knowledge than that needed by a craftsman but below that needed by a technologist (Young, 1965, p.6).

Recognising the need for developing appropriate curricula for technician courses suited to the needs of the various regions in the country, the Government of India has established, about 15 years ago, curriculum development centres in the four Technical Teachers' Training Institutes, which are located in the four regions of the country. Each of the curriculum development centres offers its services to the various States in the region. The curriculum for technician courses viz., Diploma courses in Engineering offered by the Polytechnics in each State is formulated and prescribed by the Directorate of Technical Education of the concerned State.

Though macro level evaluation of all the subjects included in the curriculum of Diploma courses in Engineering offered by the polytechnics in three States in India (viz., Madhya Pradesh, Gujarat and Andhra Pradesh) have been carried out by the Technical Teachers' Training Institutes (TTTI (Western Region), 1977 & 1982; Brahadeeswaran, Natarajan and Kanakaraj, (1983)) micro level evaluation of the curriculum of a single subject has not yet been undertaken. As the curriculum for the Diploma courses in Engineering (which are of three years duration)
consists of about 35 subjects, macro level evaluation of the entire programme will not provide detailed evaluative information needed for improving the curriculum of a single subject and for making it more effective. For this purpose, micro level evaluations focussed on the curriculum of an individual subject have to be carried out. Such an attempt will enable identification of the strengths and weaknesses of the curriculum and the factors influencing its effectiveness.

Since Mathematics, Physics and Chemistry provide the foundation needed for the preparation of technicians, they have been included as 'Service Courses' in the curriculum of Diploma courses in Engineering. Service course is one which is prescribed as a prerequisite for the main course. Macdonald and David (1972) have identified the problems encountered in offering service courses. Appropriateness of the objectives of the service course to the needs of the main course, handling the heterogeneous background knowledge of students, maintaining student interest, shortage of time, facilities and staff are the main problems faced in offering service courses.

The National workshop on "Development of Applied Sciences and Mathematics curricula relevant to technical and vocational courses" (Technical Teachers' Training Institute (Southern Region), 1980) has highlighted the need for periodic evaluation and improvement of the curricula of the service courses in Mathematics, Physics and Chemistry.

Brahadeeswaran and Ramadoss (1980) have highlighted the purposes of including chemistry in the curricula of technician
courses. Chemistry is included in the curriculum of Diploma courses in Engineering to enable the would-be technicians to understand the nature of engineering materials with which they are to work and to correlate the practical applications of materials with their fundamental properties.

In Tamil Nadu State, the curriculum for Diploma courses in Engineering includes chemistry (theory and practicals) as a separate subject of study. The present curriculum in chemistry was introduced in June, 1982 by the Directorate of Technical Education (D.T.E.) of Government of Tamil Nadu.

Though the D.T.E. of Government of Tamil Nadu revises the curricula of Diploma courses once in three or four years, no systematic effort has been undertaken till date, to determine the extent to which the curriculum in Chemistry is effective and to identify the factors influencing the effectiveness of the curriculum. Such a systematic effort, if made, will directly contribute to the improvement of the curriculum of polytechnic courses and thereby improve the quality and efficiency of technicians turned out by the polytechnics.

Thus there is a felt need for a study to analyse the effectiveness of the Chemistry curriculum.

Further in India research on curriculum evaluation is still in its infancy. Hence whatever crystallises by virtue of an attempt of the kind will be a milestone in the direction of evolving a methodology of curriculum evaluation suited to the educational context prevailing in India.
1.3.0 STATEMENT OF THE PROBLEM

The present study is to analyse the effectiveness of the Chemistry curriculum of Diploma courses in Engineering offered by the Polytechnics in the State of Tamil Nadu.

The Diploma courses in Engineering offered by the Polytechnics in Tamil Nadu are of three years duration. During the First year of the course the students of various Engineering branches (viz. Civil, Mechanical and Electrical) undergo a common programme of study which includes chemistry theory and practicals. In the proposed study this curriculum in chemistry will be evaluated in order to determine how far it had been effective and what factors influence the effectiveness of the curriculum. The problem of the study is stated as 'Analysis of the Effectiveness of Chemistry Curriculum of the Polytechnics'.

1.4.0 OBJECTIVES OF THE STUDY

The following are the objectives of the study.

OBJECTIVE 1

To determine the extent to which the objectives of the chemistry curriculum are achieved by the students in the polytechnics of Tamil Nadu.

Many researchers (Davis et al. 1974 and Orlosky and Smith, 1978) have opined that the best measure of curriculum effectiveness is the percentage of students achieving the objectives of the curriculum. In order to identify the areas of weakness in a curriculum the performance of students has to be analysed objective-wise.
Such an analysis will provide valuable inputs to facilitate (i) learning of various topics (content-areas) and (ii) attainment of the various abilities aimed by the curriculum. Bloom's Taxonomy of objectives (1956) provides a valuable frame of reference for such an analysis. Criterion referenced tests are more suited for assessing curriculum effectiveness than norm referenced tests.

OBJECTIVE 2

To identify the factors influencing the effectiveness of the Chemistry Curriculum.

Many factors influence/constrain the efforts taken to implement the 'intended curriculum' and make it a functional or 'operational curriculum'. These factors may be related to the student, teacher and instructional environment. In order to understand the factors influencing the effectiveness of the curriculum, it is necessary to assess the relationship these bear with curricular performance and further analyse. It is likely that such an analysis will enable to explain the curricular performance in terms of a few factors.

OBJECTIVE 3

To judge the relative contribution of each of the objectives or clusters of objectives of the curriculum to its total effectiveness.

A suitable index of total effectiveness of the curriculum, will be arrived at. The objectives of the curriculum can be classified into various clusters based on the category of ability
according to Bloom's Taxonomy (1956). The actual contribution made by each cluster of objectives to the total effectiveness of the curriculum when compared with the possible contribution will reveal which objectives are emphasized more (during curricular implementation) at the expense of other objectives. Further, the analysis planned for objective No.2 will also, throw light on the relative contribution of various clusters of objectives of the curriculum to its total effectiveness.

OBJECTIVE 4

To suggest changes to be made in the curriculum to make the second generation programme more effective.

Curriculum evaluation activities provide information useful in course improvement. Based on the multiple perspectives obtained by analysing the data collected from various information sources and by analysing the curriculum document, it is possible to suggest the changes to be made in the curriculum in order to make the next generation programme more effective.

1.5.0 SCOPE AND DELIMITATIONS

The scope of the study is delimited by the following aspects.

(i) The study is limited to the Chemistry curriculum of the Diploma courses in Civil, Mechanical and Electrical Engineering branches, which are offered by most of the Polytechnics in the State of Tamil Nadu. The curriculum in Chemistry is common to all the three branches cited.
(ii) The curriculum in Chemistry for the courses cited above is taught and completed in one academic year i.e. during the first year of the Diploma course. Hence the data of the study is limited to the academic year 1984-85.

(iii) The curriculum in Chemistry consists of two parts-viz., Theory and Practicals. The study covers both the parts of the curriculum.

(iv) Though all the polytechnics in the State of Tamil Nadu form the universe for the study, it is limited to the polytechnics in the city of Madras (capital city of Tamil Nadu State), because what is aimed, as will be known, is a multiphased, intensive and thorough study.

(v) By virtue of the number of teachers teaching chemistry to the few first year classes to be chosen as sample in this study remaining very limited, teacher perceptions of the instructional environment assume only a subsidiary and peripheral role. That is, data on students will provide substance to the main analysis in the study.

1.6.0 DEFINITION OF TERMS

The following definitions are presented in order to facilitate a clear and meaningful interpretation of the vocabulary used in this report.

1. Polytechnic

Institution which provides education and training in various branches of engineering to prepare technicians.
2. Main Course
Any course which is studied as an end in itself, or which constitutes a major reason for the student attending the educational institution is designated as a main course.

3. Service Course
Service course is one which is prescribed as a prerequisite for the main course (e.g., Mathematics or Science for courses in engineering)

4. Intended Curriculum
Intended curriculum refers to the prescriptions in the curriculum document. This document contains some or all of the following: Objectives of the curriculum, content details, time schedules, guidelines to teaching and learning and the performance standards expected. (Taylor and Colin, 1979, p.109)

5. Operational Curriculum
When an "intended curriculum" is enacted (implemented) in a classroom or given life through teaching, it becomes an "Operational Curriculum". The operational curriculum deals with the processes of teaching and learning, organization of the class and the milieu in which instruction takes place. (Taylor and Colin, 1979, p.109-122)

6. Second Generation Programme
Second generation programme refers to the updated version of an old programme which responds better to the existing needs of the system than did the previous programme. (Lewey, 1977, p.23)
7. **Effectiveness**

Effectiveness of the curriculum is measured in terms of the percentage of students achieving each of the objectives of the curriculum. (adapted from David et al. 1974, p.11) An overall index of programme effectiveness is provided by the 'Gain Ratio' which measures gain as a proportion of possible gain. (McGuigan and Peters, 1965)

8. **Criterion Referenced Test**

A test used to ascertain an individual's status (mastery/non-mastery) with respect to a well defined behaviour domain. (adapted from Popham, 1975 p.130.)

9. **Cut-off Score**

Cut-off score is the criterion - level (i.e. minimum level of performance) fixed for deciding whether a student has mastered the domain represented by a criterion referenced test.

10. **Master**

A student whose score in a criterion referenced test is equal to or higher than the cut-off score specified as criterion.

11. **Non-master**

A student whose score in a criterion referenced test is below the cut-off score specified as criterion.

12. **Sub-test**

The term 'sub-test' refers to an assembly of criterion referenced tests which measure the same category of behavioural ability in the Bloom's (1956) Taxonomy of educational objectives. (e.g. sub-test on Knowledge of specifics)
13. **Instructional Environment**

The conditions, circumstances and influences which prevail in the classrooms/laboratories during implementation of the curriculum through instruction.

14. **Macro Level Evaluation**

Evaluation of the overall effectiveness of the whole programme of different subjects prescribed as curriculum for the entire course.

15. **Micro Level Evaluation**

Detailed evaluation of the curriculum of an individual subject, included in the programme of study for a particular course.

The report of the research study has been presented in the following four chapters. The second chapter presents the review of related literature. The design of the study is described in the third chapter. The fourth chapter deals with the analysis of data and findings. The fifth chapter consists of a summary of research design, findings, conclusions and their implications.