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2.0 INTRODUCTION:

The discipline of education today comprises many and varied field of human inquiries and science has the major share. It is rightly said that the human progress is largely the progress of science and technology. India like many other countries has a colonial past. In 1947, with the emergence of India as an independent nation increasing attention has been paid to the maximum utilization of its resources by developing agriculture and industry aiming at economic growth and prosperity of the nation. Considering the role of education in general and science education in particular for the national development, the Government of India has taken keen interest in reforming the existing system of education in order to fit it best to the national development in the country. The curriculum and the syllabi from class VIII to class X have been modified and introduced all over the country with special emphasis on science education. The basic objectives of this curriculum have been derived from the National Education Policy for providing a meaningful education to the learner. The main ideas in this regard are to make the learner well acquainted with the resources around him and develop scientific outlook in order to enable him/her to use scientific knowledge to solve various problems of everyday life.

Secondary education in the country is both preparatory and terminal stages of education. It is terminal for the vast majority of learners who leave school as semi-skilled manpower and join the various developmental sector of the country; and preparatory stage for a few who desire to go for higher education. It is a preparatory stage of education where the basic
science is taught for building up a career with the knowledge of science i.e., Doctors, Engineers, Technologists and the Scientists.

Harbison and Myers (1962), also prescribes that,

"The reform and expansion of secondary education, placing stress on teaching fundamentals of science and mathematics for developing countries, to build the base for industrialization and agricultural expansion. Therefore, the science education has become a major concern in India for its agricultural and industrial developments."\(^{(1)}\)

2.1 CONCEPT OF SCIENCE EDUCATION:

The discipline of education today comprises many and varied field of human inquiries and science has the major share. It is rightly said that the human progress is largely the progress of science and technology. Considering the role of science education for the national development, the Government of India has taken keen interest in reforming the existing system of science education in order to fit it best to the development of the country. The main ideas in this regard are to make the learner well acquainted with the resources around him and develop scientific outlook in order to enable him/her to use scientific knowledge to solve various problems. So, high priority is being given for science education in National education policy.

Science and technology is the totality of experience; it is much more than subject matter. It is as broad as experience itself. It is experience with facts and principles of content, experience in the development of attitudes, habits, skills and many more. The science education becomes a series of those school experiences that involve, promote or depend upon the method and content of science and their relation to the life of the students. The present science education system promotes different kind of role for development. The objectives of science education as a whole till the secondary level as considered in the curriculum is:
- To develop interest and curiosity about the natural phenomenon and environment;
- To develop the ability for using scientific method of work;
- To develop ability to think logically;
- To help to develop certain vocational productive skills
- To develop in learner a system of values related to their personal and cultural life.
- To help the students to improve their quality of life and those around them through useful conservation of natural resources;
- To develop skills of observations through the study of natural environment around the students;
- To link science education to productivity;

For teaching science education at the secondary level the qualifications required for a teacher; students after pursuing basic graduation or post graduation degree in pure science subject join teachers training institute if they have a will of becoming qualified science teacher at secondary or higher secondary school. B.Ed. course grooms them towards objective of science education, explains about various science methodology, techniques to be used while delivering science content, evaluating students in science subject etc. Teachers training programme helps in producing a proficient science teacher.

Science teacher is essential to keep them aware of modern developments and new methods of teaching. To develop proficiency in secondary school science teacher Gujarat government organizes seminars, trainings and work-shops. For effective teaching in the class room science teacher must have knowledge of various kinds of teaching materials, skills, methods, laboratory, evaluation process etc.
2.2 CONCEPT OF PROFICIENCY:

From the historical point of view, the term proficiency is not new. Kinney (1952) in co-operation with California Council of Teacher Education used the term in his study, 'The Measurement of Good Teacher'. Although educators have referred to proficiencies over two decades, still there is lack of agreement among educators as to what constitutes proficiency and how to describe it. 

To some educators, proficiency is seen as the application of knowledge; to others, it is knowledge and skill combined; still others maintain that knowledge and skill constitute separate proficiencies. Some equate proficiencies with behavioral objectives; others see proficiencies as moral global and general; some hold that proficiency like a behavioral objective demands a very specific set of knowledge; while others state that proficiencies address only broad process skills that are essentially content and knowledge-free. Some claim that only directly measurable performance comprises proficiency, while others maintains that unexpected and immeasurable learning outcomes are included in the concept of proficiency;

Brunner (1974), mentioned that,

"The proficiency is not only confined to problem solving, but also problem finding. Teacher effectiveness is not only characteristics of the individual teacher but something shared by the teacher and pupils. How effective the particular teacher is, depend on the nature of the pupil who is being affected." (3)

According to Flanders (1970),

"Teacher effectiveness as an area of research which is concerned with relationships between the characteristics of teachers, teaching activities and their effects on the educational outcome of classroom teaching." (4)
It is seen that there is disagreement among educators about the concept of proficiency. The move from ‘performance’ to proficiency is one way of looking at the next stage of development in science education. Teachers have learnt to ‘perform’ teaching science as inquiry rather than as a collection of information; they have learnt to ‘perform’ experiments. A variety of skills which should enable a teacher to teach science as inquiry, as problem oriented activity, and enables a teacher to teach science considering the students’ environment.

There has always been a quest for quality-education which warrants a set of competent teachers to translate the national objectives into action in the classrooms. Questions automatically arise: what this proficiency means and how it could be generated in the teachers? These questions have attracted the attention of teachers, administrators, researchers and others who are interested in the quality of education since several decades as it is directly related with the quality of education as well as qualities of teachers, a society needs.

It is essential to study what goes on in the classroom and how they are related with achieving the objectives. The effectiveness of the teachers counts a great deal in translating these objectives into learning outcomes on the pupils. As such teacher proficiency plays a vital role in the entire teaching learning process. The Gujarat secondary education board attributes to teaching of science as a major thrust area for development. Hence, the proficiency of the science teachers (secondary education) of the Gujarat government is regarded as the most essential in the present day of demand.

2.3 TEACHING PROFICIENCIES:

Continuing efforts have been made over the years to describe the attitudes of an effective teacher and to identify the skills which good teachers must possess, because once the necessary skills are identifies,
training programmes would be established by the professional education instruction, so that pre-service teachers may achieve their skills.

Oliva (1972) analyses teaching through examining what an effective teacher is, rather than what an effective teacher does. He also described an effective teacher as one whom:

1. Has a broad general knowledge in education.
2. Is fully prepared in his/her subject.
3. Understands the role of schools in the society.
4. Holds an adequate concept of himself/herself.
5. Understands basic principles of the learning process.
6. Demonstrates effective techniques of instruction.
7. Efficiently handles management of the classroom.

But current efforts to describe effective teaching focuses on specification of performance or proficiencies which the teacher may be expected to demonstrate. When the teacher’s behaviors and expected performance are specified, the teacher can work to prepare himself to perform in the desired manner and teacher education programme can be designed accordingly.\(^{(5)}\)

Efforts have been made in recent years to specify the skills which are generic or common to teachers at all levels.

Allen and Ryan\(^{(6)}\)(1969) have suggested fourteen such skills;

1. Stimulus variation
2. Set induction
3. Closure
4. Silence and non-verbal cues
5. Reinforcement of student participation
6. Fluency in asking questions
7. Probing questions
8. Higher order questions
9. Divergent questions
10. Recognizing attending behavior
11. Illustrating and using examples
12. Lecturing
13. Planned repetition and

Copper, Jones and Weber (1973) have specified and explained four different bases related to teacher proficiencies. These are: (a) Philosophical base (b) Empirical base (c) Subject matter base (d) Practioner base. All the four different bases, from which statement of teaching proficiencies can be generated, are important.

The State of Florida has been a leader in the identification of generic teacher proficiencies and in the movement of proficiency based teacher education. In 1975, the Council of teacher Education, a group of prominent educators appointed by the State Board of Education spear-headed a project to identify those proficiencies which are most essential to all teachers. The council involved a large number of educational personnel throughout the State and conducted an extensive review of similar research in Florida and other States. Forty eight generic proficiencies which consistently appeared from investigation were selected for a final survey instrument. A random sample of five percent of all certified personnel in the state were asked to rate the proficiencies. Twenty three proficiencies met the acceptance criteria. So the State of Florida has included the twenty three generic proficiencies in state Policy, requiring all persons to demonstrate them in order to be certified as a teacher in the State.

Those twenty three generic proficiencies are grouped around five major categories are as follows.

(a) Communication skills;
(b) Basic knowledge;
(c) Technical skills;
(d) Administrative skills and
(e) Interpersonal skills.

2.4 PROFICIENCY OF SCIENCE TEACHER:

Simpson and Brown (1977) in their study have identified and validated seven fundamental areas of skills, representing basic science teaching proficiencies. The skills are as follows: (1) knowledge of science (2) professional knowledge and attitude (3) planning skills (4) instructional skills (5) management skills and (6) evaluation skills.

With these six areas of skills a list of thirty basic proficiencies for teaching secondary school science is prepared are as follows.

The six major groups of proficiencies are:

I. Proficiencies related to pre-instructional
II. Proficiencies related to presentation of lesson
III. Proficiencies related to develop interest, attitude and values
IV. Proficiencies related to apparatus, chemicals and teaching aids
V. Proficiencies related to laboratory procedure and techniques (use)
VI. Proficiencies related to evaluation

The list of science teaching proficiencies are given hereunder.

Proficiency related to planning for science

1. Selecting content.
2. Organizing content.
3. Identifying and stating objectives.
4. Classifying objectives according to domains.
5. Selecting appropriate teaching methods.
6. Choosing teaching-aids.
7. Structuring ways of evaluation.
Proficiencies related to presentation of lesson
8. Introducing lesson and sustaining attention.
10. Explaining concepts and principles.
11. Asking questions.
12. Increasing pupil participation.
13. Conducting lecture effectively.
15. Demonstration
16. Organizing and supervising field trips.
17. Giving home-work and assignments.
18. Maintaining classroom discipline.
19. Closing the lesson.

Proficiencies related to develop interest, attitude and values
20. Develop students’ interest towards science.
21. Develop students’ attitude towards science.
22. Develop students’ values towards science.

Proficiencies related to apparatus, chemicals and teaching aids
23. Using apparatus, instrument and chemicals.
24. Using teaching aids.

Proficiencies related to laboratory (procedure and use)
25. Conducting laboratory activities.
26. Maintaining safety in the laboratory.

Proficiencies related to evaluation
27. Developing different types of test items.
28. Classifying test items into domains.
29. Preparing results.
30. Using results.
Thus, from the above presentation it can be understood that to know the quality of teaching, the analysis of effective teaching has to be done in a more specific way. Therefore, it should be more meaningful to identify those desirable proficiencies of science teachers in teaching of science for the purpose of finding out the factors which influence the teachers to be proficient one. These factors may also give us an idea about the necessary inputs that are to be provided in our teacher development programme. In the light of above discussion the investigator arrived at the proficiencies and prepared the draft of proficiencies list.

2.5 RATIONAL OF THE STUDY:

In order to chalk out any meaningful programme of quality improvement, we shall have to first identify determinants of quality education. Physical facilities, qualified and proficient teachers, curriculum and instructional materials, support materials and equipments, teaching learning strategies, comprehensive and continuous evaluation, and effective management are the major determinants of quality of education. By improving the quality of each one of those elements, we can hope to bring about significant improvement in the overall quality of education. Availability of minimum required facilities is a must for ensuring desirable standards of education. In Gujarat many primary and secondary schools do not have even the basic facilities. In the majority of secondary schools, science laboratories had shortage of water, electricity and gas supply. The schools’ libraries had very poor collection of books of science. A large number of the schools of Gujarat had no playgrounds. The building and facilities may not appear to be directly related to the quality of instruction but these are undoubtedly the pre-requisites for any programmed aimed at qualitative improvement of education. It is true that first we create building and facilities and then building and facilities create us.
Teacher is the most vital input in an educational system. Availability of teachers is inadequate in number and the level of their proficiency is most essential ingredients to move towards excellence in education. In the absence of institutionalization of in-service training programmes on a continuing basis, teacher’s skills and proficiencies are fast becoming outdated. They need to be trained in the use of progressive methods of teaching and modern educational technologies. Above all, it is the motivation and professional attitude where our teachers are lacking in. It is well recognized that hidden curriculum plays more significant role than the manifest or stated curriculum in shaping the personality procedures for the requirements are made more rigorous by putting more premium on personality traits of prospective teachers.

The teacher occupies unquestionable position in the entire process of education. The super structure of education will be weak and ineffective if strong infrastructures in shape of proficient teachers are not embodied in the process of education. It is not the qualifications or training but the quality that counts, and the proficiency gives rise to the quality in teaching.

The study done by Aziz (1984) has pointed out that during the period of long twenty years no initiative has taken to assess the status of science education in the country. In 1977 the Government of Bangladesh has reformed the curriculum and syllabus of the school education. As per modifications, Science become has a compulsory subject at all stages of school education.

In India too, Teacher education is almost without a sound research base and it would continue to be so if it does not think of alternatives. Though a number of related studies lay a foundation of criteria of science teacher proficiencies, still this study may bridge the gap in teacher education programmes; and teacher proficiency profiles may lay foundation for proficient teacher preparation. Apart from these, this study
may help to know the status of science teacher proficiency in the classroom of Gujarat.

The investigator is thus prompted by this quality of teaching, and is interested to study the nature and concept of proficiency and how it has a direct bearing on teaching of science in Gujarat. In other words, the researcher has attempted to assess the proficiency of the science teachers in secondary schools of Gujarat.

There is almost no empirical study in the field of teacher effectiveness in Gujarat. Similar is the case of India and abroad. Teacher education has suffered a great deal during the last fifty years or so due to lack of experimental and innovative practices and sustain research work. Therefore, the present study is an attempt to investigate proficiency of the science teachers in teaching of science, and to identify the relationship between the proficiency and inherent capacity of science teacher, his academic background, and environmental facilities both in home and school.
CHAPTER REFERENCE


