INTRODUCTION

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1.1 IMPORTANCE OF MATHEMATICS

Modern age is an age of science and technology, Advancement in technology space, science, atomic research, commerce and trade are some of the factors which placed a special emphasis on the teaching of mathematics at all levels of instruction, i.e. it may be primary, secondary or higher secondary. Neglect of mathematics does injury to all knowledge, as it has connection with all the other subjects. (Bruner 1962). Knowledge of Mathematics is essential in solving social economic and technical problems. Whenever quantitative facts and relationships have to be dealt with or whenever questions are faced that involve space and form, mathematics has a good contribution to make. The significance of this contribution is steadily increasing. Mathematics has been considered as one of the greatest realms of human intellectual achievement.

In the modern technological and scientific era the scope of mathematics is far beyond mere numbers, space, computations, astronomy, music or fine arts. Mathematics is important not only for individual but also for the progress of the nation and human civilization. Moreover, it has provided us with most powerful practical tools to tackle all kinds of problems. Besides being an independent subject of study, it has its application in almost all other subjects.

Several mathematical concepts are being used by scientists to bring about a co-ordination among the knowledge of physics, chemistry, biology and agriculture. Social sciences like economics, sociology and politics require the use of many mathematical and statistical techniques for explanation of certain key ideas. Psychologists make use of mathematics and statistics to study different aspects on human behaviour such as ability, personality, crime and delinquency. The mathematics is also used in commerce. The mathematics of probability and linear programming is being applied in business management to schedule production and distribution. Thus mathematics is the synthesis of all sciences and all arts. Mathematics is the estate on which other subjects are cultivated. In the present technological, electronic and computer dominated age no scientific and technological advancement can be made without mathematics.

1.1.1 MATHEMATICS AS A SUBJECT

Mathematics is not merely counting, measuring or manipulating formulae but a way of thinking using deductives and inductive reasoning. It is one of the most dynamic subjects because of the prospects of existing new discoveries. It is an instrument of education found to be in keeping with the need of human mind. It is a self contained mental discipline with its own language, symbolism and structure. According to the Universal Dictionary (1988) "Mathematics when used with a singular verb, means the study of number, form arrangement and associated relationships,

using rigorously defined literal, numerical and operational symbols. When used with plural verb, means the application of mathematics to a calculation or problem. In the same sense of academic subject mathematics takes a singular verb."

The chief branches of mathematics studied at school and college level are:

ARITHMETIC :

The mathematics of integers under simple operations such as addition, subtraction, multiplication and division.

ALGEBRA :

A generalisation of arithmetic in which symbols, usually letters of the alphabet, represent numbers and are related by operations that hold for all numbers in the set.

GEOMETRY

The mathematics of the properties, measurement and relationships of points, lines, angles, surfaces and solids. Again geometry has sub-branches.

Trignometry - The study of the ratio of the sides of a right angled triangle.

Analytical geometry - The analysis of geometrical structures and properties principally by algeleraic operations on variables defined in terms of position co-ordinates.

Calculus - A method of analysis or calculation using a special symbolic notation.

Calculus is a fundamental aspect of modern physics and various other subjects.

1.1.2 NEED FOR MATHEMATICS

The teaching of mathematics must receive adequate attention, as curriculum in this subject has to meet three kinds of demands :

1. Demands of the subject itself.
2. Demands of the learner.
3. Demands of the society.

The knowledge of mathematics is growing very fast as a result of researches carried by research scholars in this field. Therefore, many new branches of mathematics have been discovered that the proving to be very useful to this scientific and technological revolution. Similarly every learner has to be acquainted with basic notions of, every branch, so that his knowledge does not remain incomplete. At the same time characteristics of growth and development of the learner have to be taken care of while planning curriculum and taking decisions regarding methodology of teaching and mode of evaluation.

1.2 GROWTH OF MATHEMATICS AT PRIMARY LEVEL

Mathematics education at the elementary school level is the first step towards the mathematics education as a whole.

It is often been found that who have not fared well in their elementary schools are destined to have unsuccessful and frustrating experience in their school career. (Bruner, 1966) one cannot deny the fact that achievement in mathematics relates to other achievement of persons in different fields. Therefore one must keep in mind that no level of mathematics is more important to people than that which they learn in the elementary school where foundation is held. For careful consideration of mathematics education at the elementary school level the first question one must ask is:"How much and what kind of mathematics is the mind of a child able to absorb?" The answer cannot be debated it is a matter of experiment and also partly depends on "how mathematics is taught and what books are followed". According to Piaget, Bruner, Zolten Deness and others (Ref.Mathematics in Primary Education, UNESCO, 1966) the age period 10 to 12 years is very important in a child's life. Piaget (1955) says that it is a period during which deductive thought processes starts in child's mind and also this is a concrete operational stage. Bruner and Zolten Dienes (1966) considered this stage as a very important one in which fairly sophisticated mathematics thinking can take place. Patrick Suppes (1966) once a Director of Standford's Institute for Mathematics studies in the social sciences and a Professor of Physiology and statistics experimented on 8000 Californian children belonging to the age group of 6 to 12 and some in San Francisco Bay area in 1961-63. However, it was found that beginners were okay but specially the children belonging to

the age group of 10 to 12 develops, like and dislikes towards mathematics. i.e., as per our Indian curriculum the students belonging to class V, VI and VII. This means if the interest is created for mathematics at this particular age. i.e., at elementary stage, the child can definitely have interest for that subject.

In the developing countries like ours children mainly depend on textbooks so if they do not find textbooks interesting then, that particular subject is also minimised. Specially in a subject like mathematics child has to think. He cannot mug up the things, hence he needs a special interest for that subject.

1.3 IMPORTANCE OF TEXTBOOK

Textbooks have always been considered as standard means of instruction in given subject of study. They can be used for self learning by the students either in classroom or at home. A textbook stimulates the interest of the student and provides extended and orgnised learning experiences. According to Buckingham (1960) the textbook in the modern sense is a learning instrument usually employed in schools and colleges to support a programme of instructions, Dave (1968) suggested a textbook is usually designed for producing variety of instructions inside and outside the classroom which ultimately results into learning. Thus, textbook is a powerful instrument for generating a variety of educational interactions. Taneja (1972) indicates that a textbook is

equally important for the teacher as it defines and delimits the content of teaching. It helps in planning as well as conducting the programme stressing the importance of textbook. Brown (1978) has mentioned that there is no substitute for the textbook. Though there are new developments like tape recorder and television but they play secondary role. Therefore a textbook is one of the most widely used instructional aids to establish communication between the students and the teacher. Some of the advanced countries at present are making efforts to reduce over emphasis given to the textbooks. However, Gaind (1958) has pointed out that textbooks have become an inseparatable and integral part of most of the education systems. In the developing countries like India, textbook is the only instructional material which is easily available to the majority of the students. Textbooks are helpful in developing expected aptitudes, attitudes and concepts.

Textbook is one of the important curricular materials which helps in generating educative interactions in the classroom between the teacher and the learner and the co-learners, as a result instructional objectives can be achieved in some instances. Textbooks are used as source of securing information for the students. In many situations, textbook is the course of study for a subject. Therefore a textbook may be defined as a systematic organisation and presentation of selected and summarised instructional materials based on the prescribed syllabus keeping in view

the needs and the interest of the pupils to facilitate teaching and learning for accomplishment of desired goals of the subject for a particular class. It is evident that textbook is instructional material and it only contains selected materials in condensed form and is organised in a systematic way for the attainment of the instructional objectives of a subject for a particular class.

1.3.1 FUNCTIONS OF TEXTBOOK

The essential function of textbook is to make the knowledge, which does not exist and available to learner in a selected in an ordered way. In fact textbooks are prepared in the manner so that they may be used by the teacher to fit his own particular teaching situation. It helps the teacher to organise and to develop major ideas, relationships, knowledge and skills in the students in the particular subject areas. Textbook can help in cultivating desired attitudes and the values in the learners mind. As a learning aid textbook can be used before the lesson, during the lesson and after the lesson and for self learning. A textbook can be helpful even to the inexperienced teacher as it provides a guide for him in his teaching. It helps to reinforce learning that originates the classroom or laboratory, in the field trip or outside the school. Such reinforcement comes from self study and homework as well as independent reading. In view of its important function textbooks are and will remain the most commonly used teaching aids in the schools of the works. The importance of the textbook varies from country to

country, still it is universally recognised as a basic teaching tool.

Special emphasis is being given increasingly where the additional reading materials are not widely available to the school children. This almost true in the developing countries of the world. India being a developing country is not an exception in this regard.

Textbook of higher quality attempts to present the materials in consonance with the syllabus of a particular manner and language which can be easily understood by the children for whom the book is written. Moreover, it is built upon what the children have learnt previously and is a preparation for what they will be expected to learn at the next level ideally. Textbook serves as the thread of continuity and the central focus for learning that is expected to take place. It provides basis for learning, knowledge, attitudes and skills in a specific subject for which it is written and it may have to be supplemented by numerous other resources like practice books, work books, etc. A textbook cannot be prepared single handed. It needs the involvement of a group consisting of subject specialist, educationalist, classroom teacher and so on.

1.3.2 CHARACTERISTICS OF TEXTBOOK IN GENERAL

Based on several difinitions available the characteristics have been given. How does an ideal textbook look like ? This is a difficult question to answer as the

very process of education itself is very complicated, according to the American textbook publishers institute.

Textbook should be so simple that the dullest child should read it with ease, yet it should be so scholarly that professors of the subject matter should approve it. It should be organised so lightly and ingeniously that each lesson should apply what has been taught before and prepare for what is to follow, yet the organisation should be so adaptable and flexible that chapter five or chapter ten may be presented first to fit any local course of study.

Any mathematics textbook is supposed to begin with an introductory section with an attempt to define mathematics, describe the mathematical method and expected development of scientific attitude, in addition to an overview of the content of the book and a list of abbreviations/symbols used (through pretext pages).

Regarding the structure of textbooks, instead of chapters only, there can be a few sections containing several chapters in each. These sections are similar to unit plans built around specific topics, thus a textbook becomes a course of study which can be used in its entirely or with certain deletion or additions according to teachers' and pupils' needs, and its content organisation should set a stage for the years' programme.

In each section or unit, there should be some provision for activity that can prepare the readers for the work to

follow, through this activity or otherwise, the readers should be able to recall the past experience (pre requisite/ entry behaviour). In order to establish the foundation upon which later learning will be built up, or the introduction may also be in the form of a brief historical background to relate the developments to the present knowledge.

The body of each section/chapter should provide printed information, in a logical order, which should be sound contentwise too and it should be supported by drawings, tables and contain supplementary activities such as additional sums, problems through out the book, references should be made to the original works of mathematicians through foot notes.

Ideally each chapter should end with a list of expected learning a list of new terms, summary, questions for formative self evaluation, suggestions for out of school activities and a list of further readings.

Finally keeping in mind India is still a developing country, next to teacher education programme, textbook preparation and production programme is most important especially in the field of mathematics and science. Textbook is the only thing that can reach each and every student in any educational process.

Discussions made so far in the above section about the textbooks may convince anybody about its importance and hence that of this investigation on mathematics textbooks, the

discussion also give a general idea of the criteria for evaluation of textbooks chosen.

1.4 TEXTBOOKS IN THE WORLD

In the ancient time when there was no technique of writing, only the spoken language was the medium of education in this way even after the invention of writing in India Vedas were taught and learned in formal education. The modern idea of textbook for schools and universities developed from the Greek and Latin texts of the ancient writers. In old Greece, Homer's Poems (500 B C) were the first textbooks, perhaps the actual grammar book the first surviving explicit description of Greek language the "Greek Tongue" was written by Dionysins Thrax (100 BC) set out the terms still used today. For mathematics and science varieties of textbooks were produced in Hellenistic period, chiefly by the scholars of Alaxandria. "Enclid's Elements" of geometry was one of those published in about 300 BC.

In ancient time a book was valuable. Most of the books were written on leather bark or leaves of trees tables made of mud or on the surface of stone. Most of the active Roman production of books, was in rolls papyrus and vellum (a type of fine parchment). In the ancient world of making extra copies of manuscripts were common practice. There is some evidence of such treatment of manuscripts in Athens in the 5th century BC but production of books in great quantity had to await till the introduction of printing was invented in

China, where the first book was printed in 9th century and was introduced to Europe in the 15th century.

During ancient period no book was written as textbook but books were used as text because as there was no uniform systematic textbook nor even graded system of education. After the development of printing technique in 18th century a revolutionary change took place in the education system throughout the world. Since then textbook has taken an important part as a medium of education. Slowly and gradually schools developed and more textbooks were available in all the subjects. After 1875, with the increase in the number of schools and students, competition grew up between the rival system of instructions and between the printers. This resulted in the production of more attractive books using better paper, clearer type, improved maps and graphics, attractive illustrations and contents interesting to children. Later on free public education the development of common courses of study and separation of pupils into grades occurred. This brought about the necessity to have the uniform textbook covering all schools under the same jurisdiction of the authority. This resulted into more systematic teaching and learning procedures. After the II World War, the textbook maker emerged with the function of surveying the markets arranging for distribution and assembling the experts necessary to produce good textbooks.

In USA, the National Science Foundation and in UK the Nuffield Foundation provided massive finding to support this

development curriculum and textbooks. In Canada, the Toranto Board of Education, in USSR the Academy of Pedagogical Science, in India the National Council of Educational Research and Training, have taken steps to develop textbooks.

1.4.1 TEXTBOOKS IN INDIA

Before 1925, the selection and prescription of textbooks was done by the heads of the education department of different states. Besides this there were many private publishers. In 1935,the Central Advisory Board of Education (CABE) was established. Zaidi (1973) reports that CABE critically examined the various aspects of Indian Education through expert committees. In 1943, one of the such committees reported that though the books were produced excellent in certain areas but on the whole they did not maintain the proper standard, it did not fulfil the educational requirement of the country. The books did not maintain proper quality. It was found that many of them those who were not expert in the subjects were engaged by publishers to write the books on poor remuneration. The publishers developed a tendency to make profit in the school books which ultimately resulted in high prices of textbooks. Those days private publishers did not take any interest in bringing out teacher's hand book or teacher's guide or workbooks nor they were interested in doing in any research for preparation of textbooks. With an increase in demand of education there was an increase in demand of textbooks. This gave rise to expansion of the textbook production. But

private publishing houses showed lack of interest in the appointing scholars in writing textbooks, moreover there arose a corruption. The society felt a need for good quality textbooks at reasonable prices which resulted in the nationalisation of textbooks. For this, textbook improvement programme was started. After independence textbooks played a major role in our educational system. In textbook improvement programme the first step was establishment of Central Bureau of Textbook Research (CBTR) was established (1954) during the first five year plan. The main objective behind the establishing CBTR was to remove the defects by undertaking research in textbooks and supplying the findings to the states. The CBTR published various reports i.e.,

*** Textbook selection procedures in India (1958)

*** Textbook production in India (1959)

*** Textbook selection, production and distribution in India(1963).

In 1961, the CBTR merged with NCERT and was named as Department of Curriculum, Methods and Textbooks (DCMT). In 1966, the functions regarding were shifted first to the Department of Curriculum and Education and then to the Department of Textbooks.

However, the improvement of textbooks has been one of the important area of the work in NCERT. Various departments of NIE have been engaged in the task of improving the quality of textbooks. The studies undertaken by NCERT include

surveys regarding nationalised textbooks in 1969-'70, 1971, 1975-'76, '77-78, '78-79, '79-80, '80-'81, '82-'83, '83-'84, '85-'86. These developments indicate a keen interest of the authorities to improve the textbooks. But till 1968, only preparation, production and distribution was done but no planned programme of improving the quality was thought of. Therefore Dave (1968) remarked that we have worked more for structural changes than substantial changes.

1.5 NATIONALISATION OF TEXTBOOKS

Krishnamurthy (1966) reports that the state governments wanted to promote uniformity in standards, improve quality of textbooks and lower the prices. While Pal (1973) describing the situation remarks that various states have nationalised the textbooks because of the defects in textbooks. Nationalisation of textbooks contemplate complete control of all aspects of textbooks. Nationalisation of textbooks in different states took place at different times. In Gujarat, nationalisation of textbook took place in 1969. But it was only after '79-'80 all the schools started using nationalised textbook as they were made compulsory. The quality of books has improved in several instances although the general level of books still remains poor. Shortcomings like failure to revise books for long period, misprints, poor production to supply books in time still remains to be overcome. As visualised by the Education Commission (1964-66) the main reason for this failure is inadequate organisation of the

agencies which have taken over the responsibility of textbook production.

Therefore Education commission (1964-66) emphasised on the urgency for the state education departments to organise themselves properly for the great educational responsibility. Uttar Pradesh state was the first to nationalise the textbooks (1942) and Himachal Pradesh was the last state to nationalise it (1979). The states of Nagaland and Manipur have not yet nationalised their textbooks. Various reports of NCERT also indicates that different types of agencies are set up in different states for textbook production.

1.6 RATIONALE OF THE STUDY

Textbook plays a vital role in education. It enjoys a unique position of teaching, learning process as it is addressed to students and is used by teachers as a vital instructional material. Hence textbook once prepared should not be considered as final and rigidly set. There is always scope for change, for improvement. But this cannot be effectively done unless the textbook programme is supported by adequate research. Textbook which fully explains itself to the students inside as well as outside the classroom. The teachers lean upon it for the planning and preparation of their lessons. A textbook can be used as an effective tool in instruction only when it fulfils the purpose for which it is written. Evaluation of any kind is carried out to check the extent to which programme achieves the predetermined

goals. Textbooks evaluation furnished evidences of weaknesses and strengths of a textbook, it is to judge how best the textbook serves as an instructional material, to its users - the students and the teachers.

The present study is undertaken to evaluate the mathematics textbooks for standard V,VI and VII (English medium) published by Gujarat State Board of School Textbooks.

The textbooks are widely in use by the students and mathematics teachers of standard V,VI and VII since 1989 and 1990. It is still in early phase of use. We may call this as an experimental phase or testing period of its use. It can still undergo changes., if necessary. It can still bring about completion, if there are inadequacies. Hence the investigator found it worthwhile and interesting to take an evaluative study of the mathematics textbooks of standard V,VI and VII (English medium) published by Gujarat State Board of School Textbooks. The evaluation of these textbooks under study will help to find out the extent to which the textbooks are in correspondence with the prescribed syllabus. The study will also help in finding out the appropriateness, adequacy, organisation and suitability of presentation of the content of the textbook under study. The evaluation will lead to the judgement as to how best are the textbooks in conformity with the teaching-learning process of mathematics. Textbook evaluation provides basis and guidelines for the further improvement.

The present study is a modest attempt to find answer to a few questions regarding the various aspects of the textbook as follows :

1. Do the textbooks cover all the topics suggested in the syllabus prescribes by Gujarat State ?
2. Do the textbooks provide with adequate content ?
3. Is the academic and physical aspects of the textbooks suitable ?
4. Do the textbook cater to the needs of the teachers and students ?
5. Do the textbook provide appropriate exercises to the learner to learn and the teachers to teach ?

1.7 STATEMENT OF THE PROBLEM

The title of the present study is **"Evaluation of Mathematics Textbooks for standard V,VI and VII published by Gujarat State Board of School Textbooks".**

1.8 OBJECTIVES OF THE STUDY

1. To study the academic aspects of the textbooks with reference to -
   a) Content
   b) Organisation
   c) Presentation
   d) Language
   e) Illustration

2. To study the physical aspects of the textbooks with reference to -

   a) Typographic complexity

   b) Design

   c) Attraction

   d) Nature of material used

   e) Size

3. To evaluate the exercises at the end of each chapter

4. To study the students and teachers opinion regarding the suitability of mathematics textbooks under study.

5. To access the textbooks on the basis of the prescribed syllabus of Gujarat State with respect to :

   a. Listing the contents and their logical sequences.

   b. Introduction to each chapter

   c. Inadequacy of content

   d. Illustrations

   e. Printing mistakes in illustration and exercises.

1.9 DEFINITION OF TERMS

a. Textbook :

A systematic organisation and preparation of selected and summarised instructional material based on the prescribed syllabus keeping in view the needs and the interests of the pupils to facilitate teaching and learning for the accomplishment of the desired goals of the subject for a particular level or class (NCERT 1970). Here mathematics textbook means mathematics textbook prepared by Gujarat

State Board of School and Textbooks implemented from June 1989 (V & VI) and June 1990 (VII).

b. Evaluation of Textbooks :

Evaluation is a process of determining the value of an attribute or a thing in relation to pre-determined objectives. Textbook evaluation therefore means finding out the worthwhileness of a book as a teaching learning tool in relation to the course of the study and the objective of the course assigned to the age group.

1.10 DELIMITATIONS OF THE STUDY

The study will be limited to the present mathematics textbooks for standard V, VI and VII (English medium) published by Gujarat State Board of School Textbooks in 1989 (V,VI and 1990 (VII).