

# **CONCEPTUAL FRAMEWORK OF THE STUDY**

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## CHAPTER - II

### CONCEPTUAL FRAMEWORK OF THE STUDY

#### 2.1 INTRODUCTION

This chapter attempts to frame a structure for evaluation procedure and the criteria for evaluation mathematics textbooks for standard V,VI and VII published by Gujarat State Board of school textbooks, which would give a clearer view of the methods of investigation for present study. Textbook plays a crucial role in school education. In any programme of improvement in education, therefore quality control in textbook production is essential which is possible by evaluation and improvement of existing textbook from time to time.

Evaluation is a process of determining the value of an attribute or a thing in relation to the predetermined objectives (NCERT 1973) therefore, to evaluate a textbook the knowledge regarding the nature and scope of a textbook, the principles of planning and preparation of a textbook, the nature and goal of the subject or content of the textbook are indispensable necessary.

Heyenemanetal (1978) in their world Bank assisted study on textbooks of twelve less industrialized countries noted that investment in textbooks would produce learning gain and they found that the very availability of the textbooks appeared to be the more consistent school factor in predicting academic achievement. Even economists do agree

that it is worth investing in education eventhough its output may be realized only the long run, investment in textbooks in process of education can prove its worth even within a year in the terms of academic achievement. No doubt curriculum gets its full meaning which we consider all the curricular materials such as syllabus, textbooks, teachers, guide, students guide, work book film laboratory equipments and other non teaching learning aids, but textbook is a bare necessity for teaching and learning. All the teachers refer a textbook of one type or the other before they enter the classroom except in the case of highly experienced teachers. In the case of students also, especially at school level perhaps it will be very difficult to get a student who might not have used one textbook or the other for his studies. In the cases where there may not be any teacher for a particular subject especially in rural schools but if atleast a textbook is available, then, students, school authorities and parents will have a sense of assurance about the possibility of learning.

In order to understand the role of textbooks in educational process there is a need to look in to the historical background of textbooks.

## **2.2 BRIEF HISTORY OF TEXTBOOKS IN INDIA**

Modern scholars are still not clear about the period during which writing started in ancient India. We can say that there was no need for them to develop writing during

that period, as they were far better in comprehending the more subtle and abstract truths about human existence and other matters in comparison to the modern mind. Writing had not developed when the vedas were composed (up to 200 BC) people learnt vedas by hearing from one another and then remembering what they had heard so the vedas were called the "SHRUTIS" (i.e. books learnt through hearing). According to winternitz (1959) in the older literacy works there is no mention of manuscripts, it is not absolutely a proof of the non existence of the letter. Perhaps they are not mentioned only for the reason that the writing and reading of them was of no importance, all teaching and learning being done by word of mouth.

At a glance the ancient society appears to be primitive but a deeper study of the highly philosophical literature of that time (which were put in writing later) would disprove this (Goel & Sharma, 1987) because intellectual capacity of the people during ancient period was such that they could always manage a vast ocean of knowledge by hearing and memorizing. The curriculum during vedic period were practical and vocational curriculum . Whether textbooks had existed or not in the earlier vedic period but at least later certain literatures were developed in written form on various types of materials such as "Bhojpatra" barks of the "Bhurja" of Bhoj tree, tamranatra and so on in place of paper. In olden times some kind of tree called 'Papyrus' grew in shallow places on the bank of Nile in Egypt the bark of that tree was

used as paper. The word "paper" has come for 'Papyrus'.(Goel & Sharma 1987). During the ancient period the teachers used to dominate the whole system of education and did not use books and teaching aids as we do today. During late vedic, period certain books which could be treated as textbooks came in to existence, but textbook could never become property of each individual student due to non existence of paper and printing technology for large scale production of the same. When the Buddhist period started (after 200 BC) more and more books came into existence.

Education during the medieval period (from 1000 AD) in India mainly had the patronage from the Muslim rulers. In the beginning textbooks used in "Madrasahs" were mainly hand written and comparatively poor in their physical aspect, but content wise they were good. The stress was more on religious teaching, partly revolved around Islam, hence these textbooks played their own role in making an impact on the majority of Indians. Education based on ancient Indian culture was also going on to some extent using oral method as well as hand written textbooks.

It was only during the British period (1700 AD onwards) the role and position of a textbook began to be almost equal to that of a teacher. During the early British students were either taught orally or with the help of hand written manuscripts. The Persian and Arabic schools also used mainly manuscripts, as printed books were not available in abundance. In the world, the first printing press started in

Germany. The Bible was the first printed book in the world. John Guttenberg of Germany printed it. Since the printing press had already developed in Britain during that period, printed textbooks were being used in British schools for their own children in India - Christian missionaries established printing presses in India mainly with the ideas of religious conversions. The books printed during that time were not of good quality. After sometime gradually Britishers acquired their power in India. They took interest in education and started many educational institutions during eighteenth and nineteenth centuries and slowly production of textbooks in India got a welcome boost. Nineteenth century onwards Calcutta school book society and the Bombay native education society took a teaching role in this connection. In this way use of printed textbooks in large scale shaped a better system of Indian education.

During British rule in India from 1854-1904, the school textbooks in social sciences were in English language strengthening British rule and weakening Indian cultural tradition but from 1905-1947, it was completely opposite as Indians were trying to reshape a sort of indigenous education system. Eventhough there was some sort of conception regarding the writeup and evaluation of text books but it got systematized with the modern approach in the school curriculum. In the post independence period especially when the spirit of nationalization of textbooks gained momentum, the process of textbooks writing, production and evaluation got further strengthened.

During the late British periods, there was only one single author of a particular subject for a particular book. but the modern trend is to have a panel of authors, and some members of the panel may not be teaching the subject but may be involved in research work. Since the knowledge is fast growing this type of arrangement can become advantageous. In the post independence period, government of India through its various educational commissions/committees has been carrying out lot of work to make changes through proper evaluation and NCERT has been working sincerely in the field of textbooks evaluation.

### **2.3 BRIEF HISTORY OF TEXTBOOKS OUTSIDE INDIA**

According to langenbach (1976) "HOMERS" poems was the first textbook in old Greece (500 BC). During this ancient period books were very few and valuable. Similar to Indian ancient period books, they were written on leather, bark or leaves of tree, tablets made of mud or even on the surface of stone. Romans used to write on rolls of certain type of fine parchments. During 5th century BC in Athens, there was provision for making extra copies of manuscripts for sale. Around 300 BC. different types of science and mathematics books were produced by the scholars of Alexandria and around 100 BC, Greek language grammar book was written by Dianysiasthrax. It was only during 9th century, books started getting produced in large numbers when printing technology was invented in China and later this was introduced in Europe in 15th century. Printing technology got



modernized and large scale production of textbooks played a major role in the process of education. In different parts of the world. Canada's Toronto board of education and the former "USSR's" academy of pedagogical science put a lot of efforts in improving the curriculum especially in sciences and hence in the improvement in textbooks. Based on the work done by the above developed countries, developing countries in Asia like India, Thailand, Srilanka etc. and many African countries such as Nigeria, Kenya etc. took up the work seriously. With all the devotion and professionalism and brought out new curriculum and attached textbooks in science as well as in other areas too for different levels of school systems in this connection the work done so far by NCERT in India is praiseworthy and this organization is now in a position to offer consultancy service in the field of curriculum and textbooks to other developing neighbouring countries too. In India though there were some efforts in developing the writing and evaluation of textbooks in the past the progress as such was not much, but during the post independence period the establishment of NCERT in September 1961 brought about a change in the whole set up. The modern concept of textbook is different from that of the ancient and the medieval period. Today textbooks are secular in nature, especially in the case of social sciences and languages textbooks. Textbook publication has become a specialized industry, even though nationalization of textbooks has taken place to some extent.

Having known the historical background now the ideal, the realistic and modern concepts of textbook art to be discussed, in the process of establishing a framework for the study.

#### **2.4 IMPORTANCE OF TEXTBOOKS EVALUATION**

Evaluation is a process of determining the value an attribute or a thing in relation to predetermined objectives. So evaluation is at once an act of measurement as well as value judgment. Textbook evaluation, therefore means finding out the worthwhileness of a book as a teaching learning tool in relation to the course of study and the objectives of the course assigned to an age group. To judge the contents to which a textbook meets the needs of the pupils, the requirement of the subject and the teaching learning situation is essential for selection of textbooks and their improvements. The evaluation always gives feed-back depending on that improvement of textbooks is possible.

To evaluate the textbooks there are certain criteria and approaches they have been detailed out in the following.

#### **2.5 APPROACHES OF TEXTBOOK EVALUATION**

Whatever may be the purpose, textbook evaluation is an important programme for curriculum implementation. Now the question arise how to evaluate ? According to the purpose, there are different ways for textbook evaluation. These are the empirical approach and the rational approach.

#### 2.5.1. EMPIRICAL APPROACH TO EVALUATION

Here empirical means experimental. Experimental evaluation can be done before the selection of new scripts the final printing. This evaluation is termed as try-out. Try-out of the textbook is undertaken to find out the worth of the textbook. Such a tryout may either be pre-publication or post publication.

In approach the manuscript is tried out unitwise in the real classroom situation in selected schools between teachers and the learners for whom it is written). This gives many ideas about the usefulness practicability weakness and short comings of the text. Thus the result of tryout suggests necessary correction, modification of the manuscript for final production of a book.

In the post publication tryout evaluation is carried out with respect to a textbook used for a year or two and the teachers and students are in better position to give their opinion regarding the usefulness of the text. This provides concrete evidence about the efficiency and usefulness of the text, for getting reliable evidence about the strong and weak point of the textbook, to have a systematic record of merits and limitations of the textbook. Thus systematic and planned observation of how the teachers and students use the book in the classroom can be obtained by means of questionnaire, checklist, observation diary etc. This provides useful information about the quality of the textbook. Therefore pre-

publication is formative evaluation and post-publication tryout is summative evaluation in nature.

#### 2.5.2 RATIONALE APPROACH TO EVALUATION

The rational approach is the approach which is logical. Different aspects of textbook can be judged on a logical basis by getting consensus of content specialists, evaluators, teachers, persons engaged in pooled opinion about the textbook and its various aspects. Evaluation can be done for revision or improvement of it, or for the selection of a better one out of more than one. The rational approach is based on different criteria of evaluation. These criteria may be developed on the basis of the role and function of a textbook. The need of the students and the teachers for the teaching learning material, requirement of the subject and curriculum and on the basis of available literature and opinion of experts in the field. Different methods and tools of evaluation can also be developed with the help of experts, teachers, educators, researchers based on the criteria of evaluation. Quantitative or qualitative way as required. These two basic approaches of textbook evaluation again suggest different types of evaluation according to the purpose. These are the discussed below :

##### SIMPLE REVIEW

A text book may be evaluated to get an interview of the book i.e. just to find out the scope and the nature of the material it contains on the basis of which a book may be

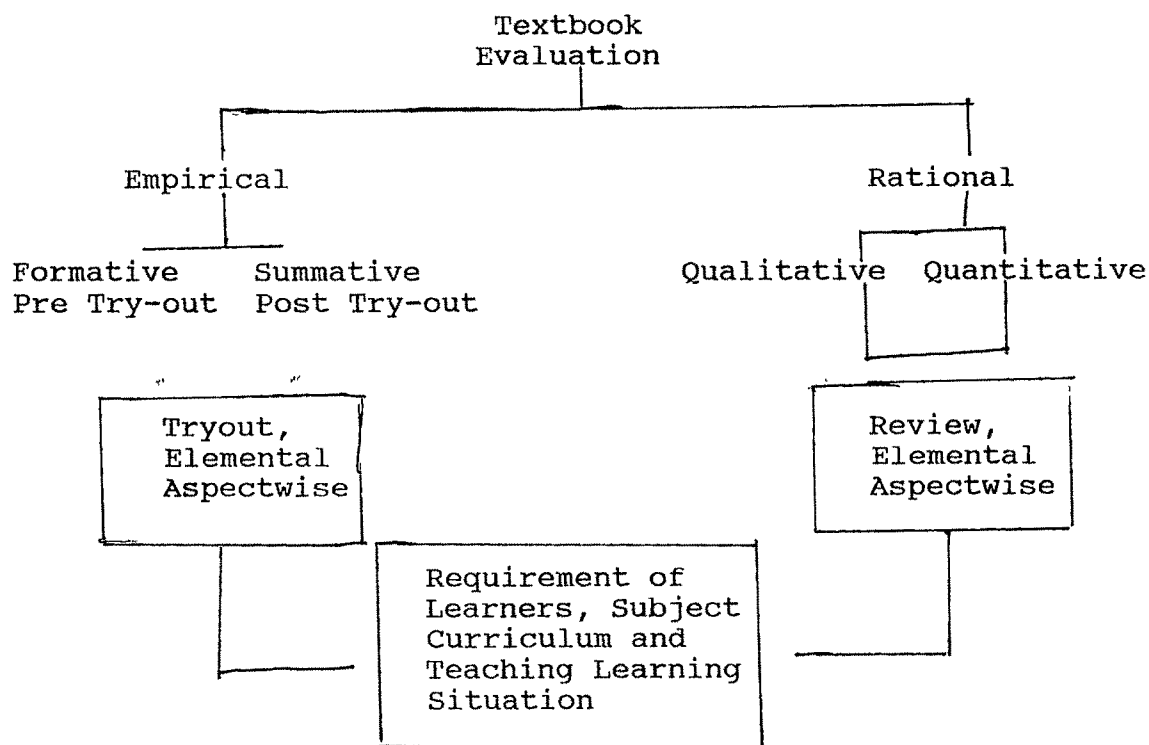
rejected or accepted for a particular programme. This is known as a simple review.

#### ELEMENTAL EVALUATION

A textbook may be evaluated for a particular point of view, which is an element. e.g. approach adopted to present the content of the mathematics textbook, organization of the content etc. This is called elemental evaluation.

#### ASPECT WISE EVALUATION

A textbook may be evaluated for a single aspect, academic aspects, organization of content, appropriateness of illustrative aspects etc. This is called aspectwise evaluation. Flow chart of the overall structure of textbook evaluation has been designed and shown.



## 2.6 CRITERIA FOR EVALUATION

The criteria of evaluation are the components of the attribute in respect of which the evidence can be obtained and judge. Thus the criteria are related to evidence on various aspects of the textbook on the basis of which inference can be made, whether a particular principle of writing the textbook has been observed or not, thus each an every aspect of the textbook has to be rated against their criteria. Therefore criteria which carry the implications of the evaluation are essential for preparing textbook evaluation tools, for that it is essential to see the requirement of a good mathematics textbook.

### 2.6.1 REQUIREMENT OF GOOD MATHEMATICS TEXTBOOK (NCERT 1970)

#### (A) LEGIBILITY

Following are some of the requirement for good mathematics textbook laid down by department of textbooks, NCERT (1970).

1. The size of the text book should be appropriate.
2. The text book should be printed in proper type size.
3. The color of the paper used should be appropriate.
4. Lines should be more or less of uniform length.
5. There should be proper sparing between words and lines in a textbook.
6. The important formulae may be highlighted by changing the type size.

7. The colour of the ink should be black.
8. Illustration should be properly used.
9. Diagrams should be accurate and diagrammatic representation of the connects should be given whenever possible to understand the concepts.

(B) DURABILITY

1. The binding should be durable and convenient.
2. The right type of paper should be used in the textbook.
3. The book cover should be stronger and long lasting.

(C) USABILITY

1. The textbook must have a preface.
2. The textbook should have a detailed table of contents.
3. A list of important formula should be given.
4. It should be conform to the state syllabi.
5. The instructional objectives of Mathematics must find a place in the textbook.

(D) QUALITY OF THE CONTENT

1. SELECTION OF THE CONTENT

1. The material of learning selected for a textbook should permit continuity and organic growth of the subject matter as mathematics is cumulative in nature.
2. There should be variety in the materials selected for the test. It should help both rural and Urban students and should achieve all instructional objectives Ed. e.g. knowledge understanding, application and help the teacher in various purposes.

3. The mathematical facts and principles given in textbook must be correct.
4. The scope of the contents selected and the emphasis should be in accordance with the current official curriculum.
5. The contents of the book should be suited to the age and maturity level of the students.
6. The contents should be consistent with the latest developments in mathematics and also in keeping with the findings of research in curriculum.
7. Provision should be made for the interaction and correlation of the subject matter of the textbook with other branches of mathematics as well as other subjects taught at the same time.
8. The contents must satisfy the individual and social needs of students.

(E) ORGANIZATION OF CONTENT

1. The content should be organized so as to enhance the structure of mathematics.
2. Organization of content should have a bearing on the sequential nature of mathematics.
3. The content should be well articulated.
4. Organization should be logical.
5. The organization of content should help in the methodology of teaching.



(F) PRESENTATION OF CONTENT

1. Each and every idea and concept should be explained properly through works, illustrations and diagrams.
2. The language used should be within comprehension of student ie. within the vocabulary of students.
3. The symbols used in mathematics textbook should be universally acceptable as far as possible.
4. Technical terms should be introduced so that students can use them freely in going explanation.
5. The explanation should be interesting.
6. Figures should be used to concretize the abstract ideas or to explain complicated situations.

(G) DEVELOPMENT OF HIGHER MENTAL PROCESS

1. There should be emphasis on the why of process rather than the how of it.
2. The textbook must contain a variety of problems.

(H) STIMULATIONS AND MAINTAINING INTEREST

1. Style of presentation should be lively.
2. There should not be printing mistakes.
3. Importance should be given to application of the concepts in everyday life.
4. There should be provision for various assignments for different categories of students.

(I) THE EXERCISES GIVEN AT THE END OF EACH CHAPTER

1. The exercises should be interested with theory.
2. The exercises given in the textbook should be well graded.

3. The number of exercises given in the textbook must be adequate.
4. Variety in the exercises should be provided in the text book.
5. Exercises must not be simple application of the concepts taught.
6. A textbook in mathematics should provide answers to exercises.
7. The textbook should include some evaluation tools.

#### 2.6.2 ASPECT WISE FEATURES OF TEXTBOOK EVALUATION

##### (1) PHYSICAL ASPECTS OF TEXTBOOKS

Apparently physical aspects of a textbook may look non-academic in nature, but if these are neglected, the textbook may fail to impress the reader.

According to Hartley (1990) here are six important concerns in textbook design namely (1) page size and spacing (2) positioning and spacing the text (3) type faces and type size (4) emphasis in text (5) access structures and (6) the design of supportive illustrative materials :

- 1) Pages size and spacing: Decisions about width of margin, column widths, interline spacing, choice of type face and type sizes and the positioning of illustrative materials are based on the size of the page. Page size is based on a number of factors, the most important being the nature and use of the text e.g.,

a pocket dictionary is supposed to be of a small page size whereas an atlas should be of a large page size. In many textbooks margins are formed like a picture frame around the information area. Tinke (1965) has reported that the space used for margins can sometimes occupy 50 to 70% of the page. No doubt, broader margins can sometimes increase the aesthetic aspect of textbook but if we are more bothered about the functional approach rather than the aesthetic one, it is fail to have a margin of about 10 MM at the top and bottom of the page and a margin of about 20 MM for the left and right sides (Hartley 1985) depending on the page size, there can be one, two or even three columns of equal width within a page. Typographically speaking, this is not very complex. If there are illustrative materials within a page there can be variation of widths of two or three columns.

- 2) Positioning and spacing the text, it is technically justified horizontal composition to see that text composition is set balanced about a central axis, i.e., there are straight left and right hand edges to the column of the print. Many printers often think of an alternative approach in which the text starts from the left hand margin, but gets ragged at right hand edge for each column of the print but this is technically unjustified horizontal composition in a printed text, to have an ethnically justified composition, the spacing between the words is varied and words are sometimes

broken by hyphenation (especially in narrow column width). There are advantages in "unjustified" composition too. Here the spacing between the words is always same and hyphenation is avoided. There is no need to fill the line with print just because the space is there. In unjustified composition, the beginning and the end point for each line is determined by syntactic considerations related to the underlying structure of the text. The above approach can be taken down the page (vertically) as well as across it (horizontally). If there are same number of print in each page it is known as technically justified vertical composition. The text may be stopped at the appropriate point in terms of sense or sanitizer, irrespective of the number of lines, in this case one can also use specified units of space between elements to group and separate related parts within the text. To do all these systematically, there is a need to specify in advance what rules of spacing are to be used in a particular text and one should stick on to these rules throughout. In connection with the two approaches, i.e., technically justified and unjustified, many studies have been carried out to find out which approach would help in the case of young children who are learning to read. Kirby and Gordon (1988) are in favour of the latter; Raban is of the opinion that it is preferable to keep "carry over" such as "and" and "but" at the end of lines.

- 3) Type faces and type sizes: The broadest and the most well known classification of type faces is that between those type faces with scripts and those without. Harley (1990) and choice is mainly based on personal preference. The measurement system used in typography looks too complex the number of characters (or words) one can have in a line of text and how many lines one can have per column- these two aspects are affected by different type sizes, if the type size is large, it restricts the number of words that will fit within given column/page width, if the type size allows only four to five words per line, then there cannot be any sensible syntactic groupings in the text composition.
- 4) Emphasis on text : There can be three levels of heading primary, secondary and tertiary. All the three require specific spatial support but can also be used typographically, e.g. capital letters can be used for primary headings, upper and lower case hold for secondary headings and italic for tertiary ones, the other types of typographic cueing are underlining and columning - all these can be used to draw the attention of the readers to particular word or points in general typographic cueing is used to emphasize different points within text as well as to indicate its overall arrangement. But According to Hartley, children do not necessarily understand the cues that adults take for granted and hence there is a need to explain their

purpose. He also feels that the multiple cueing can be confusing. At senior level typographical cueing may not be that much confusing, if used systematically, it may even reduce the amount of write up, but instead of taking it for granted that students can fully understand these typographical cueing which may look like typographical complexities, it is better to explain them in the preface.

- 5) Access structures : These are devices which help readers gain access to the text, and find their way around it Walter (1979) they are pretext pages, students especially at senior level and above may not read a textbook from start to finish and they would like to locate different kinds of information quickly. Researchers on access structures such as design of content pages, positioning of page numbers, numbering of paragraphs etc. are not available but, index and bibliography have already been explored Hartley (1985) researches on summaries and headings have been carried out Hartley and Truenam (1982, 1985) and on heading by Wilhite (1989) but according to Hartley (1990) virtually no study is available on the typographical settling of access structures asides etc.
- 6) Strengthening the message : To strengthen the communication, devices such as, tables, graphic materials and illustration can be used. Wright (1980) is of the opinion that if students have to use a table

successfully they have to understand organization of the table, undergo a process which are involve comparing the numbers within and across the same or different tables. Several research work are available on the merits of different ways of presentation for diagrams, charts and graphs and on effectiveness of illustrations too Hartley (1990), these can be more effective when they are presented in a simple way and in consistent manner from page to page, and the illustrations need to be directly relevant and supportive to the text if they are to be effective adjuncts to the communication. Due to aesthetic reasons, some illustrations may help to motivate students but there is no guarantee that such illustrations obviously help the reader to understand the text.

In connection with textbook design, one should note the fact that readers vary in their reasons for studying in their ability and motivation and in their very method of approach, there are differences between "surface" and "deep" approaches to studying and reading Marton and Saljo (1934), Entwistoe and Waterson (1988). Surface readers are those who skin the text, botger about the overall structure or argument presented in the text, whereas deep readers are those who search for the underlying structure of the text, question it, relate ideas to their own entry behavior. If the textbook authors have to attract deep readers then before designing

instructional text they have to identify successful writers about what are known as "coherent texts" which are written for specific groups of readers using the language with which they are familiar by including experiences which can be shared by readers providing meaningful examples and questions. Textbook design is one of the important ways in which we can make major improvement in the quality of the instruction.

Von restorff (1933) made a number of studies on isolation effects in verbal learning and she framed what is known as "Isolation effect" or "Von restorff effect" which refers to the enhanced recall of a perceptually or conceptually isolated item compared with the recall of non-isolated item, Panda (1990), isolation can be achieved in text materials by several ways such as printing in black, increasing the size of the letters, writing the isolated item on colored background, underlining, enclosing it by circle or rectangle or square. This isolation effect influences not only the isolated item but also the entire text material or atleast the adjacent items. The different methods of isolation may have different effect on the overall effectiveness of the text material. Mathematics textbook in general need to contain several isolations, especially for new terms, definitions, formula and rules, either by colour or size or by size contrasts. Panda (1990) study of isolation effects on learning retention of text material among elementary children strongly supports the predication that



isolation through colour and size contrasts could produce better retention effects in comparison to the normal black condition which is generally used to write text in mathematics. As the study reveals to the elementary textbooks at least some of the ideas from the study can be considered while writing textbooks. Colour contrasts may not be very much needed, but at least size contrasts and enclosure of formula using rectangles or square or circle can be done to increase the effectiveness of mathematics textbook.

Within the curricular framework, textbook is one of the devices to help to achieve the goals and objectives of education to make sure that this achievement really takes place, students have to be helped to evaluate themselves through the textbooks.

(2) ACADEMIC ASPECT

It covers planning of the textbook (appropriateness of formation of units, sequencing of different units, and relevance to the curriculum) selection of the content (attainment of instructional objectives, conformity to prescribed curriculum, meeting the needs of the learners accuracy and updatedness of facts and concepts) organization and presentation of the subject matter (suitability of the approach, uniformity of the morphology of each chapter, integration of the text material and readability of the text). Use of illustrations (adequacy of illustrations, effectiveness of illustrations) and provision for learning exercises.

### 2.6.3 NEED OF THE LEARNER

It covers developing pupils interest (proper introduction to each chapter, and diagrammatic explanation to the concepts). Meeting individual differences, simplicity of language, variety of examples, well guarded exercises, few examples for developing higher cognitive ability, accordance to pupils maturity (proper treatment to subject taken into consideration the nature of subject and maturity of pupils) and involvement of pupils, illustration for thinking developing problem solving ability etc.

### 2.6.4 REQUIREMENT OF THE SUBJECT

It covers appropriateness of content according to syllabus reflection of nature of mathematics and attainment of instructional objectives.

### 2.6.5 REQUIREMENT OF TEACHING AND LEARNING SITUATION

It covers development and organization of the subject matter (appropriateness of formation of units, highlighting the important formulas and definitions) applications of psychology of learning (students previous learning experience, placement of concept in graded way). Readability of the text (use of simple language, on printing mistake, continuity in the content etc.) and physical suitability (suitability of size, price, durability of paper and binding.)

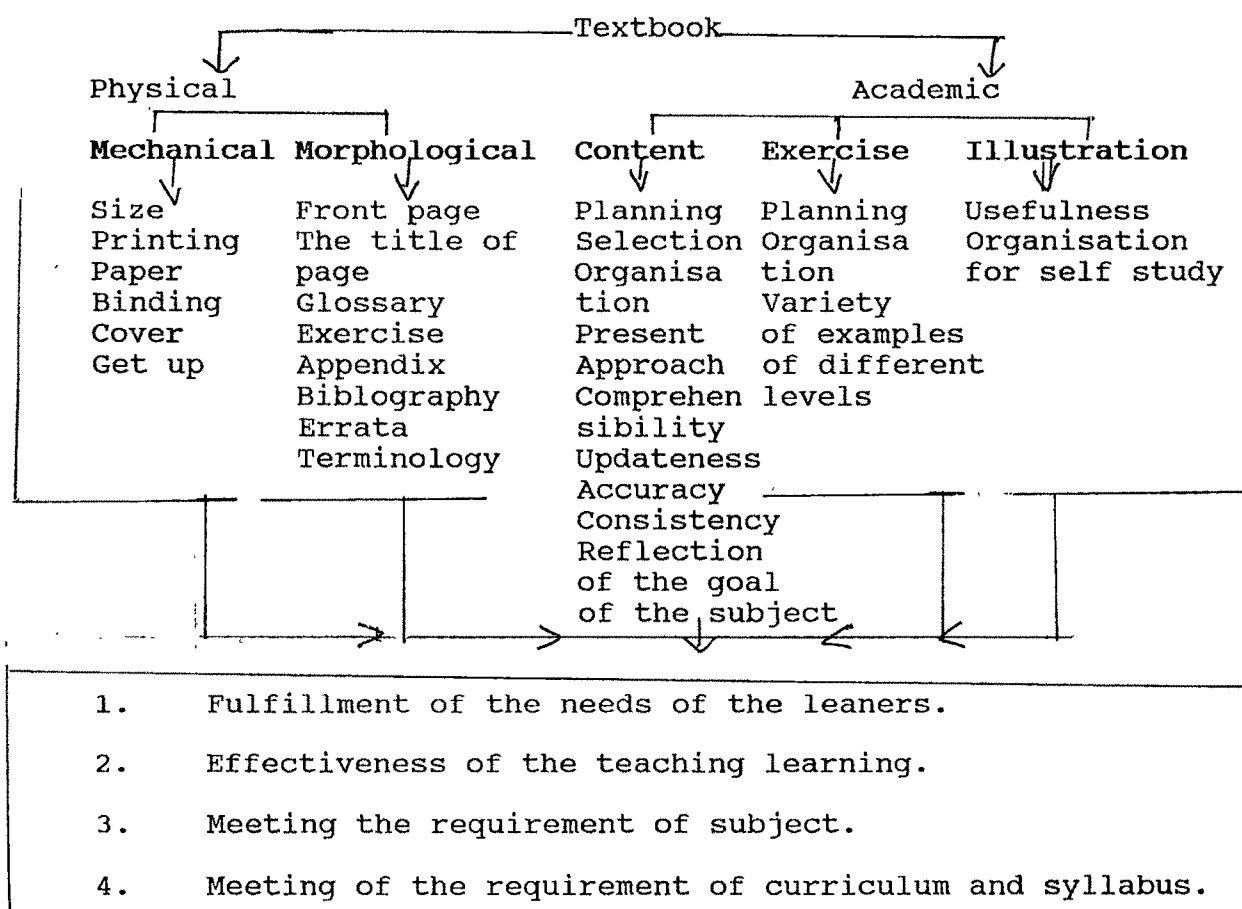
## 2.6.6 NEED FOR CURRICULUM AND SYLLABUS

It covers agreement with syllabus provision for evaluation. Keeping in mind these criteria for evaluation of the book various tools are formulated.

## 2.7 DEVELOPMENT OF CRITERIA FOR THE PRESENT STUDY

Depending on the requirement of a good mathematics textbook the investigator has developed criteria for the present study.

The main features of textbook evaluation criteria :



From the figure it is clear that criteria can be listed into two different ways.

2.7.1 CRITERIA FOR EVALUATION ACCORDING TO THE NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS: PHILIP PEAK(1965)

The national council of teachers of mathematics (NCTM) continually tries to bring to its members various types of mathematical which will be beneficial to the mathematics teacher in his day to day activities. Due to the rapidly changing nature of the mathematics being taught in the elementary school it seems wise to provide at this time a set of criteria which will aid the teacher in the selection of the textbook which will best meet his needs.

The criteria is applicable to content, presentation and organization of texts. The criteria have been brought together under headings that are closely related to large ideas. These headlines are structure, Rigor, Vocabulary. 'Definitions and underlined terms', illustrative examples 'teachability' and optional topics.

- (a) STRUCTURE : Mathematics is a body of organized knowledge. Each element which is a part of this body must fit into a properly established structure. The presentation should assist the students in understanding the structure of that particular area of mathematics.
- (b) Rigor in a text refers to the nature of the development of the arguments and the kind of justification that is used in the proof. Few presentations in the text are entirely rigorous or completely without rigor. The

level of rigor in a text may have much to do with the future understanding of the subject by the reader.

- The material presented in textbook should be in such a way that the student is expected to make conjectures and test their truth.
- The development of the topic should be made on appropriate levels of rigor.

(c) VOCABULARY : Most of the terms introduced are names of significant ideas. Since these ideas are an important part of the structure it is essential that the terms should be presented effectively.

- The vocabulary should be appropriate for the level of students.
- The rate of introduction new terms should be appropriate to the mathematical maturity of the students.
- The term defined should be used.
- In order to strengthen understanding the ideas should be restated in different language.

(d) DEFINITIONS AND UNDEFINED TERMS : Basically definitions amount to symbol substitutions, that is, the stipulation that a simple symbol for example, one word can be used instead of complex symbol like a long phrase. In the context of teaching giving a definition amounts to teaching a student how to use a symbol.

- The content should make clear the particular usage of a term which may have a different meaning in another context.
- (e) ILLUSTRATIVE EXAMPLES : Frequently illustrative examples may be designed to anticipate the development of some concepts, illustrative examples may also be used to reinforce some of the concepts which have been previously established.
- The examples should clarify the concepts presented.
  - Examples used should lead in to similar problems in the set of exercises without being merely duplications.
- (f) TEACHABILITY : Textbooks are used by the students both with and without direction of the teacher. So far as the text can be used by the student on his own, its effectiveness is enhanced.
- The ideas developed by raising questions, considering alternatives, and encouraging conjectures which may be verified later.
- (g) OPTIONAL TOPICS : It should be reorganized that a text is written to satisfy many readers and suggestions of many critics are incorporated in to its final form. It is therefore, not absolutely imperative that a teacher consider every topic equally essential and hence feel compelled to devote time to all of them.
- The text should be written in such a manner that those items considered to be optional can be deleted without destroying the continuity of the presentation.

### 2.7.2 CRITERIA RELATING TO PHYSICAL CHARACTERISTICS

The mechanical features of a text and the services provided by the publisher are of course, important, but only if the criteria of content and presentation have been met. Impressions of quality of print, paper, page organization etc. are also equally important.

#### 1. General format :

##### a. The purpose is to attract and sustain the students attention :

- The cover of the text should identify it as one on mathematics.
- The book should be of a convenient size and shape for the group for which it is intended.
- The type size and the style suitable for the group for whom the book is intended.
- The page arrangement should give a feeling of continuity.
- The colour used should contribute to the presentation.

##### b. Index and references :

- The index should facilitate referred to related ideas.
- The text should contain a glossary of the essential symbols and their definitions.

##### c. Usability :

- The text should be free from typographical errors.
- The text should not require the purchase of additional material to teach the mathematics effectively.

### 2.7.3 CRITERIA DEVELOPED BY VARIOUS RESEARCHERS

Lalithama (1981) undertook a study to develop criteria for the preparation of good mathematics text and to prepare analysis sheet for the evaluation of the mathematics textbook. The major criteria were identified into two categories - physical aspects of the textbook and academic aspect of the textbook.

Roy (1986) evaluated the high school general science textbooks in Bangladesh to assess the textbooks on the basis of curriculum objectives. The criteria developed was analysis sheet cum textbook evaluation diary. Romey's test was used to measure students involvement index. The end-of-chapter exercises were analyzed according to Bloms taxonomy.

Rao (1993) mainly used the criteria for evaluation based on the standards specified by NCERT (1987) in their publication "A study of the evaluations of the textbooks" the major criteria used were content analyses sheet.

While going through the research done in the field of textbooks it was found that most of the researches done were in social sciences, science and languages. The criteria used for evaluation was almost similar. Most of the studies focussed on physical aspect and academic aspect of the textbooks. The Investigator too felt that physical and academic aspect to be more important. So researcher also made use of same criteria used by NCERT and others and focussed on physical and academic aspect of the textbook.

