CHAPTER : III

REVIEW OF THE RELATED PREVIOUS RESEARCHES

Research is a process involved in an in-depth study in any particular field and in which generation of new knowledge is possible for the consumption of those who wish to make use of it at present or in the future. In this process, review of the related works is an integral part. In the previous chapter, numerous articles with several views on various issues related to the undertaken investigation, have been quoted and discussed so as to develop a conceptual framework of the study; as such, they may not be classified as research studies directly. But the present chapter is expected to develop the conceptual framework furthur by getting support from actual research data and the methodologies from the previous studies in India and abroad.

Several studies are available especially in the field of curriculum; wherever a curriculum is involved in a study, normally the relevant textbook also gets included; but such curriculum studies do not do full justice to the involved textbook research. So, in order to avoid the physical bulk of this particular chapter, in this report, mainly textbook research studies, that too mainly connected with secondary and Snr. Sec. school science textbooks have been mentioned; however in some cases, textbooks related to primary schools, junior Sec. Schools and higher educational institutions, as well as even to subjects other than science, have also been included wherever they give insight and support to the present investigation. Wherever possible categorisations and tabulations of the available studies and their salient, relevant features have been systematically presented by keeping in mind the objectives of the present investigation, though in some cases overlappings, have been observed; and in some

sub-areas of the objectives, the investigator is yet to come across relevant and more number of studies. In the review of selected studies, wherever possible, only those objectives and other details which are relevant to the present investigation have been mentioned with their brief methodologies and conclusions, once again to reduce the bulk of the report.

In some studies a few relevant details about methodologies ahd findings may be missing, as the investigator could not have access to their original works, though some efforts were made to contact some of the concerned researchers.

In all the tabular columns, the following abbreviations would be used : physics-phy, chemistry-chem., biology-bio., geography-geog., mathematics-maths., history-hist., social studies-s.s., secondary school-sec. sch., junior secondary school-jnr.sec. sch.

3.1 STUDIES OUTSIDE INDIA :

Research studies available from outside India have been treated separately, because, as discussed in the first chapter, historically too, modern textbook research development and evaluation have had some influence especially from the developed nations such as the U.K. and the U.S.A. As several studies are available in the field of science textbook research itself, studies in other fields have not been referred to ; of course if we look at only physics and that too at Snr. Sec. level only, studies are altogether very few; perhaps there is nothing wrong in getting the academic support from any field and from any level within the framework of textbook research or sometimes even from other frameworks.

3.1.1: STUDIES ON CONTENT ANALYSIS OF TEXTBOOKS- PRODUCT AND PROCESS OF SCIENCE :

When we glance through the Table 3.1 (pp.97-100) it is clear that doctoral studies by Garcia (1986), Chiang-Soog (1988), Eltinge (1988) and Fillman (1989) reflect in-depth content analyses of several science textbooks mainly at Sec. Sch. level in different countries; these studies in addition to knowledge (content) aspects, focus on several other aspects such as minimum competencies in scientific literacy, nature and structure of science, processes of scientific inquiry, laboratory activities and STS issues; their findings are very useful in overall revision of the chosen textbooks. The study by Koval and Staver (1985), perhaps is the only study outside India, which gives an insight for one of the sub-objectives of prerequisites in the present investigation. Nduke's (1986) study is specifically related to integrated science and process skills. Studies by Skoog (1984), Ellse (1988) and de Berg (1989) cover only certain major aspect/s concept/s in the selected textbooks; but among all these studies, Skoog's (1984) study, looks too much laborious, but worth, as it covered a period of 33 years with 105 textbooks, of course just to look at only one concept, i.e. evolution. The specialities of de Berg's (1989) study are the given connections of the findings to the learning theories and emphasis on historical presentation of physics and objectives. In all these studies general methodology has been mainly, content analysis. Eventhough these studies can be termed as qualitative studies, percentage frequencies have always been used by the investigators to arrive at meaningful conclusions.

TABLE 3.1. STUDIES OUTSIDE INDIA ON CONTENT ANALYSIS/PROCESS-PRODUCT ASPECTS:

RESEARCHER/S	TEXTBOOK/S No. - SUBJECT/S LEVEL, ETC.	SALIENT RELEVANT FEATURES OF: MAJOR OBJECTIVE/ ISSUES TREATED	SAMPLE- METHODOLOGY	MAJOR FINDINGS
1	2	3	4	5
Skoog (1984)[1]	105 Sec.Sc. bio: published between 1900-1983.	Coverage of the concept of evolution.	44 Topics : Longitudinal review word counts for comparison and as indicators of trend: content analysis.	Coverage not upto the satisfactory level except in editions during 1960s and 1970s.
Koval & Staver (1985)[2]	Sec. Sch. Sc.	Study of treatment of terms to determine the need for success in Snr. Sec. physical science courses.	Identification of prerequisite/ entry behaviour verification by content analysis.	Inadequate treatment.
Garcia (1985)[3]	5 earth science.	Treatment of (a) basic knowledge of science, (b) investigative skills, (c) nature of science & (d) interaction of science, technology and society. (STS)	Content analysis.	Except in one textbook, imbalance found among the four aspects - (a): 80%.

TABLE No.3.1 (CONTD.)

1	2	3	4	5
Ndukwe (1986)[4]	Nigerian Integrated science - Jnr. Sec. sch.	Identification of process skills	Identified and classified 15 categories of process skills	The textbooks did not adequately expose the pupils to the acquisition of process skills.
Ellse (1988)[5]	Jnr. Sec. Sc. U.K.	Treatment of energy concepts	Content analysis	Not systematic - confusing.
Chiang-Soong (1988)[6]	12 Sec. Sch. Sc.	(a) Use of page space for narration (b) emphasis on technical terms (c) laboratory activities (d) position of questions (e) STS issues (f) nature of science	Content analysis	(a):45% (b) above level (c): not open-ended-but traditional, (d)4% of the total sentences & rhetorical, (e): 7% (f) 3% only in introductory chapters. Overall: Textbooks-not written based on current goals of science education.
Eltinge (1988)[7]	4 American editions of Sec. Sch.bio: 1956, 65, 77 & 85 -	Presentation of science as an inquiry	In-depth content analysis for chapters on introduction, genetics and leaf structure -Regression equation based on categories data.	Inquiry was (a) higher in 1965 and '69 editions (b) lowest in chaoters of leaf structure & (c)highest in introductory chapters.

TABLE No.3.1 (CONTD.)

1	2	3	4	5
Hehr (1988)[8]	Texas State (USA)-25 books on life, earth physical and biological sciences - sec. Sch.	Minimum competencies for scientific literacy in terms of concepts, attitudes and process skills in textbooks	-Randomized 11,784 pages -Trained coders among teachers identified the variables, in selected topics-content analysis	(a)Most of the concepts were either not defined or partially defined. (b)Scientific attitude was referred to only in the chapters on scientific method. (c) There were references to many process skills but their identification was difficult in the case of narrated lab. activities (d) There were variations in different textbooks in the degrees to which students were exposed to concepts, attitudes and processes, necessary for scientific literacy.
Fillman (1989)[9]	11 Texas State (USA) introductory bio.	Scientific literacy in terms of (a) knowledge (b) investigation (c) STS (d) Way of Thinking	Content analyses	(a): 65-80% (b):10-20% (c): 1% (d) 0%

TABLE No.3.1 (CONTD.)

1	2	3	4	5
de Berg (1989)[10]	14 phy. 14 Chemi.for Australian Snr. Sec.Sch.	Details of quantification in the pressure-volume relationship for gases	Content analyses	(a)Presentation was from simple to complex, qualitative to quantitative & verbal to algebraic - hence written based on learning theories. (b) Qualitative properties were given minimum weightage. (c) Concepts were not presented historically & (d) objectives behind studying the gas laws were not stated in most of the textbooks.

3.1.2 STUDIES ON COMMUNICATION STRATEGIES IN TEXTBOOKS:

Table 3.2. (pp. 102-103) clearly shows that Ogunnayi (1982) made an in-depth study of six communication strategies; this study is quite useful to the present investigation. The study by Shepardson and Pizzini (1991) which is one of the latest, gives a simple way of classification of questions in textbooks; the other three studies mainly reflect on the importance of placement of questions in textbook in connection with retention of concept and hence better achievement. In addition to the studies mentioned in Table 3.2. , it is worth noting studies such as Laing's (1984)[16] investigation of the existing anatomy textbooks and his development project on graphical representation of related anatomical concept to help greater readers' understanding; Horak (1985)[17] carried out a meta-analysis of the effects of different learning aids from science text material and found their benefits to students in understanding the important concepts; Koch and Eckstein (1991)[18] investigated the difficulties in reading comprehension of introductory physics textbooks among college students in Israel and they developed a strategy to improve students' reading comprehension by teaching them the skill of formulating clear questions on textual materials, which are missing as such in the textbooks. It may be recalled that the earlier mentioned study (in 3.1.1) by Chiang-Soong (1988) also touched on the aspect of questions in textbooks. When a student reads a textbook, it is like a verbal communication between two people; so, the importance of communication strategies cannot be ignored in its presentation.

TABLE : 3.2 STUDIES OUTSIDE INDIA: ON COMMUNICATION STRATEGIES IN TEXTBOOKS:

RESEARCHER/S	TEXTBOOK/S -No -SUBJECT/S -LEVEL, ETC.	SALIENT, RELEVANT FEATURES OF		
		MAJOR OBJECTIVE/ ISSUES TREATED	SAMPLE METHODOLOGY	MAJOR FINDINGS
Ogunnayi (1982)[11]	-4 Nigerian Sec. Sch.bio.	Communication strategies: (a) questioning styles (factual, rhetorical, leading & probing). (b) position of questions (Introductory, contextual, terminal, captional) (c) status of terms and specimens used (term defined, term earlier defined, term later defined, term undefined, local specimen, non-local specimen) (d) status of pictures and diagrams (No., labelled, non-labelled) (e) major themes (in content, inquiry, history, economic importance, knowledge) (f) nature of practical suggestions (simple, specific, general, challenging.	-Comparative study using % frequencies	(a)Mainly factual in all the texts. (b)No introductory and captional question in all (c)Most of the terms defined earlier - in all; local specimens (d)Sufficient in number - in all (e)Unequal weightage in different texts (f)Only in two text-books higher % of challenging practical suggestions. On the whole, not even one textbook has a singular advantage over the other in all aspects of communication strategies.

TABLE No.3.2 (CONTD.)

1	2	3	4	5
Leonard & Lowery (1984)[12]	-University bio.	Effects of questioning upon the retention of biology concepts.	-classification of questions (hypothesizing & rhetorical,factual valuing) -tests for retention for a sample of 383 students.	-the type of textbook questions did not enahnce the retention and instead they resulted in less learning and more forgetting especially over medium to long range interval
Seebar (1984)[13]	IX Sc.	-Study of illustrations and its effect on student's performance	-science achievement tests	-illustrative condition of the textbook had a significant effect on science scores.
Leonard (1986)[14]	University bio.	-study of placement of questions and retention of concepts	-425 students -tests for short-term and long-term retention	-positioning of questions at the beginning of the passage favoured short-term retention of concepts, but no effect on long-term retention.
Shepard-son & Pizzini (1991)[15]	-8 Jnr.Sec. Sch. Sc.	-analyses of cognitive levels of questions.	-classification as input, processing and output questions. (i.e.,lower level, medium-level and higher level)	-no difference in the proportion of question levels.

3.1.3: STUDIES ON LANGUAGE ASPECTS OF TEXTBOOKS:

All the studies shown on Table 3.3 (pp.105-106), point out several criteria to evaluate the language aspects of communication in textbooks. Spiegal's (1984) study reflects on teachers' awareness of the criteria. Eventhough Kanopak's (1985) study concludes that the physics textbook without an informal prose style which depended on analogies and models for word comprehension aided in retention, we may recall that there are some other studies (Ministrell-1982, Clement- 1987 etc. p.73) to stress on the usefulness of analogies. Strube (1989) gave a very detailed picture of language aspects of physics textbooks; perhaps it is difficult to follow this study completely in the present doctoral work, unless language aspect is the only objective of the study.

3.1.4: STUDIES ON PHYSICAL ASPECTS OF TEXTBOOKS:

The investigator has come across only one study outside India which is specially on physical aspect or design of textbooks and this has been shown on Table 3.4 (Ch.107); this study gives almost a complete picture of expected text design characteristics based on students-readers' opinions which is very important as they are better judges in this regard; this study also includes certain aspects of communication strategies such as illustration, end-of-chapter questions, etc. Dali's (1989) study mentioned in Table 3.3, also touches on textbook design to some extent.

TABLE : 3.3. : STUDIES ABROAD: ON LANGUAGE ASPECTS OF TEXTBOOKS

RESEARCHER/S	TEXTBOOK/S /No -SUBJECT/S -LEVEL, ETC.	SALIENT RELEVANT FEATURES OF		
		MAJOR OBJECTIVE/ ISSUES TREATED	SAMPLE- METHODOLOGY	MAJOR FINDINGS
Wright & Spiegel (1984)[19]	Sec.Sch.Bio.	Teachers' ability to judge the language factors such as sentence structure, vocabulary, nature of the topic, concept load & concept depth in their textbooks.	Mainly questionnaires to 662 teachers	Majority of the teachers were aware of the factors.
Konopak (1985)[20]	Two Sec.Sch. Phy.	Detailed comparison of the books to find out the effects of text characteristics on word meaning.	Mainly content analyses and retention tests.	(a) The 1st text had an informal prose style that depended on analogies and and models for word comprehension. (b) The 2nd one had a formal prose style based on explicit definitional information; and this book elicited better quality definitions and aided in retention.
Dali (1989)[21]	Four chem.& bio.textbooks in Malaysia	Study of language aspects such as design, structural patterns of paragraphs and chapters, density of difficult or unusual vocabulary and editorial features.	Content analyses	Inadequate.

TABLE No.3.3 (CONTD.)

1	2	3	4	5
Strube (1989)[22]	Phy. textbooks.	Study of literary style	Content analyses	-Textbooks (a)-Used a distinct voice which was remote, anonymous, formal and lacked warmth. (b)-were more concerned for precision (c)-overemphasized logical arguments, definitions and formal reasonings at the expense of concept development. (d)-had limited context which was inappropriate for the students' world and lacked vivid figurative language. (e)-used long complex sentences; and (f)-used rhetorical tradition and rigid presentation style.

TABLE: 3.4. : STUDIES OUTSIDE INDIA: ON PHYSICAL ASPECTS OF TEXTBOOKS :

RESEARCHER/S	TEXTBOOK/S No SUBJECTS LEVEL ETC.	SALIENT, RELEVANT FEATURES OF: MAJOR OBJECTIVES/ ISSUES TREATED	SAMPLE/ METHODOLOGY	MAJOR FINDINGS
Hartley (1990)[23]	Textbooks in use (in General)	Rank order preferences of students aged between 12 & 16 for certain features in textbook design.	Students were asked to indicate regarding the listed features as: 'helpful, made no difference or unhelpful'.	Rank orders obtained: Helpful: (a) Heading (71%); (b) A section to tell you what the chapter is about (69%); (c) Short chapter (68%) (d) Cartoons (68%); (e) Use of colours to show important points, (f) Underlining and Photographs-all (63%); (h) Spacious layout (54%); (i) Subheading (53%) (j) Tables (48%); (k) A section to remind learner what the chapter was about -47% (l) Graphs (44%) (m) Questions at the end of chapter (41%) and (n) Suggestions for further reading (40%).

TABLE: 3.5. : STUDIES OUTSIDE INDIA: ON END_OF_CHAPTER EXERCISES IN TEXTBOOKS

1	2	3	4	5
McMillan (1990)[24]	Introductory College Physics at University of Colorado (U.S.A.)	Role of conceptual reasoning in solving problems given in the textbooks.	Chapter on electrostatics -students' reactions.	Conceptual reasoning did not appear to play an integral part in textbook problem solving process; rather students preferred automatic and mechanical methods.

3.1.5: STUDIES ON END-OF-CHAPTER EXERCISES :

In this case also, the investigator has come across only one study as shown in Table 3.5 (p.107); this study does not touch directly end-of-chapter exercises; but it analyses the process involved in solving physics textbook problems; the finding of the study indirectly reflects that the way in which end-of-chapter problems are presented may have to be changed if conceptual reasoning has to play an integral role rather than encouraging students' preferred, automatic and mechanical methods in textbook problem solving process. From the study by Hartley (1990) (Table 3.4. p.107) it was found that only 41% of the students aged between 12 and 16 opined that questions at the end of chapters were helpful in general in textbooks; in the case of physics textbooks, these questions at the end of chapter must include problems too; but, because of the very nature and structure of physics, these textbook problems are expected to be highly useful to majority of the students.

3.2 STUDIES IN INDIA :

Textbook is one of the important components of curriculum; but out of 347 curriculum studies in India reported upto 1988[25] in Fourth Survey of Research in Education, only 26 (7.4%) studies deal directly with textbooks; however according to Dave and Dave,[26] in the Indian context, textbook evaluation has acquired a distinct emphasis in educational research. During 1972-78 there were national-level decisions to critically examine textbooks brought out by different States/Union territories with reference to several issues and mainly from the point of view of national integration in the case of subjects in humanities and social sciences; during this period, out of 71 studies in curriculum, 9 studies (12.8%) were in the area of textbooks; during 1978-1988 the percentage got reduced. Moreover, some of the studies were not complete textbook analyses in the sense that they touched content part only and that too mainly with the intention of looking at certain important aspects such as national integration in a history textbook, role of women in social studies textbook, etc.

3.2.1: STUDIES ON CONTENT ANALYSES OF TEXTBOOKS/ PRODUCT AND PROCESS ASPECTS:

Most of the studies referred to in Table 3.6. (pp.110-116) can be considered as major ones, as they are either based on doctoral studies or financially assisted research projects; in addition to these, M.Ed. dissertations such as Joseph's (1987)[40] physics textbook evaluation and Kadam's (1989)[41] mathematics textbook evaluation, both for Std.XI in Gujarat, have further strengthened textbook research. Kelkar's (1989)[42] annual curriculum and textbook research report (1986-87) under the umbrella of Maharashtra State Bureau of Textbook Production and Curriculum Research (MSBTPCR) enumerates several textbook research projects carried out by teachers, even including those from primary schools and research workers, mainly in the field of language and social studies; these evaluative studies in Maharashtra, have very much strengthened the data base of textbook research. Recently Ishamma (1990)[43] evaluated social studies textbook for Std.VI and Patel (1991)[44] evaluated science textbook for Std.VII.,both in Gujarat State. All the above studies mainly made use of content analysis and opinion-survey and came out with number of suggestions to improve the quality of textbooks.

3.2.2 STUDIES ON COMMUNICATION STRATEGIES: QUESTIONING SKILLS AND ILLUSTRATIONS:

In the Indian scene, it seems that no work has been reported on questioning skills in textbooks; but the study of illustrations (diagrams, figures, etc.) have been directly or indirectly included among the objectives of studies such as Joshi (1972), Gopalakrishnan (1977) and Singh (1984), which have been already referred to in Table 3.6.(pp. 110-116).

TABLE: 3.6

STUDIES IN INDIA: CONTENT ANALYSES/PRODUCT-PROCESS ASPECTS

RESEARCHER/S	TEXTBOOK/S No -SUBJECT/S -LEVEL, ETC.	SALIENT RELEVANT FEATURES OF		
		MAJOR OBJECTIVES ISSUES TREATED	SAMPLE METHODOLOGY	MAJOR FINDINGS
1	2	3	4	5
Walavalkar (1971)[27]	Maths-Std.II-IV in Maharashtra	-Detection of errors -Examination of the suitability of the text-books for the level of understanding of pupils.	-Content analyses -Questionnaires for teachers and parents. -Achievement tests for a stratified random sample of 325 pupils -Interview to the teachers.	(a) The textbook contained a number of minor errors; (b) In general, they were, suitable for the level of understanding of the pupils. (c) The content reflected the day-to-day life of the pupils and created interest in maths. (d) Certain topics were to be resequenced. (e) Answer key for all exercises were not provided.
Joshi (1972)[28]	Sc.Std.IV Maharastra	-Suitability of the content to the age and understanding level of pupils. -Suitability of explanations, illustrations, language and vocabulary	-733 Instructional units; Content Analysis. -Frequencies of (i) instructional objectives for each unit, and (ii) categorized major ideas.	(a) Except in the case of one chapter, content were suitable for the age group. (b) Proper presentation. (c) More weightage to development of science process skills and appreciation of Sc. and less weightage on knowledge objectives were needed. (d) Number of coloured pictures should be increased.

TABLE No.3.6 (CONTD.)

1	2	3	4	5
Ponkshe (1972)[29]	Geog-Std.VI -Maharastra	-(a) Academic aspects -(b) Illustration -(c) End-of-chapter exerises	-Content Analysis -Classification of exercises and % frequencies: essay, short-answer, very short-answer & objective.	(a) & (b)-somewhat good. (c)-Objective type: very small proportion. Exercises: mainly knowledge Map reading: neglected.
Gopala-krishnan (1977)[30]	Maths text-book & syllabus -upper primary in Kerala	Critical analysis of content & its agreement with syllabus illustration & errors.	-Questionnaires for 1500 teachers -Interview for some pupils, teachers, parents & experts.	(a) The structure and rigour of the textbooks were appropriate - but the rate of introduction of new terms was uneven. (b) Presence of typographical errors, errors due to carelessness and real errors & (c) some disagreements between the syllabus and the textbooks.
A.P.SCERT (1981)[31]	School Phy. & Maths.	-Content -Agreement in the syllabus -Pedagogical approach	Content analyses.	(a)-Contained several modern concepts. (b)-Satisfied the principles of syllabus construction and (c) Catered to the needs and interest of the readers.

TABLE No.3.6 (CONTD.)

1	2	3	4	5
Lalithamma (1981)[32]	Sec. School Maths text-books in Kerala	-Development of criteria for evaluation. -Evaluation of academic and physical aspects.	-Questionnaires for representative sample of 240 experienced teachers to develop criteria for evaluation. -Questionnaires constructed based on the above, to another set of 240 teachers to evaluate text-books.	(a)-Process operations were given more emphasis than the products. (b)-Topics were systematically correlated with proper grading and sequencing. (c)-Exercises were sufficient in numbers. (d)-Physical aspects were adequate (e) However, there were defects such as inadequecy of life situations and historical notes, errors, omission of mentioning of reference materials and answers to the problems, etc.
Karim (1982)[33]	Sec.Sch. hist. text-books in Kerala	-To develop models and materials for national integration	-Content analyses. -Identification of instances which would promote/ hinder national integration.	Instances which would hinder national integration, were rare; but the books were not consciously aiming at promoting national integration.

TABLE No.3.6 (CONTD.)

1	2	3	4	5
Manuel (1982)[34]	Environmental Studies textbooks of NCERT & some other State systems.	-Identification of components, which might facilitate or hinder genuine environmental approach.	-Content analyses -Interview. -Observation - Focussed group discussions with science education workers and administrative officers.	Positive aspects found: Process approach in science, activation some directives to observation and visits, stimulating questions with open tables to fill in the answer. Drawbacks:(a)-lacking in higher specifications needed in open multi-disciplinary approaches to the environment, (b) preemtying investigation by suggesting the answers, (c)-premature precisions by overlooking the initial phase of pleasure in environmental exploration. (d)-artifical situations instead of using naturally available situations. (e)defective concept processing in different branches of science. (f)-Overuse of technical terms (g)-non-recognition of the time dimension in real observations.

TABLE No.3.6 (CONTD.)

1	2	3	4	5
Singh (1984)[35]	Nationalized English text-books for Std.VI to X in Haryana.	-To study academic, physical and other general aspects.	-480 students & 480 teachers based on stratified random sampling. -Questionnaires & 5-point rating scales.	-Class VI textbook met the criteria by and large. -Drawbacks such as lack of humerous materials, inclusion of difficult lessons, insufficient number of pictures and illustrations, lack of attractiveness in lay-out of the books, etc.
Ekbote (1985)[36]	Marathi textbooks upto Std.X in Maharshtra	Linguistic content analyses.	-Finding the No. & proportion of unknown words. -Classifying the words according to origin, region, culture and their proportion. -Comparison with standard vocabulary. -Identifying known and unknown proverbs. -Analyzing various classical & historical references and their values, etc.	-Defects under several variables studied, in all the textbooks. -Intellectual development of children was not taken into consideration while writing the text-books.

TABLE No.3.6 (CONTD.)

1	2	3	4	5
Menon (1986)[37]	Science textbooks from Std.VIII to XII in Gujarat.	-(As one of the objectives) to content analyse the books to look at their suitability to develop process skills.	Content Analyses	A serious deficiency of process skills in the write-up of the science textbooks.
Roy (1986)[38]	Class VI-X Sc. text-books in Bangla Desh (Study developed and reported in India - M.S.Univ., Baroda.)	-(a) To assess the books on the basis of curriculum objectives and requirements with respect to academic, pedagogical and physical aspects -(b) To study teachers and students' opinions regarding the textbooks. -(c) To carry out in-depth content analyses of the books. -(d) To study in detail the end-of-chapter questions.	For, (a) Author, editors & illustrators: information sheets & Questionnaires (b) Startified random sample of 100 students and their science teachers: Mainly Questionnaires. -School head-masters & teachers: interview schedules & evaluation diary. (c) For all books: in-depth Content analyses sheets	For, (a) -Eventhough curriculum objectives were achieved by the textbooks, the dissatisfaction of authors, editors and illustrators might have affected the final products; and the physical aspects were not that satisfactory. (b) -Eventhough science teachers were not able to show sufficient commonness in agreement or otherwise, they were more or less satisfied with aspects such as investigatory approach, organization of content, language used, etc.

TABLE No.3.6 (CONTD.)

1	2	3	4	5
			(d) All end-of-chapter exercises: Classification based on Bloom's taxonomy of Ednl.Objectives.	(c)In-depth content analyses showed several details which are useful in future review of the books. (d)End-of-chapter exercises were mainly knowledge and understanding categories and application and other higher levels were reflected in below 6% of the questions.
Bhatia (1987)[39]	Sindhi -Class VIII-X in Maharastra	-To study the external and internal characteristics to come out with suggestions for revision of the books.	Content analysis & opinion analysis of teachers & experts.	(a)Content-helpful in attaining broad and instructional objectives. (b)Content-psychologically based. (c)Presence of defects such as negligence of difficult words, outnumbering of poems over prose, spelling mistakes, lack of exercises at the end, poor durability,etc.

3.2.3 STUDIES ON LANGUAGE ASPECTS:

Table 3.7. (p.118) shows the two studies which have specifically focussed on language aspects of science textbooks, of course at primary school level; but these have some significance even at higher level. Mukhopadhyay's (1985) study was a doctoral work whereas Sharma's (1985) ERIC financed project was carried out at NCERT. In addition to the above studies we may note that some of the studies (e.g., Walwalkar - 1971, Joshi-1972, Roy-1986) mentioned in 3.2.1, i.e. on content analysis, often narrowly or indirectly touched the language aspect of textbooks through the concept of comprehensibility or understanding.

3.2.4 STUDIES ON PHYSICAL ASPECTS:

In India, the investigator has not come across so far, any major study specifically on physical aspects of textbooks, except as one of the objectives; studies by Lalithamma (1981), Singh (1984), Roy (1986) and Bhatia (1987) mentioned in 3.2.1, reflect also on physical aspects of the textbooks. Mehta's (1983)[49] doctoral work on comparative study of textbook production, set-up and processes in India touches on physical aspects of textbooks to some extent; in connection with the improvement of quality of production, she opined that paper, size B_5 could be the most suitable for primary level textbooks and size A_5 for other classes.

3.2.5 STUDIES ON END_OF_CHAPTERS EXERCISES:

Table 3.8. (p.119) shows the only two studies that are available specifically on end-of-chapter exercises of textbooks; but some other major studies such as Lalithamma (1981) and Roy (1986) also dealt in detail about this aspect. This being very important, especially in a physics textbook, it is worth studying this even at doctoral level or through a special research project.

TABLE No.3.7. : STUDIES IN INDIA: ON LANGUAGE ASPECTS OF TEXTBOOKS

1	2	3	4	5
Mukhopadhyay (1983)[45]	Sc-Class III in Rajasthan	-To carry out linguistic content analysis, to study the relationship between comprehensibility of language used in the book and science achievement.	-Content analysis -Identification of components of comprehensibility of language: vocabulary, syntax & paragraph -Achievement test & correlation.	The components of comprehensibility were significantly related to different levels of scientific achievement such as recall, recognition, translation, interpretation and extrapolation.
Sharma (1985)[46]	Sc, S.S. and language textbooks -Class III in Rajasthan	-To make a comparative study of comprehensibility of language.	-500 pupils from 20 primary schools from urban and rural areas of Jaipur district-purposive sampling procedure -Tests on comprehensibility of language.	-Percentage of complex sentences in Sc. and S.S. books were very low. -No significant difference between the comprehnsibility on science scores in urban and rural areas.

TABLE 3.8(): STUDIES IN INDIA: ON END_OF_CHAPTER EXERCISES:

1	2	3	4	5
Vaghamare (1971)[47]	Hist.Std.IV in Maharashtra	-To examine the extent to which the end-of-chapter exercises were related to objectives of history teaching.	-Determination of the weightage given to different types of exercises such as objective, short-answer, activity-oriented, essay, types involving dramatics etc.	(a)-Most of the exercises were on understanding objective/and only one on objective of personal development. (b)-The types of exercises were mainly short-answer and without any activity-oriented type.
Vidhani (1987)[48]	Sc-Std.VIII & IX in Gujarat	-Study of level of questions in the end-of-chapter exercises.	Classification based on Bloom's taxonomy of educational objectives.	Understanding questions were over-emphasized compared to knowledge and application questions.

/a few on knowledge

3.3 AN OVERVIEW OF THE RESEARCHES REVIEWED AND THEIR IMPLICATIONS FOR THE PRESENT STUDY :

Many studies abroad as well as in India, made use of several international recommendations especially from UNESCO (1970)[50], in connection with preparation, evaluation, production and distribution of textbooks; of course not all these studies have been included in this report. At the Indian scene, as discussed earlier in previous chapter, the establishment of NCERT in 1961 and 'National Board of School Textbooks' in 1968 strongly influenced the carrying out of certain important surveys such as 'Survey of School Textbooks in India (1969-70)[51] 'Position of Nationalized Textbooks in India' (1975-76,[52] 1977-79,[53]), etc., during these 1970's NCERT's Dept. of Textbooks developed clear-cut and detailed criteria of evaluation of textbooks and published brochures in the subject of social studies, history, civics, geography, mathematics, general science, biology, language and several relevant papers; NCERT's recent publication in 1987,[54] 'A Study of the Evolution of the Textbook' from the ancient to the modern period, appears like a complete source book for Indian textbook researcj workers. Several reference materials from UNESCO, as well as from many other studies referred earlier have directly or indirectly been used in this study.

Among the studies abroad the investigator has chosen to include in this report only some 23 studies starting from 1984 to 1991; this does not mean that studies were not available earlier; they have not been included, as they are more or less similar to the studies after 1984. Similarly in the case of Indian studies, only some 27 studies have been included which were carried out during the period from 1971 to 1991; as mentioned earlier, it was NCERT's special efforts, during 1970s, that have helped a lot to textbook research workers.

Among the studies in India and abroad, the chronological order of the referred works, might apparently suggest that there were no studies reported during certain periods, but this may not be always the case, as this report contains only those studies which are more or less relevant to the present investigation. Comments made separately through 3.1.1-5 and 3.2.1-5 earlier, based on the respective Tables, have reflected on several issues from the reviewed studies and helped the present investigation.

Based on a broad overview of all the referred textbook research studies done outside India as well as in India, qualitative methods using percentage frequencies have been found very useful for the purpose; and content analysis and and opinion survey have been the two major tools in the field of textbook research; eventhough most of the studies being at doctoral level, are complete in many respects, some of them look like minor studies as they treated only certain special aspects of textbook, such as certain content conceptualizations, questioning styles, end-of-chapter exercises, language, etc. In fact, there is need to raise the status of such minor studies, into major ones, as the field of textbook research is getting wider and wider. In most of the cases, research was carried out for the existing textbooks, sometimes with a comparative outlook with the previous textbooks or textbooks related to some other parallel curriculum, in order to enable the textbook authorities to revise their products, after using for some years; but the ideal timing for a textbook research is immediately after getting the experimental edition of the new textbook, as in the case of present investigation, before bringing out the final revised version, which is likely to be used for a few more years.

Studies carried out upto 1989-90.were the main basis on which, the present investigation was proposed and started; studies after 1990 also, supported this investigation to some extent, in one way o the other. Keeping in mind the eight major Objectives of the present investigation, the following reviewed studies have been found useful: (1) For the first Objective, dealing with the actual academic content (i.e. product) studies such as Walwalkar (1971), Joshi (1972), Gopalakrishnan (1977), Lalithamma (1981), Roy (1986), Chiang-Soong (1987) and Hehr (1988) have been found very useful to make use of content analysis as a tool; in fact, these studies have some effect on the methodologies of other Objectives also. (2) For the second Objective on process skills, research works of Menon (1986) and Hehr (1988), have been found useful. Even-though product (content) and process aspects of the chosen textbooks, fall under 1st and 2nd Objectives respectively in this investigation, in classification and tabulation of the relevant studies, they have been clubbed together (as Table No.3.1 & 3.6 pp.97-100 & pp.110-116), as they appear together in most of the studies. (3) For the third Objective on communication strategies, separate studies are very few; even in major studies, questioning and illustrations on text-books have not been treated in detail; however, studies by Leonard and Lowery (1984) and Shepardson and Pizzini (1991) have influenced the methodology for this Objective in the present investigation. (4) The fourth Objective on language aspects derived its methodology partly from reviewed studies such as Mukhopadhyay (1983) and Strube (1989). (5) The fifth Objective on physical aspects of the physics textbooks has been treated partly based on studies by Singh (1984) and Hartley (1990) and partly on other major content analysis studies. (6) Sixth Objective on analysis of end-of-chapter exercises has been supported by reviewed studies such as Vaghamare (1971) and Ponkshe (1972). (7) Seventh Objective

to find out the opinion of teachers, students and experts gets its support and methodology of questionnaires and interviews from number of major content analysis studies reviewed under 3.1.1 and 3.2.1 (8) Last objective, which is for the overall assessment of the physics textbooks, has been supported by several reviewed studies especially in content analysing the relevant documents and in relating the issues together.

From the above discussions on reviewed articles especially which are at doctoral level it is very much implied that the methodology for the present evaluation of physics textbooks, should be qualitative in nature using percentage frequencies and should be based on the use of the following tools: content analysis, questionnaire, opinionnaire and interviews; the next chapter would enlighten more on the methodology and these tools for the eight objectives of the study.

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