CHAPTER IX

SUMMARY AND CONCLUSION

Section I    Summary

Section II   Conclusion
SECTION I

SUMMARY
The researcher has tried to summarise the thesis in this chapter. In the process of condensation many details had to be eliminated. This sometimes gives a false impression of lack of logicality. However, whenever in doubt, it is essential to turn to the main body of the thesis to discern the underlying logic of certain statements made here under. The major points of the first chapter have been listed as 1.1, 1.2, 1.3, etc., and of the second chapter as 2.1, 2.2, 2.3, 2.4 and so on. The first figure indicates the chapter serial and the following number the important that has been summarised.

1.1 In the rapidly evolving technological culture of the modern times, there is increased reliance on the educational institutions for keeping up the tempo of progress. The evident gap between the developed and the developing nations can be mainly attributed to the technological progress of these nations, which is directly dependent upon scientific progress and the high-level skilled man-power that is available to sustain this culture.

1.2 Scientific progress and technological applications are directly dependent upon the sophisticated and high-level competence in mathematics. The destiny of the world is being increasingly controlled by the computing
machines of the finest order. It is needless to reiterate the impor-
tance of the study of mathematics as basic to our wellbeing.

1.3 The horizons of mathematics have expanded, are expanding and shall expand. The quantum of knowledge in this branch of science is well beyond the comprehension of any single individual. A variety of hitherto unknown areas are being explored and a variety of new branches of mathematics are developing to fulfill the ever increasing demands of different areas of science and life.

1.4 School mathematics is the beginning of initiation to advanced mathematics. There is an organic relation-
ship between the mathematical knowledge available at a time and the school mathematics. It is impossible to teach all mathematics to all students at the school stage. It is a self-defeating proposition. Demarcating the content area of school mathematics is a highly difficult problem. How much of mathematics should be taught and how - is a very important problem that haunts the sensitive teachers of all school systems. Mathematics as a necessity, as an expression of human mind of reflective activity, as logical reasoning and rationality, and as an instrument for exercising the various faculties of the mind have variously been emphasised by different mathematicians and pedagogues.
1.5 Quantification and exactitude are the two important aspects of mathematics that appeal greatly to all other branches of knowledge. Mathematics is at once a pure science and has tremendous scope of applicability to each and every branch of human existence.

1.6 The close relationship of mathematics with physics, chemistry, life sciences, geography, astronomy as well as with social sciences has been highlighted. It has affected language, arts, crafts, sports, ethics, amusement, etc. and this has been briefly touched upon.

1.7 An attempt has been made to arrive at a working definition of the word 'curriculum' so that a viable and pragmatic operational system can be suggested. The views of Lawton, Kerr, Krug, Doll, Richmond, Hirst, Musgrove have been considered. Dean's schematic representation of Everyman's syllabus indicates the core curriculum. Richard's statement that "Designing curriculum follows logically from what we think curriculum is" has provided the basic frame of reference. A narrow definition leads to the limited subject approach; whereas a highly ambitious view would lead us to a thorough examination of all the aspects of the teaching-learning process.
1.8 Mathematics is highly abstract in nature and its concretization is a difficult task. Simple numbers like 2 and 3 are not really simple because the twoness of two and threeness of three is a theoretical idea which has to be generated through a series of concrete examples. Acquaintance with symbols, notations, generalizations and the symbolism is extremely essential for mastering the basics of mathematics. The mathematics curriculum should provide adequate scope to pupils to learn abstractions of mathematics with interest. The intention should be concerned with pupil's appreciation of and attitude to mathematics.

1.9 The present study is concerned with the critical appraisal of the present secondary school mathematics curriculum of Orissa and is titled "A Critical Appraisal of the Secondary School Mathematics Curriculum of Orissa."

1.10 Definitions of selected terms like 'Critical', 'Appraisal', 'Secondary School', 'Curriculum', 'Mathematics Curriculum', 'Board of Secondary Education, Orissa', 'Orissa State' have been provided.

1.11 The need for fundamental research in the curricular processes of various school subjects had been emphasised by the Secondary Education Commission of India, 1952. The imperatives of research in this field had amply been stated
by Thwaites. This in general and such related theoretical
studies convinced the author of the need for research in
mathematics curriculum.

1.12 The need for research arose from the
personal predicament of the researcher as a secondary school
teacher for a period of eight years and his current involvement
as the method master of the subject in the Faculty of Education.

The Government of India and the several State
Governments are intent upon raising the standard of mathematics
teaching with the technical collaboration of the National Council
of Educational Research and Training. Research in curriculum
diagnoses the defects of the present curriculum and
facilitates scientific reforms. Ad hoc changes and tinkering
are replaced by scientific reflections. The present study as
a benchmark survey of the intended and operational curriculum
is expected to augment the process of curricular change in
mathematics of Orissa.

1.13 The main objectives of the study were:

a) To analyse the objectives of teaching
mathematics from the view of students,
teachers, specialists and pedagogical
literature.
b) To compare selected mathematical curricula with that of Orissa.

c) To assess the relative importance of this subject vis-à-vis other school subjects.

d) To delineate the present operational situation relating to the mathematics curriculum.

1.14 This study has attempted to analyse the Compulsory Mathematics Curriculum of the secondary school, i.e., of Classes VIII, IX and X of Orissa.

1.15 The study is circumscribed by certain limitations which relate to sampling, access to information, paucity of resources, and lack of response from certain teachers.

1.16 The related studies have been comprehensively dealt with in Chapter II.

1.17 The normative survey method was adopted in this research project. The questionnaires were designed and administered by the researcher. The data so collected were analysed and interpreted. The standard format of the research project has been followed.

1.18 The sample consisted of 220 teachers from six revenue districts with varying maturity, belonging to different types and sizes of the schools. The sample of the students was
556 hailing from families with differential educational backgrounds, educational achievements and ages, reading in classes VIII, IX and X.

1.19 The pupils' questionnaire had 40 questions. There were 113 questions in the teachers' questionnaire. The researcher consulted specialists, practitioners and educational administrators to supplement the information gathered through questionnaire and/or to interpret.

2.1 Survey of related research enlightened the researcher with the general trends and neglected areas of the field. The studies that were plainly relevant have been discussed.

2.2 One of the earliest studies of the field was of Samanta (1944) relating to the survey of Teaching of Mathematics in Secondary Schools of the Bombay Province.

2.3 Dave and Saxena (1965) studied the Curriculum in the Teaching of Mathematics in Higher Secondary Schools.

2.4 Pillai's survey of Mathematics Teaching in Kerala is one of the earliest status surveys in post-independent India.

2.5 Karandikar tried to study the Mathematical concepts as Developed in Mathematics Textbooks in classes II to VII.
2.6 Wanchoo and Sharma conducted a study on Survey and Development of Research in Science and Mathematics Education in India.

2.7 Sinha in his study tried to establish some broad outlines of criteria for evaluation of curricular materials in new mathematics.

2.8 Paranjape studied the Changing Objectives of Mathematics Teaching in the Primary schools.

2.9 Gopalkrishnan’s study was related to the New Mathematics Syllabus and Textbooks of Upper Primary Classes of Kerala.

2.10 Dev’s study related to the position of Mathematics Teaching in the State of Nagaland.

2.11 Gupta’s study was an Experimental Evaluation of the Effectiveness of the Methods of Teaching in High Schools.

2.12 Lalithamma tried to formulate the Criteria for Writing Textbooks in Mathematics and their Evaluation for the Secondary Schools of Kerala.

2.13 Mohammad tried to examine the relationship between Mathematical Creativity and different Methods of Teaching.
Chapter III attempts to outline the objectives of the secondary school mathematics curriculum.

The importance of objectives in formulating the curriculum was explained with reference to Gronlund's dictum that those be stated 'in terms of learning outcomes rather than the learning process'; UNESCO's that they were '..............what a person should be able to do', and as precise end point whose attainment can be clearly assessed. Dubisch Roy's discussion on the changing debate relating to the importance of various objectives and the inherent vagueness and lack of clarity of thought in this regard has been described.

The specific objectives relating to secondary school mathematics curriculum has been analysed with reference to pedagogical literature like the Report of the International Commission on Mathematical Instruction (1976) of the UNESCO; recommendations of the All India Survey of Achievement in Mathematics at the School Level (1964) of the NCERT; the recommendations of the National Conference on School Mathematics (1969); objectives as enumerated by Iswar Bhai Patel Committee Report (1977); The National Policy on Education (1986) and the objectives stated by it, the proposals of the Inter-State Board for Anglo-Indian Education (March 1988) in this regard; the explication of objectives of Mathematics syllabus for the High School Certificate Examination have been examined.
3.4 An attempt was made to analyse and compare the objectives of mathematics of the curricula of the NCERT, CBSE, ICSE and the BSE, Orissa.

3.5 The teachers' perception of the objectives of secondary school Mathematics was studied and analysed. In general, the teachers were conservative in their outlook in this regard and belonged to the genre of teachers prior to the Introduction of New Mathematics in Indian Schools. They emphasised the fundamental mathematical operations, familiarity with mathematical concepts and terms, and development of mathematical skills. Objectives like development of discipline, determination and a sense of proportion were given the least importance.

3.6 Students, by and large, were pragmatic in their approach and considered mathematics to be a utilitarian subject. It was considered helpful in their progress in higher scientific education and in procuring technical jobs. It was disturbing to note that the students failed to understand the organic relationship between mathematics and logical thinking and rated this objective as of the least importance.

3.7 52.27 % of the teachers stated that the objectives of mathematics instruction had been well reflected in the topics of the mathematics syllabus. However, the disagreement of 47.72 % of the teachers in this regard strikes a jarring note.
4.1 An analysis of the intended curriculum (or the syllabus) of the secondary schools of Orissa has been attempted in chapter IV. At first the need for syllabus has been highlighted with reference to the opinions of eminent authors in the field like Prof. Sinha, Prof. Thwaites, Prof. Watson, Sir Eccles etc. This was reinforced by the arguments put forth by the Education Commission of India in its Report of 1966; in the Report of National Curriculum for Primary and Secondary Education and the National Curriculum advocated in pursuance of the objectives laid down in the National Policy on Education(1986).

4.2 The Board of Secondary Education, Orissa was established in 1955. It is the statutory accrediting authority for all the secondary schools of Orissa. It inherited the erstwhile matriculation syllabus of the Utkal University and allowed it to continue with minor modifications upto 1973. In 1973, the syllabus was thoroughly overhauled - the weightage to arithmetic decreased and that of measurement and algebra increased. New topics were included and some of the traditional topics were eliminated. The winds of change under the impact of New Mathematics were evident. In 1980, the syllabus again underwent major structural changes. Algebra and its application received 50% weightage and equal weightage was accorded to Geometry and its application which encompassed Mensuration. Arithmetic lost its place of pride.
4.3 The detailed specifications of the curricula of the Board of Secondary Education, Orissa, the Central Board of Secondary Education; and the Indian Certificate of Secondary Examination have been provided.

4.4 A comparative analysis of the syllabi brings the following facts to light.

a) The syllabi of NCERT and BSE, Orissa were class-wise and that of ICSE was paper-wise. Greater weightage had been accorded to Mathematics in the ICSE syllabus.

b) The provision of optional mathematics was a very good feature of the Orissa syllabus which was absent in the other two.

c) The NCERT and the ICSE syllabi were boardly identical.

d) The Orissa syllabus was broadly divided into "Algebra and its application" and Geometry and its application.

4.5 The teachers' opinions were elicited on different aspects of the syllabus. Almost 50% of the teachers did not favour a school specific curriculum. It was either due to the lack of expertise at the local level or due to a love...
for uniformity throughout the state.

4.6 Teachers desired that the headmaster and mathematics teachers should jointly prepare the syllabus. They were allergic to associate the students and the parents in syllabus framing. They were afraid of administrative sabotage, and so did not like to shoulder this responsibility without associating the headmaster in this work.

4.7 The suggested composition of the syllabus committee of 10 members was to have four mathematics teachers, three university teachers of mathematics, two method masters from colleges of teacher education and one primary school mathematics teacher. They did not favour the inclusion of student representatives, guardians or any other category of persons in the Board.

4.8 Most of the teachers refrained from responding to the questions on the demerits of the present mathematics curriculum which may be due to a lurking fear of the administrators who do not take kindly to criticisms. Most of the answers on the 'merits' smack of sycophancy and flattering.

4.9 As regards the relative importance of the various topics of mathematics, teachers exhibited their conser-
-vative attitude by providing higher ranking to traditional topics and resisting the intrusion of new topics. It has exposed their outdated outlook and obsolescence. Teachers need to be reoriented with the emerging changes of mathematics.

4.10 The students' likes and dislikes of topics were highly confusing. In such of the schools where the younger teachers were in charge, the students indicated a decided preference for new topics like logarithms, identities, quadratic equations, inequations etc; whereas in schools where the old guard were teaching, the preference was for traditional topics.

4.11 An analysis of the likes and dislikes of the students largely depended on the teachers and the methods adopted by them. The Geometry syllabus was satisfying to most of the students.

5.1 This chapter attempts to analyse the various facets of the mathematics textbooks. The importance of the mathematics textbook was highlighted.

5.2 In all six textbooks had been prescribed for classes VIII, IX and X which contained 1075 pages of materials.

5.3 Most of the teachers opined that the textbooks failed to state the objectives in clear cut terms. A few introductory remarks touching upon the objectives were all that were available.
5.4 The detailed objectives stated in the syllabus in accordance with Bloom's Taxonomy was more an exercise of unimaginative repetition bereft of basic understanding. The curriculum specialists tried to be fashionable by parading the Taxonomic objectives without really utilising them in syllabus formulation.

5.5 More than 52% of the teachers did not appreciate the get-up of the mathematics textbook. However more than 91% of the students considered the get-up of the book to be average or good. This was essentially due to their lack of exposure to quality textbooks of the developed nations.

5.6 According to 70.9% respondents the quality of the paper used in the textbooks was good; but printing technologists did not subscribe to this view.

5.7 The printing of the textbook was carried out through the outdated manual block system resulting in faded impressions and defective printing. The printing technology adopted for textbook production needs to be modernised.

5.8 The 12-point pica size letters were used for printing the mathematics textbooks which was considered to be the appropriate size for the concerned age group. More than 55% students were satisfied with the printing. The textbooks had many mistakes; and many of them might be due to the outdated block system of printing. The errors and mistakes of the
textbooks have been documented in detail in consultation with the practising teachers, the students and the specialists.

5.9 The binding of the textbook was far from being satisfactory as per the opinions of the printing technologists. However, the cost component seen to be a major deterrent in upgrading the quality of textbook production.

5.10 163 out of 220 teachers considered the cost of the mathematics textbooks to be moderate or low; and 57 teachers considered the cost to be high.

5.11 59.54% teachers testified that the language used was appropriate and accurate. The disagreeing teachers could not corroborate their views with specific examples.

5.12 There is an evident trend of translating the mathematical terminology into the state language i.e. Oriya. Over translation is an imminent danger of mathematics which is an international language.

5.13 Most of the topics were explained through the discussion method. The analysis-cum-discussion method was largely neglected.

5.14 The new terms were explained in clear and definite terms. However 35% of the teachers disagreed with this view.
5.15 The inadequacy of the pictures and diagrams was highlighted by 114 teachers of the responding 220 teachers.

5.16 Answer to the exercises, exercises for revision and illustrative solved examples were absolutely adequate. Practical exercises and heuristic presentation were lacking to a high degree.

5.17 The textbooks, it was stated, helped the bright students to pursue the studies independently. On the whole the textbooks were not designed to meet the varying levels of intellectual differences and programmed texts are a far off cry.

5.18 No systematic effort had been made to formulate a conceptual flow-chart showing therein the gradual development of inter-related concepts.

5.19 The sums were graded according to the difficulty level through a process of crude assessment. Realistic and practical gradation of gradients of conceptual difficulty is subject to further research and exploration.

5.20 Inclusion of lengthy calculations were stoutly defended for their value in promoting concentration, steadfastness and tenacity.
5.21 The experimental work was inadequate.

5.22 Experienced teachers relied less on the textbooks for teaching, setting questions and assigning homework. The novices greatly depended on textbook.

5.23 Generally correct answers were provided to all the problems included in the textbook. If due to the author's mistake or printer's devil some error creeps in, both the students and the teachers were confused. It may sabotage the students' confidence in the proficiency of the teachers.

6.1 Chapter VI deals with the teachers of mathematics. He puts the theory into practice and enkindles the interest of the students. He should be able to exploit the educational possibilities implicit in the subject. The teaching of New Mathematics demands greater creativity and alertness on the part of the teachers. He must continuously update himself and keep himself abreast of the latest developments in his subject and its related pedagogy. Hoyle's categorisation of restricted and 'extended' professionals is apt.

6.2 The traits of an ideal mathematics teacher have been listed by Joseph Leese, Kenneth Frasure, Mauritz Johnson, Roy Dubisch, K.S. Sidhu, J. N. Kapur, Bryan Thwaites etc. But between the ideal and the reality always a shadow falls.
6.3 The realities relating to the mathematics teachers have been ascertained from the responses of the teachers.

6.4 There were 1635 teachers in the 220 schools in all subjects of which 558 teachers had the requisite minimum qualification (34.1%). The standard staffing pattern of a three-class secondary school was eight teachers. Most of the schools were inadequately staffed. A school had an average staff-strength of 7.3. In the 220 responding schools there were 574 mathematics teachers working; of them 323 teachers had studied mathematics up to the graduation level, of these 220 teachers were trained. One out of every five mathematics teacher was an underqualified untrained teacher.

6.5 As many as 91.5% of the teachers did not get any opportunity of inservice training.

6.6 66% of the teachers were in the age range 35 to 58. 54.35% of the teachers had an experience of 10 years or more. The student-teacher ratio was 1:45 on an average. The rapport between the students and the mathematics teachers was reported to be very cordial by 38.6%, cordial by 53.4% and neutral by 8% of the teachers. The rapport is highly satisfactory.

6.7 Teachers unwillingly promote a dislike for the subject through their shortcomings. 13.1% of the students ascribed the cruelty of the teachers as the reason for their
dislike for mathematics, 9.1% due to the failure to clarify the mathematical ideas and 2.3% due to non-clarification of their doubts.

6.8 88.1% of the teachers succeeded fairly in their task by following the chalk and talk method, 12 teachers were reported to be totally incapable of teaching and fiftyfive taught mathematics verbally by not using the black board.

6.9 50% of the students were satisfied with the prevailing methods of teaching and the rest 50% were dissatisfied.

7.1 The teaching-learning process related to mathematics has been analysed in Chapter VII from different angles. The success of the operational curriculum depends upon the effective translation of the intended curriculum into realistic learning outcomes through the adoption of effective methods. The teachers' activities, the school environment and the mathematics curriculum are closely inter-related and influence each other in a variety of ways. Dean's schematic representation with the help of a tetrahedron illustrates the situation graphically. The School's Council Team of U.K. had listed quality, continuity, autonomy and discussion as the desirable characteristics of mathematics teaching. Servais and Varga stressed the importance of spiral curriculum and cyclical courses and the substitution of the mechnical drills by methods of
intelligent and intuitive learning. Dienes represented diagrammatically the six stages of teaching mathematics beginning from preliminary free play activities followed by structured activities, intuitive abstraction activities, representation activities, examination and description activities, culminating in axiomatic formulation activities.

7.2 9.5% teachers stated that they always followed the prescribed pedagogical methods of teaching mathematics, and 85.45% stated that they followed such methods sometimes. 5% teachers categorically stated that they never followed such methods.

7.3 The reasons adduced for not following pedagogical methods were lack of time (151), lack of students' participation (72), lack of ancillary facilities (64), unsuitable timetable (25), constraints of examination (25), and lack of motivation (11). The shortened 35-minute period constrained the mathematics teachers to hurriedly skip through the course. Further the imported western methodologies seem to be ineffective in the Indian situation.

7.4 42.7% teachers preferred the analytic method. The lecture method was described as totally unsuitable. The deductive method and the inductive and synthetic methods were not in vogue due to lack of rigorous practical training.
7.5 In most of the schools (96%) the skill of drawing geometrical figure was taught. However 44.5% of the teachers did not bother to develop the skills of drawing mathematical charts among their students. The preparation of mathematical models was not practised by 34.1% of the teachers. Though geometrical constructions were practised universally, they were traditional and unimaginative in approach. The geometrical experiments were limited to the experimental proofs of certain theorems. Reference books were mostly unavailable and most of the teachers did not bother to refer them.

7.6 36.3% of the teachers depended solely on the textbooks for their classroom preparation. None of the teachers read the mathematical journals regularly, twenty teachers had never read them and 200 teachers had occasionally read them. For the students it was considered to be a non-feasible activity.

7.7 The teachers' perception of their own performance was rather negative. Only 14% teachers considered the present teaching standard to be good. 58.18% teachers described the present standard of teaching to be average and by 27.72% teachers as poor. The causes that adversely affected teaching were the limited working days (100), shorter duration of periods (96), inadequacy of teaching periods (69).

7.8 Students study for knowledge; but mark-fetching knowledge is more popular. All topics do not receive equal
attention. The examination-centred approach skews both teaching and learning towards such topics which have higher recurrence in examinations. 19.5% teachers stated that they did not bother regarding understanding of mathematical concepts.

7.9 Mathematics is a compulsory subject in the High School Certificate Examination as per the regulations of the Board of Secondary Education, Orissa. However, 39.1% teachers were not in favour of such compulsion. 15.8% teachers were satisfied with the present allotment of five periods a week for mathematics. 42.7% teachers pleaded for six periods per week to complete the course. However, for the comprehensive coverage of the mathematics course 83% of the teachers favoured allotment of six to eight periods per week.

7.10 Special rooms for mathematics were conspicuous by their absence. Only two schools reported that they had such rooms and one of them was a central school and the other was a private school.

7.11 The students had a positive attitude towards mathematics. 52.7% students stated they derived pleasure in studying it and 37.4% stated it as being indispensable. However 9.1% students felt disgusted and around 7% students considered it as total waste of time.
7.12 40.5% of the students liked mathematics more than the other school subjects and 47.1% of the students loved it like any other school subject. 10% of the students considered it the most important subject.

7.13 Geometry and its application was liked by 66.7% students and was more popular than Algebra and its application. The concretisation of concepts through geometrical figures made this subject more popular.

7.14 41% of the students stated they understood all the theorems; 29.8% understood most of them and 18.7% students remembered the theorems by rote learning without understanding. 100% of the students neither understand nor remembered the theorems.

7.15 Around 19% students or roughly one fifth of the student population solved only a few problems in the exercises or none at all. Similarly 29% students only drew the geometrical constructions drawn by the teacher on the blackboard or none at all. 11.5% students disliked the exercises on mensuration. Around 48% students were regular in solving the problems of mensuration. In this regard it is worth noting that 2.2% students did not study the solved problems of the mensuration text and as many as 48.9% had studied only some of the solved problems.

7.16 Textbook was the only source for 60% of the students and they had no access to books of similar content. Students accorded higher weightage to the annual examinations.
as is evident from the time devoted by them for preparation, compared to the half-yearly examination. 54.6% students preferred to study all alone and the rest indicated their preference for group study. 78.6% of the students sought special coaching or tuition. Only those who could not afford missed them. As many as 50% of the institutions stated that they organised coaching classes for remedial teaching 20.7% of the students abstained from attending such classes. 28.7% students used guides or keybooks in addition to the regular textbooks.

7.17 Teaching aids play a crucial role by concretising the abstract mathematical concepts.

7.18 The secondary schools of Orissa seem to be lacking the minimum aids without which mathematics teaching is absolutely impossible. 21 schools lacked chalks, 44 schools did not have adequate number of blackboards, and dusters were not available in 57 schools.

7.19 211 out of the 220 schools did not have adequate financial resources to purchase the necessary aids. It was stated by 39.5% students that teaching aids were never used in the mathematics classes. The geometry box was the most frequently used aid followed by the graph cloth. Models, charts were rarely used and the use of the radio and the filmstrips is nonexistent.
7.20 Cocurricular activities related to mathematics were rare. Around 3% students indicated that they played "Business" or "Mathematical Quizzes." The preparation of mathematical models was an equally neglected area and only 69 students participated in it.

7.21 Much can be said for and against homework. Homework is an additional burden for the students and so is unpalatable. However, it is a universal phenomenon in all the schools of Orissa. It reinforces learning.

7.22 31.8% of the teachers never bothered to correct the homework assigned to the students. The reason for such neglect was stated to be heavy workload, over crowded classes, additional curricular load and administrative and cocurricular involvement. 57.2% teachers opined that the assignments should be corrected in the class and not at home. 31% of the teachers stated that they had no time to correct the assignments due to heavy personal engagements. 65% of the students stated that they spent two hours or more per day for home study. Most of the students (358) finished the assignments the day they were given and 157 prepared them on the day appointed for checking. Around 41 students totally neglected this aspect. 288 students completed the assignments during the morning hours and 181 in the evening. The rest had no scheduled hours. 43% students did not receive any help from the home front in preparing the assignment. Mostly it was either the brother or the father who assisted the students. Only 13% students received the assistance...
from either the mother or the sister. Here in lies a hidden commentary of the educational backwardness of the women of Orissa. Most of the students received assistance at times or only when asked for.

7.23 The library is the store house of all knowledge including that of mathematics. Only 6.3% schools stated that they had reference books on mathematics and only 15.4% students took some interest in studying them.

8.1 This chapter deals with evaluation of mathematics. The entire educational system of India seems to be revolving around examinations. The present system of evaluation is mostly of the written type. Oral and practical examinations are absent. The system of internal assessment has successfully been sabotaged. The formative evaluation is a far off cry; and the summative evaluation decides the destiny.

8.2 38.3% of the teachers had never used any classroom tests; 39.1% teachers were giving weekly tests. Half-yearly and annual examinations were conducted in all the schools as they were mendatory. 200 teachers felt that the class tests can be utilised as good feed-back; but 20 teachers did not agree.
8.3 The teachers suggested that an ideal question paper should give equal weightage to all the three types of questions - long answer, short answer and objective types. However, a preponderant majority of students (372) preferred the objective type question; only 184 the long answer type. An analysis of the question papers of most of the schools reveal that they greatly conform to the procrustean standard set by the B.E.E., Orissa. 59% teachers expressed their dissatisfaction with the present pattern of examination conducted by the B.E.E., Orissa. 21.82% of the teachers did not accord equal weightage to the various content areas.

8.4 99% of the teachers opined that the high rate of failure in mathematics was ascribable to the defective methods of instruction and were not due to defective questions.

8.5 An analysis of the causes of failure in mathematics revealed that most of them related to defects in learning strategies, promotion procedures, curriculum designing and evaluation system etc. The negative attitude of the teachers came next followed by the apathy of the parents.

8.6 As many as 252 students expressed their fear for the examination in mathematics. Researches on state anxiety and trait anxiety related to mathematics examination need to be conducted.
8.7 The perception of the difficulty level of the various items of the tests largely depended on the ability, aptitude and achievement in the field of mathematics.

8.8 An analysis of the marks secured in mathematics by the students, broadly conform to the principles of normal distribution. More students were in the higher ranges during the half-yearly examinations; but this situation changed at the time of the annual examination. This was due to the traditional stricter evaluation at the end-of-the-session examination.

8.9 The B.S.E., Orissa is adopting a system of central valuation. 220 teachers disapproved such a system. They stated that hurried and cursory evaluation deprived the students of their due reward. "Justice hurried is justice buried" even in evaluation. The teachers gave a number of reasons for the decreasing credibility of the central valuation system.

8.10 Most of the teachers preferred the procedure for awarding marks step-wise. 166 teachers were against negative marking.

8.11 27.2% candidates failed in mathematics in the H.S.C. Examination 1986, 39.6% in 1985 and 30.1% in 1984. Uniformly, only 7 to 8% students secured more than 75%
marks in mathematics. It was disheartening to note that only 7 students could qualify in the National Talent Search Examination in the entire state, with mathematics as a major subject. This is a very poor index of mathematical achievement.

9.1 This chapter provides a succinct summary of the entire thesis. It also provides a considered conclusion.
SECTION II

CONCLUSION
The momentum of development is dependent upon the technological progress which is sustained by the pace of the scientific and mathematical advances. The mathematical spectrum encompasses elements of numeracy to the advanced application of mathematical researches in super computers. Mathematics as the queen of the sciences is the basic foundation for development of civilization and culture. Mathematics is changing and school mathematics is in a flux. Demarcating the content area of school mathematics is a difficult curricular task. The intended curriculum can be chiselled with care by a few eminent experts; but the outcomes of the operational curriculum ultimately depend upon the limited capabilities of a single mathematics teacher working in a forlorn village high school totally isolated from the great stream of intellectual activities.

The study of objectives, selection and organisation of content and methods, evaluation, the total situation, various settings for curriculum development and the advantages of cooperative curriculum planning were some of the aspects which were considered; and which should continue to engage the attention of the teachers of mathematics in the years to come. Adhoc changes and tinkering with the curriculum must give place to scientific curricular decisions based on cross-cultural exchanges of research findings relating to
this field. A clearing house of mathematical ideas needs to be established at the state level which should disseminate them to the practising teachers.

The present practice of imposing the curriculum from above should give place to the school-based curricula. The autonomous schools like autonomous colleges must be in a position to develop need-based area-specific curricula suited to their institutions. The curriculum making must be a joint endeavour of the specialists, pedogogues, practising teachers, students and the employers. Programmed learning and computer assisted learning can greatly be experimented with in the field of mathematics. Trait analysis of successful teachers and students of mathematics would greatly facilitate the restructuring of the methodology.

The findings of this thesis portray the sordid stark realities as they were in the eighth decade of the Nineteenth Century. This bench-mark survey should spur the curriculum specialists to engage themselves with greater rigour and dedication to mathematics. Almost every facet of mathematics teaching is in need of urgent improvements. The neglect or failure in this critical area may have disastrous after effects. The United States was constrained to accord a place of priority to curriculum renewal and innovation in the post-Sputnik era
as it felt that Russia had stolen a lead over it. Things are far from being satisfactory with regard to mathematics in India, in general, and in Orissa, in particular, and the country can ill afford to aggravate the situation through neglect a default.

Today, there is greater access to secondary schooling. The young adults passing out from these institutions enter a world totally different from that which confronted their parents when they left secondary school. The integration and enrichment of the contents of mathematics and science hold the key to future technological progress. Every part of the school curriculum, irrespective of level or subject, needs to be scrutinised with absolute thoroughness if India wishes to catch-up with the advanced nations. Schools have to rise to the challenge of creating appropriate curricula, to meet the varied needs of a developing, democratic, secular country that is fast speeding towards industrial progress and self-sufficiency. The whole hearted cooperation of all the mathematics teachers is solicited in this grand endeavour.