CHAPTER-I
INTRODUCTION

Science has radically transformed man's material environment. In the technologically advanced countries the average span of human life has increased by more than a third over the last hundred years. Science is universal and so can be its benefits. Its material benefits are immense and far reaching - industrialisation of agriculture and release of nuclear energy, to mention two examples - but even more profound is its contribution to culture. Science is liberating and enriching mind and enlarging the human spirit. Its fundamental characteristics has turned out to be the possibility of unlimited growth. Every advance in science deepens one's understanding of nature; but it also heightens the sense of ignorance. Nature is inexhaustibly knowable. Nothing comparable to the scientific revolution in its impact on man's development and outlook has happened since the neolithic times.

THE PROBLEM

The aim of research is, always, to provide answers about the particular universe of events, or, to verify propositions about the structure of events in that universe. The first of these alternatives is clearly appropriate in the areas under study and governs research strategies adopted. The problem can be stated as: "A critical appraisal of the Primary School Science Curriculum of Orissa."

In this context the researcher has tried to elicit cogent, coherent and comprehensive answers to the following questions related to the curricular process.
Question-1: How far are the objectives of the Primary School Science Curriculum of Orissa appropriate?

Question-2: How far are the contents of the Primary School Science Curriculum of Orissa adequate to fulfil the objectives?

Question-3: How far is the implementation of the Primary School Science Curriculum of Orissa adequate?

Question-4: How far is the evaluation of outcomes of learning the contents of the Primary School Science Curriculum of Orissa effective?

Techniques:

1. Questionnaires for the pupils and the teachers of the Primary Schools and experts in science teaching.
2. Analysis of the Primary School Science Curricula of Orissa, different States of India and some foreign countries.
3. Study of related literature.

Only the pupils and teachers of the Primary Schools and experts were consulted as they are involved in handling the curriculum.

SIGNIFICANCE OF THE PROBLEM

The School Science Curriculum is in a state of flux all over the world. The Primary School Science is facing increasing criticism as being inadequate and outmoded and as not having been properly designed to meet the needs of the modern times. In the United States of America the traditional curriculum had been radically transformed in the early decades of this century under the impact of progressivism, the contents of the School Science
Curriculum are being criticised by the educationists and the scientists; and a new reform movement is steadily blowing which is for shadowing sweeping curricular changes.

Tremendous explosion of knowledge has taken place in physical Science, Life Sciences, Space Sciences and Earth Sciences. Philosophy and Religion were the parents of Science; but now Science has evolved to such an extent that it is impossible for other disciplines of study to vie with it. Research and Experimentation reformulate scientific concepts and unveil the mysteries of nature. For these reasons a wide gulf is apparent between the Primary, the Secondary and the University Science Curricula. Inter-stage and intra-stage articulation and co-ordination is an urgent imperative.

The nature of General Science and the current rethinking in education have their impact in the appraisal of the Primary School Science Curriculum as well. The Experts and Specialists in Science and Education advocate the study of Space Sciences, Earth Sciences, Life Sciences and Physical Sciences in an integrated way, as Environmental Studies and sometimes as separate disciplines.

The plethora of scientific knowledge is necessitating the inclusion of more and more significant items in an already over-packed school science curriculum. It is imperative to identify the useless educational lumber in the school courses which can be safely discarded; and to develop better strategies for effectively presenting the essential knowledge. Explosion of scientific knowledge impels one and better strategies of teaching compel one to focus attention on the appraisal of the School Science Curriculum from time to time.
Education is a three-fold process of imparting knowledge, developing skills and inculcating proper attitudes. Now the primary schools are concentrating all their efforts to actualise the first part of the process - the imparting of knowledge - and even this is in an unsatisfactory state. The existing curriculum places importance on bookish knowledge and rote learning; makes inadequate provision for practical activities and experiences; and is dominated by examinations, both internal and external. It will be ridiculous to style the present Science Curriculum as satisfactory, as it is out of step with the present definitions of curriculum and science; and as well with the tune of the modern times.

Hence, there is the need to revise, upgrade, appraise and improve the Primary School Science Curriculum of Orissa.

OBJECTIVES OF THE STUDY

1. Objectives determine the scope and limitations of the content for inclusion, the methods of teaching and the procedures of evaluation. They provide the frame of reference for the study. The objectives of the Science Curriculum have been investigated from the points of view of the:
   (a) Teachers
   (b) Students
   (c) Pedagogic literature
   (d) Taxonomic analysis of the contents.

2. To analyse the contents of the intended curriculum with reference to the courses of study prescribed by the authorities and the text books.
3. To compare the intended Science Curriculum of Orissa with those of other States of India and some foreign countries.

4. To analyse the facilities of teaching Science at the Primary School stage - the science kit, the science laboratory, the text-book, the science museum, community resources, Co-curricular activities etc.

5. To analyse the operational curriculum with reference to:

(a) Teachers and their competence
(b) Students and their abilities
(c) Methods of teaching and learning
(d) Timetable and allocation of time
(e) Comparative importance of the subject vis-à-vis other subjects.

6. To analyse the evaluative procedures in science education with special reference to achievement.

LIMITATIONS

The researcher made the following assumptions and recognised the following limitations so that the attention was focussed on the valid objectives; and the danger of over-generalisation was minimised.

1. The curriculum for Classes III to V was taken for investigation. The reason for not including the curriculum of Classes I and II was that there was no prescribed text book or curriculum for Classes I and II; and only the study of the environment was suggested in general terms. The curriculum for
Classes VI and VII was not included as it is traditionally considered to be the Lower Secondary Stage. Only recently it has been styled as the Higher Primary Stage. The second reason for limiting the topic was to keep the project within reasonable limits for adequate investigation.

2. The universe was too large to be analysed. Since the number of schools, pupils, teachers, colleges and college teachers was extremely large, their sampling was done carefully. There were many content experts and method experts, it was not possible to elicit the opinion of all; and here too the researcher had to take recourse to sampling and limiting their numbers.

3. To evaluate the Primary School Science Curriculum of Orissa, the curricula of the Primary Schools of the various States of India were compared and contrasted for cross-sectional study. The researcher had addressed two to three letters to all the State Councils of Educational Research and Training, all the Directors of Education, all the Boards of School Education and all the State Institutes of Education of India; but the replies were discouraging and negative. Many authorities did not bother to favour the researcher with a reply. Their silence was a great stumbling block and is indicative of the latent inertia of the educationists towards research.

4. A few Science Curricula from the foreign countries had been taken for evaluation. It was difficult to get the curricula of foreign countries. Those documents were not available with the foreign embassies in India. In some cases the curricula of the respective countries were in their own languages and English translations were not available. The investigator could not make a
comparative study of such curricula whose English versions were not available.

5. The objectives pertaining to the Psychomotor and Affective Domains could not be taken for objective analysis of the course contents rigorously as no explicit work has been done in these two areas.

6. Evaluation for Psychomotor objectives and Affective Objectives has not been done systematically and so the investigator did not attempt to assess the evaluation of these objectives of the Primary School Science Curriculum. In the Cognitive Domain evaluation for 'Analysis', 'Synthesis' and 'Evaluation' was not attempted as these are higher mental abilities; and are out of scope of the Primary School Curriculum. The development of these higher mental processes was not attempted at the Primary stage; and as such the analysis of the curriculum from this context was considered not necessary.

7. The tools were planned, prepared, tried out and evaluated and these were used for evaluating the curriculum. The tools were prepared keeping in view the existing curriculum of the Primary Schools of Orissa.

8. The resources for the study in Orissa were not adequate. The teachers and experts were not specialists in "Curriculum Development". The literature in this field was scarce, scanty and inadequate. However, the researcher had tried to tap resources from other outside sources for expert advice, reference materials and other aspects.
SOME TERMS

It was necessary to clarify the meanings of some terms generally used in the topic lest these may be mis-interpreted. The act of stating about these terms helped to establish the frame of reference with which the researcher approached the problem. The word "appraisal" denotes "evaluation". The "Primary School" means "Grade School (USA), for Pupils of 6 to 11".

"Science" means "the study of systematised knowledge produced by careful observation, measurement and experiments to establish general laws or principles to describe the phenomena under the study." "Curriculum" means "the set of desired learning outcomes — or — the structured set of learning experiences aimed at achieving such outcomes." "Orissa" is one of the States of the Indian Union recognised by the Indian Constitution (FIGURE- 1).

REVIEW OF PREVIOUS RESEARCH

Indian Research:

The following research had been undertaken by the different Universities in India on "Curriculum, Methods and Text Books" upto 1972.


FIGURE 1  The political map of India, showing Orissa.
(Based upon the survey of India map 1930)


Kelkar, S.V.A. - Tentative Course of Study in General Science, Ph.D., Bombay University, 1950.

Pillai, K.S. - An investigation into the changes in the context and scope of the Primary and Secondary School Curriculum in Kerala during the last thirty years (since 1934) with a view to ascertaining how far these have been helped to the raising of standards. Ph.D., Kerala University, 1968.

Pires, E.A. and Katyal, K. - Building up a social Studies Curriculum for the Central Institute of Education basis School, Central Institute of Education, New Delhi, 1957.


Srivastava, S.K. - Differences in curricular learning Ph.D., Gorakhpur University, 1968.


As stated by Sunirmal Roy the following research works were undertaken during (1972-1979):

Dewasthalee, R.B. - An investigation into the present secondary education curricula (Standard V to X) in the Maharastra State with a view to revision in the context of Vocationalisation of Education at all levels. Ph.D. Bombay University, 1978.

Ghosal, T. - An enquiry into the Curriculum trend in the secondary school of India during the British rule (a comparative study), Ph.D., Calcutta University, 1973.

The following were the objectives of the study: (i) to analyse critically the elementary and junior school curriculum in NEFA on the basis of an examination of its socio-economic and cultural condition and (ii) to offer suggestions for improvement.

The study was divided into two sections. Section one explained the purpose, need, scope and methodology and gave the socio-economic survey of the place. The second section provided an account of the progress of education in North Eastern Frontier Agency from 1947 to 1970. Information regarding the socioeconomic status and educational progress was sought from village elders, teachers, village level workers and officials of the medical and agricultural departments working in the area, directorate of education, state department of education and the report of the Education Commission.

The findings of the study were as follows: there was an increase in the number of primary schools with emphasis on agriculture and crafts. Schools of NEFA suffered from problems of low enrolment and irregular attendance. The following were the defects of the existing curriculum - over emphasis on the three R's, isolation from life outside the school, inadequate provisions for the needs of child life, subject-centred rather than child-centred, dominated by examination, inadequate preparation for life and not related to NEFA environment. Some of the modifications suggested in the basic school curriculum were: (1) emphasis should be on the child rather than the crafts (2) music and fine arts must be included for the emotional growth and the aesthetic development of
the child. (3) Concept of work experience should be included in NEFA Schools.


The main objectives of the study was to have a deep look into the programme of Home Science Education and to propose an improved four years programme for secondary schools. The study was undertaken with the following hypotheses: (i) Adequate finance and physical facilities are the main contributing factors which are vitally correlated with the achievement in Home Science Programme. (ii) The girls are being benefitted through this programme due to facilities available from the department of education and the institutions of their own. (iii) The syllabus meets the needs of the teenagers as the individual authority is authorised to make it problem-oriented. (iv) Finance, lack of physical facilities, lack of trained and experienced teachers have hindered the development of the programme of Home Science Education at Secondary level. (v) Like other subjects Home Science also has its worthiness in the field of education. (vi) Being a new subject it is continuously developing and improving.

All the secondary and higher secondary schools offering Home Science in all the States of India were taken up for the present study. The Union Territories except Delhi were not included.
In this way, 594 higher secondary schools formed the sample of study. Questionnaires, observations and discussions were the main techniques for data collection. Mean and percentages were the main statistical measures used for the analysis and interpretation of the data.

Almost all the hypotheses formulated were accepted. In addition, some salient findings were as follows: There were more than one thousand multipurpose schools with Home Science Wing in India. The educationists emphasized the importance of scientific knowledge in the day to day affairs and recognized Home Science as a major activity in terms of work experience; but it failed to achieve the goals due to academic, financial and other physical hindrances. The methods employed for Home Science teaching and evaluation were inadequate. There were reasons that in Home Science teaching was not related to the expectation. Internal assessment was impracticable mainly on account of lack of funds, facilities and enthusiasm of both administrators and teachers.


The objectives of the study were: (i) to evaluate the present science curriculum of standard-VIII in vogue from 1972. (ii) to modify the present curriculum with a view to achieving skill oriented objectives of the teaching of science; and (iii) to finalise the practical and progressive science curricula, after a tryout.

The existing science curriculum was evaluated by questionnaires and interviews. On the basis of opinion of experienced and
trained science teachers, the curriculum was modified and made more skill-oriented. Two groups of students of standard-VIII of Six English medium High Schools in Bombay were selected for experimentation. The two groups were matched on the basis of achievement of the pupils in Science in standard-VII. The previous knowledge of the two groups was measured by a pretest based on the curriculum of standard-VIII. The modified curriculum was taught to the experimental group and the existing curriculum was taught to the control group. After teaching both the curricula a post test was administered to both the groups. Significance of the difference between means was computed.

The main findings of the study were: (i) Significant difference between the means of achievement in knowledge objectives was found in three out of six schools. (ii) Significant difference between the means of achievement in skill objectives was found in all the schools and (iii) Significant difference between the means of achievement in application objectives was found in five out of six schools. The investigation concluded that the curriculum suggested was more suitable than the existing curriculum and that the existing curriculum in force in the state needed modification.

Srivastav, P.L. - Development of Home Science Degree Programmes in India, Ph.D., M.S. University, Baroda, 1976.

Umamaheswar, P. - Practices and Prospects of Physical Education in the Colleges under the University of Kerala, Ph.D., Kerala University, 1976.

The above data reveal that within 1947 to 1979 i.e. within 32 years only 20 projects had been undertaken for the Ph.D., or equivalent works on curriculum studies. Only one project on elementary science curriculum was under-taken in the Gauhati Univer-
sity, Assam in the year 1973. In Orissa there are three Universities which impart instruction in Education; but not a single research project had been undertaken in these three universities up to 1979 on Primary School Science Curriculum.

Research in USA:

The investigator presents below a specially compiled list of doctoral dissertations on "Science Curriculum in Schools from 1977 to 1983.

(a) General:

Brandenburg, Richard Kenneth. Development of a predictive systems model for course research and improvement. (Michigan State University).

Crabil, Jack Alden. Factors related to the estimated percentage of Science instructional time spent in laboratory investigations (University of Maryland).

Enz, Judili Elaine. Redefinition and validation of Science education curricular goals. (University of Arizona).

Foster, Gerald William. Creativity and the group problem solving process. (University of Iowa).

Halverson, Wesley Frant. An environmental education curriculum: Its development and dissemination. (University of Wisconsin Madison).

Hangen, Robert Kenneth. Student use of time in a large and a small self-paced science class room. (University of Illinois at Urbana-Champaign).

Huggins, Leslie Maurice. Laboratory methods and analysis of fossil leaves and their application to educational curricula. (University of Idaho).

Kastuck, Edwin Naum. The development of marine education resources pertaining to the Blue Mussel (Mytilus Edulis L). (Union for Experimenting Colleges and Universities).

Lahde, James Anthony. Effect of an educational land planning strategy on students' cognitive and affective development. (University of Michigan).

Mecu Lough, Leelavathie Cooppan. An organismic approach to the development of a comprehensive science curriculum. (University of Masssachusetts).
Mengel, Branda Moore. Science Curriculum Selection criteria as disseminated by division-makers, charge agents and curriculum developers/publishers. (University of South Dakota).

Thompson, Gary Lea. A descriptive study of the Forty Washington Trip Winners in the Thirty Ninth Annual Westinghouse Science Talent Search, their sponsoring teachers, their schools, the Science Curricula of their Schools and their projects.

(b) Elementary:

Allen, Irma Acosta. From consensus to controversy: A case study of a K-8 Family Living curriculum. (University of Illinois at Urbana Champaign).

Calvay, Helen. The effects of a process-oriented elementary school Science programme on Piaget's operative content comprehension. (State University of New York at Buffalo).

Dresser, Harry Holland, Jr. An investigation of differences in school organisational climate and other selected variables and the implementation of a marine education infusion curriculum. (University of Maine).

Hall, Gary Lee. The teaching of Ecology in a novel and relevant wilderness setting and its effects on the ecological thinking, feeling, and perceiving of elementary school youth. (University of Montana).

Harvey, Francis Aidan. The interaction of television viewing and experience with manipulable materials in children's science concept development. (Harvard University).

Khan, Muhammad Bahadur. The Development of an elementary school science curriculum for Pakistan based on American Programs as models.

Koller, Geraldine Rhea. The effectiveness of an implementation of an elementary school science programme with a science resource supply centre. (Washington State University).

Lavorgna, Gary M. The assessment of a revised field study program in elementary barrier beach ecology. (New York University).

Lucas, Rhodora Joy. An investigation of the development of life science concepts in selected elementary school science text-books and laboratory programs (Montana State University).

Mallon, Gerald L. Student achievement and attitudes in Astronomy: an experimental study of the effectiveness of a traditional "Star-show" planatorium program and a "Participatory oriented planatorium" Program (Temple University).

Swift, Jennifer Ruth Wallenfels. The effects of participation in selected activities from the Biological Sciences curriculum study-elementary school sciences program on the enhancement of listening skills (University of Texas at Austin).

Can Rennes, Eve Cynthia. The effectiveness of guided inquiry for teaching Physics to sixth grade students in a museum environment (Wayne State University).

Willet, Richard Earle. An analysis of selected national elementary science curriculum projects using Ralph W. Tyler's "Basic Principles of Curriculum and Instruction" as a standard of comparison. (New York University).

(c) Junior High:


Batty, Barbara Daub. The effects of advance organisers on the learning of the students in the study of oceanography in Eighth Grade Earth Science Classes in an inner city school (University of Texas at Austin).

Bishop, Jeanne Emmons. The development and testing of a participatory planetarium unit emphasizing projective Astronomy concepts utilizing the Karplus learning cycle student model manipulation, and student drawing with Eighth Grade Students. (University of Akron).

Fletcher, Jack Kenneth. An experimental comparison of the effectiveness of a traditional type planetarium program and a participatory type planetarium program. (University of Virginia).

King, Robert Engene. The impact on knowledge, attitude, and achievement motivation scores of various sequences of field trip and classroom instruction using selected Energy Education concepts (University of Kansas).

Krane, Elizabeth. The effect of learning centres with selected Human Sciences Program activities on vocabulary and reading comprehension of Seventh Graders including under-achievers (University of Northern Colorado).

Rivers, Robert Hinton. A study of the association between the use of Individualised self-pacing science curriculum Materials (ISCS) as a reading course and gains in reading comprehension and vocabulary skills of Seventh Grade Students (Florida State University).

Staylor, Gerald Edison. An investigation of the relationship between Piagetian reasoning development and Junior High School Science Curricula (University of Northern Colorado).
Robergte, David Richard. Development of Life Science-based human sexuality program for the middle school years (University of Cincinnati).

(d) High School:

(1) General:

Fathiazar, Eskander. Analysis of Science text-books used in Iranian Upper Secondary Schools (University of Illinois at Urbana - Champaign).

Han, Jong Ha. An analysis of the second year Korean Science text-books using Piagetian concrete and formal operational thinking patterns (Florida University).

Levin, James. Sexuality differences in attitudes that are hypothesized to be related to cognitive performances in secondary school biology with grade level and type of science course considerations (Pennsylvania State University).

Lyon, Laurie. Development of guidelines for high school students of conducting research in the sciences (Duke University).

Mahmood, Hussein. Secondary school science curricula practices: A ten-year longitudinal study of schools in ten states (Ohio State University).

(2) Biology:

Jones, Grace May-Ping. Analysis and evaluation of High School Biology text-books (Auburn University).

Lee, Mae T. The effects of visuals and communication structure on meaningful knowledge acquisition and retention (Columbia State University Teachers' College).

Roadrangka, Vanitipa. A comparative content analysis of Texas and Thai High School Biology text-books. (North Texas State University).

Robbins, Jon Ira. The effects of three variations in lesson structure on the performance of a manual laboratory task and on task-related concept acquisition. (Columbia University).

Soydhurum, Pisarn. An analysis of the Thai IPST Biology Program in terms of classroom activities and attitudes. (University of Texas at Austin).

Western, Dorothy Elizabeth. A validation of predictive accuracy of readability formulas appropriate for use with High School Biology texts. (Purdue University).
Wilhelm, Richard David. A chronology and analysis of regulatory actions relating to the teaching of evolution in public schools. (University of Texas at Austin).

Yousuf, Zeinab Abdal. An experimental study comparing effects of Biological Science Curriculum Study (BSCS) and traditional Biology instruction in an Egyptian Public Secondary School for girls (Pennsylvania State University).

(3) Chemistry

Bolesky, Edward Michael. The influence of electronic Hand-Held Calculators on cognitive achievement in Chemistry (Boston College).


Gibian, Leslie M. A problem solving model in a general Chemistry Course (Columbia University).


Jones, Loretta Lucek. The teaching of Chemistry of means of Videocassette employing computer graphics. (University of Illinois at Chicago Circle).

Porter, Nadine Sumpter. An instructional programme to facilitate student achievement of the role concept. (University of Houston).

Tatum, George Roger. A study of the effectiveness of learning laboratory-based high school chemistry independent of the classroom. (University of Maryland).

(4) Earth Science


(5) Ecology

Leftridge, Leonavol Alan. Rural and urban secondary student perception of environmental issues: relevance to environmental education curriculum development. (Kansas State University).

Macgregor, Bruce A. The use of survival paradigms in environmental education. (Stanford University).

Markovits, Paul Stephen. Environmental education and the resident outdoor education experience. (Syracuse University).

Effects of various models on disinhibition and verbal commitment of perform environmentally sound behaviour (University of Iowa).

(6) Physics and Energy:

Abdulwahab, Mohamed Gamal. Levels of understanding of the physics laws. (University of Wisconsin-Madison).

Kirkland, Elmo Ronald. The feasibility of the use of dimensional analysis as a quantitative solving technique in High School Physics (Temple University).

Quint, Walter. Secondary transfer of energy awareness from student to parent based on a centered, activity-oriented energy focussed curriculum. (Temple University).

Taitt, Henry Albert. The effectiveness of Hobby Oriented Physics Experiences (HOPE) in the teaching of high school Physics.

(7) Others:

Wilson, David Lee. High school students' attitudes towards science and the marine environment following a summer marine Science Program (University of Alabama).

The above bibliography on doctoral dissertations indicates that research had been carried out on the general aspects of Curriculum, Elementary School Curriculum, Junior High School Curriculum and High School Curriculum for the School stage. Again research was done specifically in Physics, Chemistry, Biology, Ecology and Earth Science Curriculum. A critical analysis reveals that investigations had been carried out on Curriculum Development, Curriculum Evaluation, Objectives, Contents, Implementation including allocation of time, instructional materials, Text-books, instruc-
TIONAL STRATEGIES, EVALUATION OF PUPILS ACHIEVEMENT AND CURRICULUM IMPLEMENTATION AGENCIES.

DESIGN OF THE STUDY

The project was completed following the standard procedures adopted in educational research. The procedures have been described below:

Selection, Formulation and Definition of the Problem.

The author was conducting a research project for his M.Ed. Degree in the field of Curriculum. Since he was a Science Teacher in a School for fifteen years he was deeply interested in problems relating to Science Education. These two factors impelled the investigator to choose this problem. The caption of the problem is, "A critical appraisal of the Primary School Science Curriculum of Orissa."

Survey and Collection of Related Information.

The author studied the related literature from various Primary and Secondary sources. He borrowed books and journals from the University Libraries, the Libraries of Colleges of Education, the British Council Library, Calcutta and National Institute of Education Library, Delhi. Some books and journals were purchased from the research fund, granted to the researcher by the University Grants Commission, India. The information was collected to build a theoretical background about the field and the topic.
Preparation of the Tools of Research and Collection of Data.

(i) For preparation of tools of research the investigator prepared a preliminary plan. The following points were emphasised:

a. Major aspects of the curriculum and their details
b. The persons who can supply necessary data
c. The questions to be answered for the problems
d. Suitable tools to be chosen.

The investigator consulted his guide and experts in Education to finalise these issues.

(ii) The following tools of research were finally chosen:

a. Questionnaire for pupils
b. Questionnaire for teachers
c. Questionnaire for experts.

(iii) The following steps were followed to prepare the questionnaires:

a. Planning the Questionnaires
b. Preparing the Questionnaires
c. Trying out the Questionnaires
d. Standardising the Questionnaires.

At each step expert opinion and suggestions of the experts in the field were taken. After completing all these formalities and steps, the final draft was prepared. The pupils' Questionnaires and the Teachers' Questionnaires were printed
and the Experts' Questionnaires were Cyclostyled. (Vide items B, C, D of the Appendix.) These tools of research were administered on teachers and pupils by the author. The Experts' Questionnaires were mailed to the experts and the investigator sent a forwarding letter with these questionnaires.

(iv) In addition to information through these tools, the author collected Curricula of Indian States and foreign Curricula and journals.

Organisation, Analysis and Interpretation of Data; and Formulation of Conclusions and Generalisations:

The investigator analysed and interpreted the data. He analysed the data with text, tables and figures. The conclusions and generalisations were drawn on the basis of factual observation and available evidence.

Preparing the Research Report:

Following the general guidelines for writing the research report chapterisation was designed and the report has the following format:

A. Preliminary Section:

1. Title Page
2. Acknowledgement
3. Table of contents
4. List of Tables
5. List of Figures
B. Main Body of the Report:

1. Introduction
   (covering review of related literature and design of the study)
2. Place of Science in the Primary School Curriculum
3. Objectives of the Curriculum
4. Intended Curriculum
5. Implementation of the Curriculum
6. Evaluation
7. Summary

C. Reference Section:

1. Bibliography
2. Appendices

Footnotes were provided at the end of each chapter for immediate reference.

SAMPLE

In a research project sample is the mirror of the population. This is the representative of the whole population. The following tables would indicate the samples of the Primary School Pupils, the Primary School Teachers and the Experts from the different districts of Orissa (FIGURE-2).

TABLE I
THE SAMPLE OF THE PUPILS

<table>
<thead>
<tr>
<th>Districts</th>
<th>Bolangir</th>
<th>Kalsang</th>
<th>Komarpur</th>
<th>Sambalpur</th>
<th>Sundargarh</th>
<th>Ganjam</th>
<th>Total</th>
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<td>Rural Boys</td>
<td>59</td>
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<td>35</td>
<td>17</td>
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<td>20</td>
<td>192</td>
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<tr>
<td>Area Girls</td>
<td>11</td>
<td>15</td>
<td>10</td>
<td>8</td>
<td>9</td>
<td>7</td>
<td>60</td>
</tr>
<tr>
<td>Urban Boys</td>
<td>39</td>
<td>31</td>
<td>25</td>
<td>14</td>
<td>16</td>
<td>13</td>
<td>138</td>
</tr>
<tr>
<td>Area Girls</td>
<td>31</td>
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<td>20</td>
<td>11</td>
<td>14</td>
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<td>114</td>
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<tr>
<td>TOTAL</td>
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<td>50</td>
<td>60</td>
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</tbody>
</table>

N = 504
TABLE II
THE SAMPLE OF THE TEACHERS

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<th>Kora-</th>
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<th>Sundar-</th>
<th>Gan-</th>
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<tr>
<td>Male</td>
<td>36</td>
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<td>23</td>
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<td>2</td>
<td>1</td>
<td>95</td>
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<tr>
<td>Female</td>
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<tr>
<td>Urban Area</td>
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</tr>
<tr>
<td>Female</td>
<td>19</td>
<td>15</td>
<td>12</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>52</td>
</tr>
<tr>
<td>TOTAL</td>
<td>78</td>
<td>63</td>
<td>49</td>
<td>9</td>
<td>5</td>
<td>4</td>
<td>208</td>
</tr>
</tbody>
</table>

N = 208

TABLE III
THE SAMPLE OF THE EXPERTS

<table>
<thead>
<tr>
<th>Respondents</th>
<th>Content Area</th>
<th>Method Area</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Professors/Principals</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Readers</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Lecturers</td>
<td>12</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>TOTAL</td>
<td>14</td>
<td>3</td>
<td>17</td>
</tr>
</tbody>
</table>

N = 35

METHODS OF GATHERING DATA

The Normative Survey Method was accepted by the investigator as the principal method of investigation. This method concerns in itself with the present phenomena in terms of conditions, relationships, practices, beliefs, attitudes, processes, effects or trends. It is also called the descriptive survey, status,
normative or trend study. This type of research collects three types of information - of what exists, of what is wanted and of how to get there - and is thus, highly purposive.

Characteristics:

It distinguishes itself by gathering data from a relatively large number of cases, by being cross-sectional, by concerning itself with general statistics of a population or a sample, by serving as the basis of fundamental research, by possessing various degrees of complexity, by being both qualitative and quantitative and by having a good range of phenomena as its subject. It was provided itself of great value in advancing knowledge.

Major Steps:

Since it is a school survey, it consists of the following steps -

1. Preparation of plans
2. Preparation of adequate tools
3. Gathering data
4. Interpretation of data
5. Preparing the report

DATA GATHERING INSTRUMENTS

The Pupils' Questionnaires:

This was of six pages and this consisted of two sections with closed-ended questions. All possible precautions had been taken to make it simple and intelligible. The general information necessitates pupil's name, address, age and data about parents. In the direction section five directions were given which provided the pupils with the necessary hints for answering the
TABLE IV describes the questionnaire for the pupils in brief.

### TABLE IV

THE PUPILS' QUESTIONNAIRES

<table>
<thead>
<tr>
<th>Question *</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 10</td>
<td>Activities in Science</td>
</tr>
<tr>
<td>11</td>
<td>Values of Science</td>
</tr>
<tr>
<td>12</td>
<td>Evaluation in Science</td>
</tr>
<tr>
<td>13</td>
<td>Objectives of Science</td>
</tr>
<tr>
<td>14</td>
<td>Pupils' reaction for Science Education</td>
</tr>
<tr>
<td>15</td>
<td>Science in the Primary School Curriculum</td>
</tr>
<tr>
<td>16</td>
<td>Liking for branches of Science</td>
</tr>
<tr>
<td>17</td>
<td>Suggestions</td>
</tr>
</tbody>
</table>

* Vide Appendix.

### Teachers' Questionnaire:

This consisted of nine sections along with general data about the respondents and five hints. Here fortynine questions were given in thirteen pages. The directions were given in general and near each question in particular. In this questionnaire questions were of open-ended type as well as closed-ended type. TABLE V describes the questionnaire briefly.
The Experts' Questionnaire

This Questionnaire consisted of seventeen questions, general information about the experts and seven hints for answering the questions. In a questionnaire of five pages experts were requested to give answers to open-ended and closed-ended questions. These questions necessitated expert opinion in different areas. TABLE VI describes the questionnaire briefly.

TABLE V
THE TEACHERS' QUESTIONNAIRE

<table>
<thead>
<tr>
<th>Section</th>
<th>Question $</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1-2</td>
<td>Objectives</td>
</tr>
<tr>
<td>II</td>
<td>3-11</td>
<td>Curriculum</td>
</tr>
<tr>
<td>III</td>
<td>12-23</td>
<td>Instructional Materials</td>
</tr>
<tr>
<td>IV</td>
<td>24-33</td>
<td>Text book</td>
</tr>
<tr>
<td>V</td>
<td>34-41</td>
<td>Teacher</td>
</tr>
<tr>
<td>VI</td>
<td>42-43</td>
<td>Teaching Strategies</td>
</tr>
<tr>
<td>VII</td>
<td>44-47</td>
<td>Allocation of time</td>
</tr>
<tr>
<td>VIII</td>
<td>48-49</td>
<td>Evaluation</td>
</tr>
<tr>
<td>IX</td>
<td>-</td>
<td>Suggestions</td>
</tr>
</tbody>
</table>

$ Vide Appendix.
TABLE VI
THE EXPERTS' QUESTIONNAIRE

<table>
<thead>
<tr>
<th>Questions</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Science in the Primary School Curriculum</td>
</tr>
<tr>
<td>2</td>
<td>Objectives</td>
</tr>
<tr>
<td>3 to 13</td>
<td>Dimensions of the Curriculum</td>
</tr>
<tr>
<td>14</td>
<td>Teaching Strategies</td>
</tr>
<tr>
<td>15 to 16</td>
<td>Evaluation</td>
</tr>
<tr>
<td>17</td>
<td>Suggestions</td>
</tr>
</tbody>
</table>

$ Vides Appendix.

STATISTICAL TREATMENT

After administration of the questionnaires the items were scored and the data were classified and tabulated. On required occasions, the data were described by the figures and measures of central tendency and relationship for analysis and interpretation.

NOTES


3
Ibid., P.303.

4
Ibid., P.95.

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