CHAPTER IV

THE INTENDED CURRICULUM

The problem of appraising the contents of the curriculum taxonomically and transversely is the most vital issue in the whole curriculum evaluation process. Taxonomic analysis shows clearly how objectives of the curriculum have been actualised in the concrete form. The evaluation in terms of external evidence reveals how far the curriculum is related to the Indian curricula, foreign curricula and above all to secondary and higher primary curricula. The cross-sectional study shows aspects like organisation, planning, values, importance, order of teaching different units, structure of contents and the relevance of the Primary School Science Curriculum.

SOME GENERAL ASPECTS OF THE CURRICULUM

Benefits of Science:

An analysis of the responses of the pupils for benefits of science indicates the ideas of the students as regards the benefits likely to accrue from the study of Science.

TABLE X

BENEFITS OF SCIENCE AS PERCEIVED BY STUDENTS

<table>
<thead>
<tr>
<th>Items</th>
<th>Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enables the student to be a good man</td>
<td>446</td>
</tr>
<tr>
<td>Enables the student to pass the examination</td>
<td>422</td>
</tr>
</tbody>
</table>
TABLE X (CONTINUED)

<table>
<thead>
<tr>
<th>Items</th>
<th>Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enables the student to know facts of Science</td>
<td>422</td>
</tr>
<tr>
<td>Enables the student to think critically</td>
<td>414</td>
</tr>
<tr>
<td>Enables the student to understand the nature</td>
<td>411</td>
</tr>
<tr>
<td>Enables the student to be truthful</td>
<td>358</td>
</tr>
<tr>
<td>Enables the student to enjoy his life</td>
<td>295</td>
</tr>
<tr>
<td>Enables the student to get a good job</td>
<td>290</td>
</tr>
<tr>
<td>Enables the student to be a successful man</td>
<td>281</td>
</tr>
</tbody>
</table>

N = 504
Mean = 371

$ Vide Question No. 11 of the Pupils' Questionnaire.

Table X indicates the perception of the benefits likely to accrue from the study of Science by the students. It is needless to state that the students might have been influenced by their science teachers in this regard. The differential emphasis on different types of benefits elucidated by different teachers was reflected in this table.

As many as 446 students of the total sample opined that they studied science to become 'goodman'. Indian culture and for that matter Indian Education have had strong idealistic overtones; and no wonder the teachers emphasized and the students were influenced by these 'goodman' possibilities of Science. "Knowing the facts of Science" and "Passing the examinations" shared the second place and both these are highly pragmatic stances compared to the highly idealistic aspiration described just above. "Critical Thinking", "Understanding nature", "Truthful-
ness", "Enjoyment" and "Occupational Utility" aspects of Science were given descending priorities in the order in which they have been arranged. At the high school and in the first two years of the collegiate education 'occupational utility' becomes the most important aspect of Science. But the primary school students feel that they are far away from the world of work and as such occupational utility occupies the lowest position in the scala.

Importance of Science vis-a-vis other subjects:

Science enjoys a dominant place in the curriculum. In the past years it was a helpless child which was fighting for its very existence; but now it is feared that this young child will occupy the central position in the stage of the curriculum and there is an increasing apprehension that this newcomer may ultimately totally oust the older established disciplines. The opinion of the pupils, the teachers and the experts have been analysed below:

TABLE XI

IMPORTANCE OF SCIENCE AS PERCEIVED BY THE PUPILS

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Weightage</th>
<th>Weightage in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother tongue</td>
<td>2654</td>
<td>88</td>
</tr>
<tr>
<td>Arithmetic</td>
<td>2109</td>
<td>69</td>
</tr>
<tr>
<td>English</td>
<td>1712</td>
<td>56</td>
</tr>
<tr>
<td>Science</td>
<td>1435</td>
<td>47</td>
</tr>
<tr>
<td>Social Studies</td>
<td>1380</td>
<td>45</td>
</tr>
<tr>
<td>Drawing</td>
<td>1321</td>
<td>43</td>
</tr>
</tbody>
</table>

N = 504

$ Vide question No. 15 of the Pupils' Questionnaire
Table XI shows that Science does not enjoy high prestige in the elementary curriculum like the Mother Tongue, Arithmetic and English. (FIGURE 4)

The hangover of the traditionalism is clearly evident here. The traditional curriculum was heavily skewed towards the languages and liberal arts subjects. This tendency has been corrected and science has been accorded its due importance under the impact of progressive education in developed countries. Utilitarianism is becoming increasingly important and idealism is losing its cold grip over the curriculum. Life-adjustment subjects have gained ascendancy over the literary subjects. But the winds of progressivism have not reached the primary schools of India and inspite of the many attempts, the primary schools continue to be citadels of conservatism. Literary subjects like 'Mother Tongue' and 'English' continue to occupy a position of preeminence and science is unable to dislodge them from their pedestal. Parents educated earlier had inadvertently instilled the values relating to different subjects. The schools may try to bring about changes; but the homes have their say too.

It is the teachers who make or mar the importance of a particular subject in the school curriculum. The teachers lay too great an emphasis on languages to the detriment of science. Until and unless the Teachers' Training Institutes reorient the teachers and impress upon them the importance of science, things are not likely to change. This is a highly disturbing finding and steps need be taken to emphasise the importance of science in the school curriculum.
FIGURE 4
Place of Science vis-a-vis other subjects according to pupils of Orissa.
(Based on Table XI.)

Subjects

% Weightage

Mother Tongue

Arithmetic

English

Science

Social Science

Drawing

43%

45%

47%

56%

69%

88%
TABLE XII
IMPORTANCE OF SCIENCE AS SEEN
BY TEACHERS

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Weightage to Knowledge</th>
<th>Weightage to Attitudes</th>
<th>Weightage to Skills</th>
<th>Total weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Studies</td>
<td>602</td>
<td>626</td>
<td>740</td>
<td>1968</td>
</tr>
<tr>
<td>Science</td>
<td>421</td>
<td>666</td>
<td>755</td>
<td>1842</td>
</tr>
<tr>
<td>Mother Tongue</td>
<td>490</td>
<td>707</td>
<td>382</td>
<td>1579</td>
</tr>
<tr>
<td>English</td>
<td>648</td>
<td>553</td>
<td>377</td>
<td>1578</td>
</tr>
<tr>
<td>Drawing</td>
<td>392</td>
<td>294</td>
<td>880</td>
<td>1566</td>
</tr>
<tr>
<td>Arithmetic</td>
<td>418</td>
<td>301</td>
<td>397</td>
<td>1116</td>
</tr>
</tbody>
</table>

N = 204

Vide Question No. 3 of the Teachers' Questionnaire

Table XII indicates that Social Studies occupied the first position and Arithmetic came last. Certain highly technical difficulties were experienced by the researcher in eliciting accurate responses to questions where a knowledge of taxonomy of educational objectives was a prerequisite.

The Teachers were requested to accord weightage to knowledge (Cognitive Domain), attitudes (Affective Domain) and Skills (Psychomotor Domain) of different school subjects. Teachers did not have even the least rudimentary knowledge about the taxonomy. The researcher had to explain, to each and every teacher the fundamentals of the taxonomy to enable them to answer this question satisfactorily. Inspite of the best of the efforts of the researcher it was noted that many of the teachers could not grasp the
basic ideas of the taxonomy. In consequence the tabulated data could not reveal the accurate picture.

The teachers listed the school subjects in the following order in respect of their contribution to the knowledge aspects.

1. English  
2. Social Studies  
3. Mother Tongue  
4. Science  
5. Arithmetic  
6. Drawing

Knowledge of English was the summum bonum of colonial Indian Education. Education meant English Education and Knowledge was assessed in terms of a person's mastery over English, the foreign language of the erstwhile colonial masters. But the teachers by and large, failed to understand the taxonomic connotation of Knowledge which encompasses terms, facts, convention, trends, and sequences, classification, criteria, methodology, principle and theory. Science and Mathematics which greatly contribute to the aforesaid conception of knowledge were given the fourth and fifth places respectively. The traditional idea of ornamental knowledge which bolsters up the ego still reigns supreme and the idea of functional knowledge has not yet taken roots.

Difficulties were experienced in assessing the contribution of different subjects to the development of attitudes and skills and the researcher had to explain the question in great detail to each and every teacher. It was stated by the teachers that Mother Tongue contributes the maximum, in fostering attitudes; Science was given the second place, followed by Social Studies, English, Arithmetic and Drawing in that order. This seems
to be a fairly reasonable assessment and is not tangentially off the mark.

Drawing was perceived as the subject with the maximum potentiality to develop skills and this needs no corroboration or elucidation. Science was accorded the second place in skill development followed by Social Studies, Arithmetic, Mother Tongue and English.

**TABLE XIII**

**IMPORTANCE OF SCIENCE AS PERCEIVED BY THE EXPERTS**

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Weightage to cognitive Aspects</th>
<th>Weightage to Affective Aspects</th>
<th>Weightage to Psycho-motor Aspects</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science</td>
<td>105</td>
<td>73</td>
<td>102</td>
<td>280</td>
</tr>
<tr>
<td>Social Studies</td>
<td>75</td>
<td>98</td>
<td>91</td>
<td>264</td>
</tr>
<tr>
<td>Mother Tongue (Oriya)</td>
<td>75</td>
<td>115</td>
<td>45</td>
<td>235</td>
</tr>
<tr>
<td>Arithmetic</td>
<td>76</td>
<td>73</td>
<td>63</td>
<td>212</td>
</tr>
<tr>
<td>English</td>
<td>70</td>
<td>96</td>
<td>35</td>
<td>201</td>
</tr>
<tr>
<td>Drawing</td>
<td>35</td>
<td>43</td>
<td>104</td>
<td>182</td>
</tr>
</tbody>
</table>

$N = 35$

§Vide Question No.1 of the Experts' Questionnaire

The total number of experts was 35; of these 18 were experts in the Methodology of Science and 17 were specialists in different contents areas of Science. Table III of Chapter I shows the detailed breakup of experts statuswise (Professors/Readers/Lecturers), content-wise and Method-wise. The specialists
in the content area were chosen from fields of Physics, Chemistry, Zoology, Botany and Geography. However, no specialists were there in the fields of Astronomy and Earth Sciences and so could not be included. The method specialists included Readers and Lecturers of Government Training Colleges of the State with both content and methodological specialisation.

The content specialists experienced difficulties in understanding the technical terminology of the taxonomy, but could easily appreciate once the researcher explained it to them. According to these experts Science was considered to be the most important subject of the primary school curriculum and is sharply at variance with the perception of the students and teachers. They had accorded the highest weightage to the knowledge aspects and skill aspect had been given weightage next only to Drawing; and it was accorded the fourth place in so far as the affective domain was concerned. All in all, it has been accorded the greatest weightage followed by Social Studies, Mother Tongue, Arithmetic, English and Drawing. The low importance given to English is in tune with the current paedagogic thinking and the prevailing situation. The perspective of the specialists is altogether different from that of the primary school students and their teachers.

The most likely criticism against this finding is that the experts were biased in favour of their own subject and that their judgement had been coloured by their deep involvement in the subject. Science and a high degree of objectivity are expected to go together; and in this instance it may be alleged that subjectivity and personal pre-occupation have had the better of the day.
Conclusion:

It becomes now difficult to establish relationship among the above three findings. Science occupied the first position according to the teachers and fourth position according to the pupils in the curriculum of the primary stage. The position of the Experts was obvious and findings were in tune with their standing and specialisation. Teachers ranked it second because they were teaching the subject and had considerable personal love and involvement for the subject. Pupils' opinion is more or less correct since they saw and weighed the different subjects in the School and the element of subjectivity is the least in their case.

The investigator is of the opinion that Science should occupy rightfully the third position in the primary school curriculum logically, since the foundational knowledge of Mother Tongue (Oriya) and Arithmetic are essential to the proper understanding of Science and should have precedence over all other subjects.

Arrangement of different units or branches of Science:

The units of the curriculum can be viewed in two ways - the environmental units and branches of Science. The branches of Science are Astronomy, Botany, Chemistry, Geology, Hygiene, Physics, Physiology and Zoology. These branches can be renamed as environmental units: The Earth and the Sky; Air, Water and Weather; The Living Things; Matter and its properties; The resources of the Earth; Soil erosion and Conservation; Nutrition and Health; Clothes; Force, Work and Energy; The Human Body etc. Some times
the practising teacher felt puzzled and was unable to make up his mind regarding the order of teaching the various units. To answer such a question the opinion of pupils, teachers and experts were examined and the findings have been summarised in Tables XIV, XV and XVI.

TABLE XIV
ARRANGEMENT OF UNITS ACCORDING TO PUPILS

<table>
<thead>
<tr>
<th>Units</th>
<th>Weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health and Hygiene</td>
<td>2724</td>
</tr>
<tr>
<td>Animals</td>
<td>2613</td>
</tr>
<tr>
<td>Human Body</td>
<td>2547</td>
</tr>
<tr>
<td>Plants</td>
<td>2466</td>
</tr>
<tr>
<td>Matter and its properties</td>
<td>2388</td>
</tr>
<tr>
<td>Force, Works, Energy and Machines</td>
<td>1929</td>
</tr>
<tr>
<td>The Earth</td>
<td>1678</td>
</tr>
<tr>
<td>The Universe and the Sky</td>
<td>1605</td>
</tr>
</tbody>
</table>

N = 504

$Vide Question No. 16 of the Pupils' Questionnaire

Table XIV indicates that Science is to be taught as per the following order:

1. Hygiene
2. Zoology
3. Physiology
4. Botany
The analysis of the teachers' responses as regards the desirable order of teaching the various units of Science had indicated the following orders as the most preferred:

1. Biology
2. Physiology
3. Astronomy
4. Chemistry
5. Physics
6. Hygiene
7. Geology

The teaching of the Life Science and Physiology were considered to be of prime importance and had been accorded the
greatest weightage. Students need to know about the "Living Plants" and "The Human Body". The recent advances in space travel have had their impact and at a time when an astrophysicist like S. Chandrasekhar is accorded the highest scientific honour by the conferment of the Nobel Prize; it is no wonder that the attention of the teachers had also been turned towards the study of Astronomy. The teachers and the students were in complete agreement as regards the importance to be accorded to Biology and Physiology. However, the students gave Astronomy the least priority, whereas the teachers accorded it the third place. This is a conflicting situation. The schools were ill-equipped to teach Astronomy and none of the Primary Schools had even a telescope to cope with this baffling but interesting branch of science, Chemistry, Physics and Geology - come in that order in the estimation of both the students and the teachers.

TABLE XVI
ARRANGEMENT OF BRANCHES OF SCIENCE
ACCORDING TO EXPERTS

<table>
<thead>
<tr>
<th>Branches</th>
<th>Weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics</td>
<td>186</td>
</tr>
<tr>
<td>Chemistry</td>
<td>185</td>
</tr>
<tr>
<td>Astronomy</td>
<td>173</td>
</tr>
<tr>
<td>Geology</td>
<td>170</td>
</tr>
<tr>
<td>Zoology</td>
<td>156</td>
</tr>
<tr>
<td>Botany</td>
<td>133</td>
</tr>
<tr>
<td>Physiology</td>
<td>104</td>
</tr>
<tr>
<td>Hygiene</td>
<td>99</td>
</tr>
</tbody>
</table>

N = 35

$\text{Vide Question No. 7 of the Experts' Questionnaire}$
Table XVI reveals that the suggested order of teaching different branches science or units by the Experts was as follows:

1. Physics
2. Chemistry
3. Astronomy
4. Geology
5. Zoology
6. Botany
7. Physiology
8. Hygiene

Traditionally Physics and Chemistry enjoyed a place of pride among the different branches of Science; and some people still think that the term "Science" connotes the study of these two branches only. The ascendancy of Astronomy after 1957 is too well known and needs no elaboration. Words like, "Sputnik", "Apollo", "Columbia", "Discoverer", "Insat", "Satellite" etc. have become everyday words of the common people. Youngsters are enjoying such comic films, like the 'Star Wars' and 'Star Trek'. The experts have also accorded Astronomy the third place after Physics and Chemistry. These were followed by Geology, Zoology, Botany, Physiology and Hygiene. The opinion of the experts is at total variance with that of the students and Teachers and finding out congruence was extremely difficult. However these seemingly difficult problems can be solved to satisfaction if a dialogue could be started between the teachers and the experts at the first instance and later with the students; and if channels of communication are established among them. Isolationism breeds separation, and if this isolation is broken the path may be paved for better understanding and convergence of ideas.
Conclusion:

The opinion of the students, teachers, and the experts have been analysed in Table XIV, XV and XVI respectively. It is very difficult to specify the exact sequence of teaching the various units and perhaps such a prescription is also not desirable. A certain amount of flexibility and latitude should be granted to experiment with in this regard. Though a rigid prescription is undesirable; it is desirable to state that all the units of Science have their importance and contribute in their own unique ways to the growth and development of the scientific knowledge, attitudes and skills. None of the branches should be neglected, and all units need to be taught with honesty, sympathy and thoroughness so that students taste science and fall in love with Science and may continue to study and take interest in Science long after the formal examinations are over and they have entered upon the serious business of life. The teaching of the different units - whatever may be the order - must engender the scientific attitude in life.

Forms of Knowledge for inclusion:

According to Benjamin S. Bloom, Terminology, Specific facts, Conventions, Trends, Sequences, Classification, Criteria, Methodology, Principles, Generalisations and Theories are the different forms of knowledge in the taxonomic way. The following discussion answers to the Question, "which aspects of knowledge are to be dealt in the Primary School Science Curriculum?"
Table XVII shows that criteria, Trends and Theories are difficult forms of knowledge in descending order. The experts are of opinion that all forms of knowledge are to be included in the Primary School Science Curriculum of Orissa. Although taxonomically Terminology is the simplest form of knowledge experts opined that specific facts should be accorded the first place. They were justified for the fact that Terminology needs definition which becomes difficult for the pupils in the first grades. Again though taxonomically Theory is difficult, experts opined that criterion is the most difficult item. They were justified
on the ground that criterion was linked with "Evaluation" which is the highest mental ability.

Taking into consideration the objectives of the Primary School Science Curriculum of Orissa, opinions of Peter C. Gega and Taxonomic view points, Generalisations should be included in the curriculum. Hence it is logical to include all forms of knowledge in the taxonomy upto Generalisation.

Classification of Science:

Broadly Science can be classified as Space Science, Biological Science (Life Science) and Physical Science. Space Science includes Astronomy, Meteorology and Geology (Earth Science). Biological Science includes Botany, Zoology, Physiology and Hygiene. Physical Science includes mainly Physics and Chemistry. The following discussion answers the question "Is the selection of units adequate considering the classification of Science as Space Science, Physical Science and Biological Science?"

TABLE XVIII

<table>
<thead>
<tr>
<th>Adequacy of the Curriculum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
</tr>
<tr>
<td>Positive</td>
</tr>
<tr>
<td>34</td>
</tr>
<tr>
<td>Negative</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

$\text{N} = 35$

$\text{vide Question No.11 of the Experts' Questionnaire}$

Table XVIII indicates adequacy of the curriculum so far as classification of Science was concerned. As per the experts'
opinion the curriculum was adequate in respect of classification of Science specified above.

The investigator classifies the units in the light of the classification suggested above as follows:

**Space Science(s)**
1. The Earth and the Sky
2. Weather
3. Soil erosion and conservation
4. Natural Resources

**Biological Science(s)**
1. Cleanliness
2. Biological Kingdom
3. Human Body
4. Clothings
5. Living Things

**Physical Science(s)**
1. Force, Work and Energy
2. Matter and its properties

Relevance of the Curriculum

Educationists, Philosophers and Sociologists always assert that Curriculum should be planned to fulfil the needs and aspirations of the people and it should be according to the age and ability of children. In the following lines opinions of the experts were examined to assess this aspect.

**TABLE XIX**

<table>
<thead>
<tr>
<th>RESPONSES</th>
<th>N = 35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>2</td>
</tr>
<tr>
<td>Positive</td>
<td>33</td>
</tr>
</tbody>
</table>

$Vide Question No. 12 of the Experts' Questionnaire
From Table XIX it is evident that the curriculum was relevant in respect of the needs of Orissa according to the unanimous opinion of the experts.

TABLE XX

<table>
<thead>
<tr>
<th>RELEVANCE OF THE CURRICULUM IN RESPECT OF NEEDS AND ABILITIES OF PUPILS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
</tr>
<tr>
<td>Negative</td>
</tr>
<tr>
<td>Positive</td>
</tr>
</tbody>
</table>

N = 35

$Vide Question No. 13 of the Experts' Questionnaire

Table XX gives an impression that all experts were not unanimous regarding the relevance of the curriculum and its suitability in respect of needs and abilities of pupils. Still 74.3 per cent of the respondents agreed as regards its relevance.

The dissident group of 25.7 per cent respondents suggested the deletion of the following topics as these were considered to be too difficult:

Topics relating to the entire Unit captioned "Force, Work and Energy", Soil erosion and conservation, nutrition, health, nervous system, cyclone, irrigation, underground water, the entire unit - "Properties of Matter", the entire unit "Clothings", Digestive System, Evaporation and Condensation of Liquids, Comparison of Densities, Air Pressure, Pumps, Specific Gravity, Composition of Air, Coal and Petroleum.
J.S. Bruner says:

The basic concepts of science and the humanities can be grasped by children for earlier than has ever been thought possible. The task is to present the fundamental structure of the material to be learnt in a form that, can, first be apprehended intuitively by the child, and then later, through instruction to build up this intuitive understanding.¹

Taking this opinion of Bruner no topic is to be deleted. If the treatment of the topic is unsuitable in the textbook, it may be rewritten suitably in the revised editions.

CURRICULUM PLANNING

In major curriculum development tasks, selection of objectives, selection of contents, selection of teaching-learning strategies, creation of instructional materials, organisation of materials for courses of study, try-out of new materials, dissemination, quality control and recycling are the noteworthy stages. Out of these activities the first five aspects are the concerns of the curriculum committee or centre. So only tryout, dissemination, updating, quality control and recycling are discussed in the following lines.

Tryout of New Materials:

Gathering of evidence while parts of the programme are still being developed is termed as formative evaluation. As soon as certain components are developed, it is advisable to examine these empirically in order to determine their efficiency in obtaining the desired objectives (prototype evaluation). When the
curriculum team has developed the major portions of the programme, it becomes possible to assemble these into a tentative kit and try these out on a few classes (preliminary tryout). After this, the field trial is done on the final edition of the programme.

TABLE XXI
TRYOUT OF THE CURRICULUM ACCORDING TO TEACHERS

<table>
<thead>
<tr>
<th>Techniques</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taking the opinion of some teachers</td>
<td>104</td>
</tr>
<tr>
<td>Experimenting some new topics in some new schools at the time of its preparation</td>
<td>101</td>
</tr>
<tr>
<td>Experimenting intensively many new topics in many schools after its preparation</td>
<td>84</td>
</tr>
<tr>
<td>Taking the opinion of some experts</td>
<td>83</td>
</tr>
<tr>
<td>Experimenting some new topics in many schools at the time of its preparation</td>
<td>73</td>
</tr>
<tr>
<td>Taking the opinion of students</td>
<td>43</td>
</tr>
</tbody>
</table>

N = 208

$\text{Vide Question No.6 of the Teachers' Questionnaire}$

Table XXI attested to the prevalence of all techniques for tryout of new materials.

Implementation of the Curriculum:

Success of a particular curriculum depends solely on how the programme is implemented. The first aspect is to disseminate
the programme in a number of ways i.e. setting up the logistics, organisation of Training or orientation programmes for teachers, contact with administrative agencies and Boards of School Education. The second aspect is establishing curriculum centres, contact with teachers, schools, community and other agencies. In the following lines opinion of the teachers was examined.

### TABLE XXII

**IMPLEMENTATION ACTIVITIES**

<table>
<thead>
<tr>
<th>Activities</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training of Inservice Teachers</td>
<td>138</td>
</tr>
<tr>
<td>Relation with Inspector of Schools</td>
<td>126</td>
</tr>
<tr>
<td>Relation with State Council of Educational Research and Training</td>
<td>118</td>
</tr>
<tr>
<td>Relation with Teachers' Association</td>
<td>116</td>
</tr>
<tr>
<td>Relation with Teacher Training Institute</td>
<td>101</td>
</tr>
<tr>
<td>Relation with National Council of Educational Research and Training</td>
<td>74</td>
</tr>
<tr>
<td>Relation with Government of Orissa</td>
<td>73</td>
</tr>
<tr>
<td>Establishing Curriculum Centres</td>
<td>52</td>
</tr>
<tr>
<td>Relation with Examining Bodies</td>
<td>38</td>
</tr>
</tbody>
</table>

N = 208

§Vide Question No. 7 of the Teachers' Questionnaire

Table XXII shows that all activities were more or less frequently in practice.
Updating the Curriculum:

To monitor the programme, updating is an indispensable stage. In this stage new curriculum package, newsletter publication, supplementary materials like addition or deletion of exercises, improvement of equipments and modification of teachers' training are the important renewal aspects. In the following lines teachers' opinions were examined regarding the techniques of updating.

TABLE XXIII
UPDATING ARRANGEMENTS OF THE CURRICULUM

<table>
<thead>
<tr>
<th>Arrangements</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introducing new exercises and teaching strategies</td>
<td>98</td>
</tr>
<tr>
<td>News letters for teachers</td>
<td>58</td>
</tr>
<tr>
<td>Informing teachers about new innovations of Science</td>
<td>34</td>
</tr>
<tr>
<td>Repair and change of instruments</td>
<td>28</td>
</tr>
</tbody>
</table>

N = 208

$Vide Question No.8 of the Teachers' Questionnaire

Table XXIII indicates that updating arrangements of the curriculum were not adequate; and urgent steps need to be taken in this direction.
Quality Control of the Curriculum:

An educational programme is said to have deteriorated when it loses effectiveness. There are a number of factors which were responsible for this. The opinion of the teachers were examined in the following ways. Maintenances of good standard and control of quality are the basic aspects for any educational pattern or structure.

### TABLE XXIV

CAUSES OF INEFFECTIVENESS OF THE CURRICULUM AS STATED BY THE TEACHERS

<table>
<thead>
<tr>
<th>Causes</th>
<th>Weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td>When there is explosion of knowledge in Science</td>
<td>1312</td>
</tr>
<tr>
<td>When the neighbouring states adopt new curriculum</td>
<td>1246</td>
</tr>
<tr>
<td>When the curriculum becomes ineffective in some regions</td>
<td>1104</td>
</tr>
<tr>
<td>When the social, economic and political life of the State changes</td>
<td>1004</td>
</tr>
<tr>
<td>When facts are proved untrue</td>
<td>901</td>
</tr>
<tr>
<td>When the results of the examination is not satisfactory</td>
<td>863</td>
</tr>
<tr>
<td>When the teachers oppose the curriculum vehemently</td>
<td>862</td>
</tr>
<tr>
<td>When the students express discontentment for the curriculum</td>
<td>776</td>
</tr>
<tr>
<td>When the curriculum does not fulfil some of the objectives</td>
<td>684</td>
</tr>
</tbody>
</table>

$\text{N} = 201$

*Vide Question No.9 of the Teachers' Questionnaire*
Table XXIV succinctly states causes of ineffectiveness of the curriculum according to teachers. The general and professional qualifications of the primary school teachers consisted of 11 years of general schooling followed by two years of professional training. Limited as their knowledge and skills were relating to curriculum development, the outcomes of Table XXIV make interesting reading. The teachers had realised that explosion of knowledge was the major cause of obsolescence. They rightly realised that Orissa should keep step with other States; and if it lags behind its curriculum would become irrelevant. Curriculum planning must take cognizance of regional needs and problems; and inability to meet these demands would make the curriculum irrelevant. Regional and sectional needs should be accommodated in the overall policy planning of the State Curriculum. Social, Economic and Political upheavals have their immediate impact on curriculum development. Old order changeth yielding place to new and emergence of new concepts and ideas prove that some of the current conceptions are untrue and so become useless curricular lumber that needs elimination. The responses of the teachers to this section of the questionnaire indicated their sensitivity and awareness of curricular changes.

Re-cycling the Curriculum:

To keep abreast with the changing demands, a periodic re-examination of the curriculum is necessary. This aspect of the curriculum is named as recycling. Recycling can be done by piece-meal alteration or complete reformulation of the curriculum. The
following is an examination of the views of the teachers regarding recycling of the Science Curriculum.

TABLE XXV

MODES OF CURRICULAR CHANGES

<table>
<thead>
<tr>
<th>Items</th>
<th>Weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Including some new topics</td>
<td>710</td>
</tr>
<tr>
<td>Deleting some topics</td>
<td>684</td>
</tr>
<tr>
<td>Adopting a new curriculum</td>
<td>635</td>
</tr>
<tr>
<td>Making some changes here and there in the curricu-</td>
<td>582</td>
</tr>
<tr>
<td>lum</td>
<td></td>
</tr>
<tr>
<td>Removing defects in the curriculum</td>
<td>398</td>
</tr>
</tbody>
</table>

N = 205

$Vide Question No. 10 of the Teachers' Questionnaire

Table XXV indicates that teachers were in favour of piece-meal changes which indicated their conservative and cautious approach. Overnight overhauling of the curriculum was well nigh impossible. Cataclysmic curricular changes would result in traumatic results and were foredoomed to failure. Therefore, slow and steady changes take place in the field of curriculum. The curricular evolution is possible; curricular revolution is untenable. Teachers have corroborated this view through their negative responses to total change. Curriculum recycling becomes imperative with the explosion of knowledge which necessitates the inclusion of new topics and the consequent deletion of out-
dated old topics.

Conclusions:

In so far as the tryout aspect was concerned teachers laid much emphasis on prototype evaluation and opinion of teachers although the field trial is the most appropriate approach. As regards 'implementation' teachers accorded top priority to the training of teachers, contact with the inspectors etc. The most important need was the establishment of a curriculum centre. For 'updating' teachers laid much emphasis on introduction of new exercises and teaching-learning strategies; but the most important aspect is the provision of news letters and curriculum packages. Teachers were of the opinion that constant revision of teaching strategies and exercises supplemented by the inflow of information through news letters would ensure quality-control. Teachers, by and large, did not favour total change and were in favour of inclusion of emerging new concepts and deletion of ineffective curricular lumber to ensure proper recycling.

On the whole the primary school teachers have a sense of awareness relating to curricular changes which forebodes a brighter future.

A TRANSVERSAL STUDY OF THE CURRICULUM

The discussion in this section gives a microscopic view of the different constituents of the contents. Concept Clusters, Units, Topics, Sub-topics, Captions, Activities etc. of the curriculum are the aspect of the microscopic cross-sectional study.
Units:

There are environmental units in the Science curriculum of Orissa for the Primary Schools. There are aspects of correlation in the Units but there is no fusion among the branches of science. Adequacy of the units and caption have been examined in the following section.

TABLE XXVI
ADEQUACY FOR THE SCOPE OF THE UNITS*

<table>
<thead>
<tr>
<th>Aspects</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>The scope is more than adequate</td>
<td>14</td>
</tr>
<tr>
<td>The scope is adequate</td>
<td>21</td>
</tr>
<tr>
<td>The scope is less than adequate</td>
<td>-</td>
</tr>
</tbody>
</table>

N = 35

*Vide the Primary School Science Curriculum of Orissa in the Appendix-A.

$Vide Question No. 3 of the Experts' Questionnaire

The experts were of opinion that the scope of the topics included in the Primary School Science Curriculum of Orissa was either adequate or more than adequate. The scope of none of the units was considered to be inadequate. This indicates the general satisfaction and approval of the syllabus by the experts and it is a testimony as regards its adequacy. As an introductory course to Science the framers of the syllabus had quite a formidable task before them and that their efforts have received the approval of the experts is heartening.
Table XXVII indicates that the experts were of the opinion that the captions of the Units were appropriate. However, 14.3 per cent of the experts did not concur with this view and advocated changes in captions as they felt that the present captions were inappropriate.

Some of the experts suggested changes in the captions. Chemistry unit may be designated as 'Matter and its properties'. Weather unit may be named as 'Air, Water and Weather'. Physics units maybe written as 'How do we move?' in the problematic form.

**Topics:**

Units contain generally concepts, processes, topics and sub-topics. The PrimarySchool Science Curriculum of Orissa contains topics and sub-topics only. In the following discussion adequacy and sequence of topics are dealt as perceived by the pupils, teachers and experts.
### TABLE XXVIII
DELETION OF TOPICS ACCORDING TO THE PUPILS

<table>
<thead>
<tr>
<th>Topics relating to</th>
<th>N = 504</th>
</tr>
</thead>
<tbody>
<tr>
<td>Force, Work, Energy and Machines</td>
<td>78</td>
</tr>
<tr>
<td>Plants</td>
<td>70</td>
</tr>
<tr>
<td>Animals</td>
<td>69</td>
</tr>
<tr>
<td>Matter and its properties</td>
<td>68</td>
</tr>
<tr>
<td>Human Body</td>
<td>66</td>
</tr>
<tr>
<td>The Universe and the Sky</td>
<td>62</td>
</tr>
<tr>
<td>Hygiene and the Health</td>
<td>53</td>
</tr>
<tr>
<td>The Earth</td>
<td>47</td>
</tr>
</tbody>
</table>

\[\text{N = 504}\]

\[\text{\$Vide Question No. 16 of the Pupils' Questionnaire}\]

Some specific topics, have been mentioned by the pupils emphatically for deletion as given below:

- reproduction, food, solar system, minerals, measurement, sky, machines, soil erosion, soil conservation, dependence of man on plants and animals, changes in the environment, rain, rocks, stars, and planets.

Table XXVIII and the above text indicates the likes and dislikes of the pupils and steps should be taken to accommodate these opinions.
<table>
<thead>
<tr>
<th>Branches of Science</th>
<th>Topics for deletion</th>
<th>Topics for inclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astronomy</td>
<td>earth's birth, shape of the earth, eclipses, satellites, day and night phases of the moon, seasons.</td>
<td>-</td>
</tr>
<tr>
<td>Geology</td>
<td>soil conservation</td>
<td>earth quake, volcano landslide</td>
</tr>
<tr>
<td>Physics</td>
<td>force, work, energy, machines, air, water, magnetic lines of force, density, specific gravity, lift pump, lever.</td>
<td>more contents in weather</td>
</tr>
<tr>
<td>Chemistry</td>
<td>Composition of air, distillation, electrolysis</td>
<td>-</td>
</tr>
<tr>
<td>Biology</td>
<td>-</td>
<td>some specific plants and animals for study, life-cycles, parts of plants</td>
</tr>
<tr>
<td>Physiology</td>
<td>digestive system, blood circulation</td>
<td>-</td>
</tr>
<tr>
<td>Hygiene</td>
<td>Vitamins</td>
<td>some diseases, medicine plants, exercises, cold, cough, scabies, cleanliness</td>
</tr>
<tr>
<td>General</td>
<td>-</td>
<td>scientific stories scientists, transport, radio, cinema, television, satellite communication</td>
</tr>
</tbody>
</table>

N = 205

*Vide Question No. 4 of the Teachers' Questionnaire*
The experts, by and large, felt that the topics were adequate. Some experts suggested the following topics for deletion:

**Class III:** Comparison of forces, gravity, digestive system, irrigation, cyclone, underground water.

**Class IV:** Machines

**Class V:** Nervous system, comparison of density, eclipses, nutrition.

Some experts were in favour of the inclusion of the following topics:

- stars, solubility in hot and cold water,
- acid, alkali

---

### TABLE XXX

**ADEQUACY OF TOPICS ACCORDING TO EXPERTS**

<table>
<thead>
<tr>
<th>Responses</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>The scope of the topics is adequate</td>
<td>27</td>
</tr>
<tr>
<td>The scope of the topics is more than adequate</td>
<td>8</td>
</tr>
<tr>
<td>The scope of the topics is inadequate</td>
<td>-</td>
</tr>
</tbody>
</table>

N = 35

$\text{Vide the Question No. 4 of the }$

*Experts' Questionnaire*
TABLE XXXI
ARRANGEMENTS OF TOPICS ACCORDING TO EXPERTS

<table>
<thead>
<tr>
<th>Responses</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>29</td>
</tr>
<tr>
<td>Negative</td>
<td>6</td>
</tr>
</tbody>
</table>

$N = 35$

$\text{Vide Question No.9 of the Experts' Questionnaire}$

Table XXXI shows that most of the experts agreed as regards the arrangement of the topics. Some experts suggested that Unit-I in Class III may be rearranged as: The earth, The sun, The moon, The stars, Day and night.

Sub-Topics:

Topics need to be defined in terms of sub-topics to clarify the scope of each topic. It facilitates the text-book writers, teachers and pupils to understand topics in a better way. The following discussion leads to clarify the adequacy and sequence of sub-topics of the curriculum according to experts.

TABLE XXXII
THE SCOPE OF THE SUB-TOPICS

<table>
<thead>
<tr>
<th>Responses</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>The scope of the subtopics is adequate</td>
<td>30</td>
</tr>
<tr>
<td>The scope of the subtopics is more than adequate</td>
<td>4</td>
</tr>
<tr>
<td>The scope of the subtopics is less than adequate</td>
<td>1</td>
</tr>
</tbody>
</table>

$N = 35$

$\text{Vide Question No.5 of the Experts' Questionnaire}$
Table XXXII indicates that experts in large number agree as regards the adequacy of the scope of subtopics. However some experts advocated the deletion of the following sub-topics:

Comparison of forces, weathering of rocks, parts of the nervous system, movement in a smooth and rough surface, the process of digestion.

Only one expert pleaded for the inclusion of the following subtopics in the curriculum:

Solubility in cold water and hot water and inter-dependence between plants and animals.

<table>
<thead>
<tr>
<th>TABLE XXXIII</th>
</tr>
</thead>
<tbody>
<tr>
<td>THE SEQUENCE OF SUB-TOPICS ACCORDING TO EXPERTS</td>
</tr>
<tr>
<td>Responses</td>
</tr>
<tr>
<td>Positive</td>
</tr>
<tr>
<td>Negative</td>
</tr>
</tbody>
</table>

N = 35

$^\S$Vide Question No. 9 of the Experts' Questionnaire.

Table XXXIII indicates that according to the experts the arrangement of subtopics within topics in the curriculum was appropriate. The experts were satisfied as regards the internal arrangement of sub-topics.

Activities in the Curriculum:

Marshall C. Jameson and Wm. Vernon Hick$^2$ are of the opinion that there should be a set of prescribed activities in the Science curriculum which should be an integral part of the contents. Curriculum Theorists hope that pupils can manifest scien-
tific attitudes, scientific enquiry and develop skills through these activities. In Table XXXIV certain fundamental activities have been analysed according to the responses of pupils.

TABLE XXXIV

LEARNING ACTIVITIES IN SCIENCE ACCORDING TO PUPILS

<table>
<thead>
<tr>
<th>Activities</th>
<th>f</th>
<th>f in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hearing</td>
<td>487</td>
<td>97</td>
</tr>
<tr>
<td>Reading</td>
<td>476</td>
<td>94</td>
</tr>
<tr>
<td>Writing</td>
<td>472</td>
<td>93</td>
</tr>
<tr>
<td>Seeing</td>
<td>426</td>
<td>84</td>
</tr>
<tr>
<td>Speaking</td>
<td>407</td>
<td>80</td>
</tr>
<tr>
<td>Drawing</td>
<td>399</td>
<td>79</td>
</tr>
<tr>
<td>Experimenting</td>
<td>219</td>
<td>43</td>
</tr>
<tr>
<td>Going on excursions</td>
<td>195</td>
<td>38</td>
</tr>
<tr>
<td>Making new things</td>
<td>85</td>
<td>17</td>
</tr>
</tbody>
</table>

N = 504

$\text{vide Question No. 1 of the pupils' Questionnaire}$

The basic weakness in the teaching-learning process of Primary School Science has been well reflected in Table XXXIV. Experimentation, doing, observation and active participation constitute the core activities of Science learning and these had not received due importance. Science learning was still based on hearing, reading, seeing, writing and speaking; and at best
drawing. Herein lies the greatest weakness of the science learning and strategies adopted by the teachers for the same are repeated in it (FIGURE - 5).

TABLE XXXV

SOURCES OF HEARING IN SCIENCE

<table>
<thead>
<tr>
<th>Sources</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers</td>
<td>487</td>
</tr>
<tr>
<td>Classmates</td>
<td>414</td>
</tr>
<tr>
<td>Radio</td>
<td>395</td>
</tr>
<tr>
<td>Taperecorder</td>
<td>167</td>
</tr>
<tr>
<td>Gramophone</td>
<td>106</td>
</tr>
</tbody>
</table>

$\text{Vide Question No. 5 of the Pupils' Questionnaire}$

Table XXXV indicates that students hear the discussion of the teacher mainly to learn Science. Although many improvements have been brought in hearing activities, the teacher still occupies the prominent place in so far as the hearing activity in formal education is concerned. Since India and specifically Orissa is a developing region pupils do not find enough opportunities for hearing programmes from radio, taperecorders and gramophones. However some students get opportunities to hear programmes from all sources.
FIGURE-5 Activities in the science curriculum according to the pupils of Orissa
(Based on Table xxxiv)
Table XXXVI shows items of reference by the students to learn Science. Text books, notes, biography of scientists, the newspaper, magazines, stories, essays, dramas, poems, novels, dictionaries, encyclopaedias, etc., were the various reference materials which were used to enrich the pupils' horizon of scientific knowledge. It was observed that the textbook in Science was the main reference material and the next item was the teachers' notes. Most of the students read text books only to learn Science for which the sole purpose of learning science was spoilt. Other
items of reference materials were neglected.

TABLE XXXVII
ASPECTS OF WRITING IN SCIENCE

<table>
<thead>
<tr>
<th>Items</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answering questions</td>
<td>272</td>
</tr>
<tr>
<td>Reporting</td>
<td>157</td>
</tr>
<tr>
<td>Writing stories</td>
<td>123</td>
</tr>
<tr>
<td>Writing essays</td>
<td>104</td>
</tr>
<tr>
<td>Writing poems</td>
<td>40</td>
</tr>
</tbody>
</table>

N = 504

$\text{Vide Question No. } 2 \text{ of the Pupils' Questionnaire}$

Table XXXVII shows that pupils mainly wrote answers to the questions in Science. They seldom wrote reports, stories, essays and poems. In a good science programme pupils write reports and essays effectively as they have to write project reports. In Orissa pupils wrote however, essays and reports on rare occasions. This indicated that the programme was rich with projects but it was influenced by the examination system.

TABLE XXXVIII
THE OBJECTS OF SEEING IN SCIENCE

<table>
<thead>
<tr>
<th>Objects</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pictures</td>
<td>426</td>
</tr>
<tr>
<td>Globes</td>
<td>415</td>
</tr>
<tr>
<td>Maps</td>
<td>409</td>
</tr>
</tbody>
</table>
Table XXXVIII (continued)

<table>
<thead>
<tr>
<th>Visual Aids</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apparatus</td>
<td>380</td>
</tr>
<tr>
<td>Specimens</td>
<td>310</td>
</tr>
<tr>
<td>Diagrams</td>
<td>296</td>
</tr>
<tr>
<td>Models</td>
<td>237</td>
</tr>
<tr>
<td>Exhibitions</td>
<td>215</td>
</tr>
<tr>
<td>Charts</td>
<td>213</td>
</tr>
<tr>
<td>Nature</td>
<td>211</td>
</tr>
<tr>
<td>Television</td>
<td>204</td>
</tr>
<tr>
<td>Films</td>
<td>200</td>
</tr>
<tr>
<td>Microscopes</td>
<td>193</td>
</tr>
<tr>
<td>Photographs</td>
<td>173</td>
</tr>
<tr>
<td>Telescope</td>
<td>154</td>
</tr>
<tr>
<td>Art Gallery</td>
<td>141</td>
</tr>
<tr>
<td>Fairs</td>
<td>135</td>
</tr>
<tr>
<td>Slides</td>
<td>129</td>
</tr>
</tbody>
</table>

$N = 504$

Vide Question No. 6 of the Pupils' Questionnaire

Table XXXVIII shows the range of visual aids used in the teaching of Science in the schools of Orissa in the primary stage. It is seen that students more or less got opportunities to see all the items. Every item of the visual aids has its own importance in specific learning situation. The pupils saw pictures to learn Science in the first place. Since children need first hand expe-
science and that too in Science they should see specimens, apparatus, nature, models etc., to gain exact experience.

TABLE XXXIX
THE SPEAKING ACTIVITIES IN SCIENCE

<table>
<thead>
<tr>
<th>Items</th>
<th>( f )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question-Answer</td>
<td>407</td>
</tr>
<tr>
<td>Current problems</td>
<td>215</td>
</tr>
<tr>
<td>Debating</td>
<td>147</td>
</tr>
<tr>
<td>Discussion</td>
<td>121</td>
</tr>
<tr>
<td>Lectures</td>
<td>119</td>
</tr>
<tr>
<td>Seminar</td>
<td>104</td>
</tr>
<tr>
<td>Reading poems</td>
<td>48</td>
</tr>
</tbody>
</table>

\( N = 504 \)

$Vide$ Question No. 4 of the .Pupils' Questionnaire

Table XXXIX indicates the types of speaking activities undertaken by the primary school children of Orissa. Speaking was an indispensable activity in Science for the primary school stage. Students were more engaged in speaking than in other practical activities. This indicates that science was taught in the class mainly through the Lecture Method. The Laboratory Method and the Demonstration Method are yet to arrive. In the primary schools of Orissa 'Science is talking' and 'Science is not doing'.

TABLE XL
THE DRAWING ITEMS IN SCIENCE

<table>
<thead>
<tr>
<th>Items</th>
<th>( f )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pictures</td>
<td>399</td>
</tr>
<tr>
<td>Diagrams</td>
<td>253</td>
</tr>
<tr>
<td>Coloured pictures</td>
<td>218</td>
</tr>
</tbody>
</table>
### TABLE XL (CONTINUED)

<table>
<thead>
<tr>
<th>Items</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maps</td>
<td>186</td>
</tr>
<tr>
<td>Charts</td>
<td>92</td>
</tr>
<tr>
<td>Sketches</td>
<td>88</td>
</tr>
</tbody>
</table>

N = 504

Vide Question No. 8 of the Pupils' Questionnaire

Table XL indicates aspects of drawing in Science among the primary school pupils of Orissa. In science drawing of diagrams and charts is an essential activity which promotes conceptual clarity. Children need to draw diagrams of apparatus; anatomy of plants, animals and human beings and of different processes and phenomena. They need to draw charts and flowcharts on different academic occasions and for fairs and exhibitions. But these aspects do not occupy a high place in actual practice of Orissa. Children learn to draw such of the pictures which have been provided in the text books. Sketches, charts, maps and diagrams do not find a regular place and so a creative interest in science is sadly absent. However if children are helped by the teacher to draw figures it will help them in their future career to draw better diagrams and in the present context they will grasp the materials in science with ease.
Table XLI shows aspects of simple laboratory activities relating to experimentation at the primary school stage. Experimentation is the heart of any science programme. Science by its very nature is experimental. Students are trained to become scientists through laboratory activities and experimentation. This is the foundational stage and the students should be oriented with basic spirit of science right from the start. Students should be allowed to use the various instruments, improvise them and they should be looked upon as the budding scientists of tomorrow. Though experimentation is the monopoly of science it is observed that students of Orissa in the elementary classes are not trained in the art and science of this technique as it is expected from the intended curriculum.

<table>
<thead>
<tr>
<th>Activity</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using scale, watch, balance etc.</td>
<td>210</td>
</tr>
<tr>
<td>Taking precautions to use apparatus and chemicals</td>
<td>208</td>
</tr>
<tr>
<td>Observing accurately</td>
<td>206</td>
</tr>
<tr>
<td>Doing easy calculations</td>
<td>205</td>
</tr>
<tr>
<td>Using apparatus</td>
<td>195</td>
</tr>
<tr>
<td>Rectifying errors of apparatus</td>
<td>118</td>
</tr>
<tr>
<td>Arranging apparatus</td>
<td>84</td>
</tr>
</tbody>
</table>

$N = 504$

Vide Question No. 9 of the Pupils' Questionnaire
Table XLII gives a picture of excursions for the sake of science. During the hours of teaching mountains, sea beaches, factories, hospitals, planetariums, steel plants etc. can not be brought to the classrooms to give pupils direct experience. Therefore the place of excursion has a place of importance in promoting the scientific spirit. The table reveals that a few students went on field trips on their own expenses and beyond the school hours. Careful observation of the environment in and around the school can generate a genuine love for science. The spirit of enquiry and curiosity to know the inherent laws of nature should be promoted through short trips during school hours and during holidays. Hurried journeys over long distances can never promote the scientific spirit.

TABLE XLII
EXCURSION IN SCIENCE

<table>
<thead>
<tr>
<th>Items</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travelling to nearby places</td>
<td>195</td>
</tr>
<tr>
<td>Travelling beyond the school hours</td>
<td>159</td>
</tr>
<tr>
<td>Travelling on own expense</td>
<td>135</td>
</tr>
<tr>
<td>Travelling at the expense of the school</td>
<td>126</td>
</tr>
<tr>
<td>Travelling to distant places</td>
<td>106</td>
</tr>
<tr>
<td>Travelling during the school hours</td>
<td>85</td>
</tr>
</tbody>
</table>

$N = 504$

$Vide$ Question No.7 of the Pupils' Questionnaire


<table>
<thead>
<tr>
<th>Activity</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preserving leaves, flowers, fruits, animals etc.</td>
<td>85</td>
</tr>
<tr>
<td>Collecting plants, animals, rocks, minerals etc.</td>
<td>80</td>
</tr>
<tr>
<td>Making simple instruments</td>
<td>74</td>
</tr>
<tr>
<td>Making some new things from useless things</td>
<td>70</td>
</tr>
<tr>
<td>Repairing instruments</td>
<td>63</td>
</tr>
<tr>
<td>Making charts and models</td>
<td>59</td>
</tr>
</tbody>
</table>

$N = 504$

Vide Question No. 10 of the Pupils' Questionnaire.

Table XLIII gives a picture of activities related to science learning in the primary schools of Orissa. It was expected that a student of science should learn preservation of plants and animal bodies, collection of scientific objects, preparation of simple instruments, improvisation of models, repairing and preparation of teaching aids. The data revealed that only a few students learn these activities. Greater stress needs to be laid on this aspect.

Conclusions:

It is observed that most respondents express satisfaction for the scope, sequence and captions of the units, topics and sub-
topics. A few respondents opine for deletion of contents. The horizons of science are fast expanding and new facts and theories are emerging which need to be accommodated through constant periodical revisions of the curriculum. Regarding the sequence of units, topics and subtopics the practising teacher should be ensured adequate latitude and the curriculum must have an inbuilt flexibility.

Dr. D. S. Kothari suggested the following nomenclature for captions to be followed for all classes and for units in the primary stage:

- The heavenly bodies of the sky
- Air, Water and Weather
- Force, Energy and Machines
- Matter and its properties
- Personal hygiene and sanitation
- Human body
- Plants and animals
- The Earth

Regarding the activities of science curriculum care should be taken to provide core activities in science like experimentation, manipulation, field trips, and drawing in addition to other fundamental activities. Without these activities science will lose its taste and charm. In Orissa the primary school science curriculum lacks this and science continues to be 'hearing', 'reading' and 'writing'. 
CURRICULUM EVALUATION IN TERMS OF EXTERNAL CRITERIA

In the appraisal of a curriculum, evaluation in terms of external criteria is necessary in addition to evaluation as per internal evidence. Indian states and foreign countries adopt their curricula and these curricula are to be compared with the intended curriculum of Orissa in different dimensions. Again the depth of the existing curriculum is to be judged comparing the contents of it with those of the Higher Primary and Secondary Curriculum of Orissa in General Science. These analyses will reveal the real worth and standard of the Primary School Science curriculum of Orissa.

Comparison of some foreign curricula and Indian curricula with the Primary School Science Curriculum of Orissa.

Twenty-eight Primary School Science curricula of India and abroad are compared with the Primary School Science curriculum of Orissa in respect of contents in the following table:

TABLE XLIV
COMPARISON OF CONTENTS AMONG THE CURRICULA

<table>
<thead>
<tr>
<th>Contents</th>
<th>Curricula</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Universe</td>
<td>1, 2, 3, 4, 6, 7, 9, 10, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29</td>
<td>25</td>
</tr>
<tr>
<td>Air, Water and</td>
<td>1, 2, 3, 4, 9, 10, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29</td>
<td>23</td>
</tr>
<tr>
<td>Contents</td>
<td>Curricula</td>
<td>p</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>----</td>
</tr>
<tr>
<td>Rocks, Soils and Minerals</td>
<td>1, 3, 4, 6, 7, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29</td>
<td>25</td>
</tr>
<tr>
<td>Animal Life</td>
<td>1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29</td>
<td>29</td>
</tr>
<tr>
<td>Plant Life</td>
<td>1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29</td>
<td>29</td>
</tr>
<tr>
<td>The Human Body</td>
<td>1, 4, 5, 7, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29</td>
<td>24</td>
</tr>
<tr>
<td>Hygiene and Sanitation</td>
<td>1, 2, 4, 9, 10, 18, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29</td>
<td>16</td>
</tr>
<tr>
<td>Safety and First Aid</td>
<td>1, 13, 17, 18, 20, 21, 25, 26, 27, 28, 29</td>
<td>11</td>
</tr>
<tr>
<td>Force, Work, Energy and Machines</td>
<td>1, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29</td>
<td>27</td>
</tr>
<tr>
<td>Matter and its properties</td>
<td>1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29</td>
<td>27</td>
</tr>
<tr>
<td>Housing</td>
<td>1, 9, 17, 18, 20, 21, 24, 25, 26, 27, 28, 29</td>
<td>12</td>
</tr>
<tr>
<td>Clothings</td>
<td>1, 9, 17, 18, 20, 21, 24, 25, 26, 27, 28, 29</td>
<td>12</td>
</tr>
<tr>
<td>Agriculture</td>
<td>1, 7, 17, 22, 24, 25, 27</td>
<td>7</td>
</tr>
<tr>
<td>Scientists</td>
<td>2, 11, 18, 23, 26</td>
<td>5</td>
</tr>
<tr>
<td>History of Science</td>
<td>12, 14</td>
<td>2</td>
</tr>
<tr>
<td>Man's necessities</td>
<td>29</td>
<td>1</td>
</tr>
<tr>
<td>The environment</td>
<td>29</td>
<td>1</td>
</tr>
</tbody>
</table>
Table XLIV indicates that 'History of Science', 'Scientists', 'Necessities of man' and 'Preservation of the environment' should be included in the curriculum of Orissa. Under Scientists' life and works of the following scientists should be studied:

The Primary School Science Curriculum of Orissa and the SAPA Project Curriculum:

The Science - A process Approach (SAPA) Project of USA was a new project in the history of Science Curriculum. Most emphasis is laid here on process aspect of Science. The two curricula are compared for the process and the content aspect in the following tables:

**TABLE XLV**

**COMPARISON BETWEEN THE PROCESS ASPECTS**

<table>
<thead>
<tr>
<th>SAPA Project</th>
<th>Orissa$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observing</td>
<td>Observing</td>
</tr>
<tr>
<td>Using space/time relationship</td>
<td>-</td>
</tr>
<tr>
<td>Using number</td>
<td>-</td>
</tr>
<tr>
<td>Measuring</td>
<td>Measuring</td>
</tr>
<tr>
<td>Classifying</td>
<td>-</td>
</tr>
<tr>
<td>Communicating</td>
<td>Communicating</td>
</tr>
<tr>
<td>Predicting</td>
<td>-</td>
</tr>
<tr>
<td>Inferring</td>
<td>-</td>
</tr>
<tr>
<td>Formulating hypothesis</td>
<td>Formulating hypothesis</td>
</tr>
<tr>
<td>Controlling variables</td>
<td>-</td>
</tr>
<tr>
<td>Interpreting data</td>
<td>-</td>
</tr>
<tr>
<td>Defining Operationally</td>
<td>-</td>
</tr>
<tr>
<td>Experimenting$^{32}$</td>
<td>Experimenting</td>
</tr>
</tbody>
</table>

$^{32}$See Appendix-A

Table XLV clearly states that processes like - Using space/time relationship, Using number, Classifying, Predicting, Inferring, Controlling Variables, Interpreting data, Defining operationally are absent in the Primary School Science Curriculum of Orissa. This aspect establishes the superiority of the SAPA
project over the Primary School Science Curriculum of Orissa in respect of the process aspect.

TABLE XLVI

COMPARISON BETWEEN THE CONTENTS ASPECTS

<table>
<thead>
<tr>
<th>SAPA Project</th>
<th>Orissa$</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Universe</td>
<td>The Universe</td>
</tr>
<tr>
<td>Air, Water and Weather</td>
<td>Air, Water and Weather</td>
</tr>
<tr>
<td>Rocks, Soils and Minerals</td>
<td>Rocks, Soils and Minerals</td>
</tr>
<tr>
<td>Animal Life</td>
<td>Animal Life</td>
</tr>
<tr>
<td>Plant Life</td>
<td>Plant Life</td>
</tr>
<tr>
<td>Human Body</td>
<td>Human Body</td>
</tr>
<tr>
<td>Matter and its properties</td>
<td>Matter and its properties</td>
</tr>
<tr>
<td>-</td>
<td>Housing</td>
</tr>
<tr>
<td>-</td>
<td>Clothings</td>
</tr>
<tr>
<td>-</td>
<td>Agriculture</td>
</tr>
<tr>
<td>Mathematics</td>
<td>-</td>
</tr>
<tr>
<td>Social Science</td>
<td>-</td>
</tr>
<tr>
<td>Psychology(^3)</td>
<td>-</td>
</tr>
</tbody>
</table>

$^\text{N} = 2$

Table XLVI indicates that the SAPA Project lacks the following units:

- Hygiene and Sanitation
- Safety and First Aid
- Housing
- Clothings
- Agriculture

This aspect shows that the SAPA Project advocates the study of pure science to convert the theoretical science into realistic
and rigorous. Another observation is that the curriculum of Orissa lacks the following units:

- Mathematics
- Social Science
- Psychology

This aspect indicates that Mathematics, Social Science and Psychology are recognised as Sciences like Physics and Chemistry in the USA. These aspects should be included in the Science curriculum of Orissa.

Comparison of the Secondary Curriculum and Higher Primary Curriculum of Science with the Primary School Science curriculum in Orissa:

The examination of Secondary Science Curriculum and Higher Primary Curriculum in Science is necessary to evaluate the Primary School Science Curriculum and to determine over-adequacy, inadequacy and adequacy of it.

**TABLE XLVII**

<table>
<thead>
<tr>
<th>Contents</th>
<th>Curricula</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Universe</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>Air, Water and Weather</td>
<td>1</td>
</tr>
<tr>
<td>Rocks, Soils and Minerals</td>
<td>1</td>
</tr>
<tr>
<td>Animal Life</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>Plant Life</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>Human Body</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>Hygiene and Sanitation</td>
<td>1, 3</td>
</tr>
<tr>
<td>Safety and First Aid</td>
<td>1</td>
</tr>
<tr>
<td>Force, Work and Energy</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>Matter and its properties</td>
<td>1, 2, 3</td>
</tr>
</tbody>
</table>
TABLE XLVII (CONTINUED)

<table>
<thead>
<tr>
<th>Contents</th>
<th>Curricula</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Housing</td>
<td>1</td>
</tr>
<tr>
<td>The Clothings</td>
<td>1</td>
</tr>
<tr>
<td>Agriculture</td>
<td>1, 3</td>
</tr>
<tr>
<td>Nature of Science and</td>
<td>3</td>
</tr>
<tr>
<td>Scientific Method</td>
<td>3</td>
</tr>
<tr>
<td>Animal husbandry</td>
<td>3</td>
</tr>
</tbody>
</table>

N = 3

Key:

1 = Primary School Science Curriculum of Orissa (Class III - V)

2 = Higher Primary School Science Curriculum of Orissa (Classes VI - VII)

3 = Secondary Curriculum of Orissa in Science (Class VIII - X)

Table XLVII indicates that the following units are taught only in the Primary Classes:

- Air, Water and Weather
- Rocks, Soils and Minerals
- Safety and First Aid
- The Housing
- The Clothings

Hence these units should be dealt in detail and in depth.

Again 'Nature of Science' and the 'Scientific Method' and 'Animal Husbandry' are taught only in the Secondary classes. The following units are common to the Higher Primary and Secondary Curricula.

- The Universe
- Animal Life
- Plant Life
- Human Body
- Force, Work and Energy
- Matter and its properties
Science is a sequential and structured subject and a concentric approach steadily increases the depth of knowledge in the particular branch of Science. The classical branches of Science like Astronomy, Zoology, Botany, Physiology, Physics and Chemistry find their place in all the curricula.

Important features of some curricula:

The following features are revealed from an analysis of Indian and foreign curricula of Science meant for the Primary School children:

1. The Curriculum by Ronald Good has concepts at concrete level and abstract level. This curriculum has prescribed the study of cells, electrons, atomic energy and types of motion.

2. In the curriculum of Punjab outside activities, gardening, practical works (P), museum preparation and study of infectious diseases are prescribed.

3. In the curriculum by P.C.Gega, Science is prescribed as a basic programme, correlated teaching programme and incidental teaching programme. Science is considered as a process and a product. Oceanography and earth's history are prescribed for study.

4. In the curriculum by Abraham S.Fishler, a modern trend is suggested i.e. out of suggested units only four units are to be taught in each grade with depth.

5. In the curriculum by H.O.Thier study of cells, measurement, crystals are prescribed. This curriculum has also suggested skills to be mastered.

6. In the COPES Curriculum, Study of Crystals and cells are prescribed. The project has also defined skills for practice.

7. In the ESS Project Units are captioned only on concrete living and non-living objects. Here some process skills are defined. There are some Physical Science Units, Biological Science Units and General Education Units in the curriculum.

8. In the SCIS Project topics like relativity, life cycle of specific species, evolution and ecology are prescribed for the pupils.
9. In the curriculum by Marshall C. Jameson activities of the curriculum are defined systematically stagewise.

10. In Science 5/13 Project, Science is defined as an enquiry mind and a scientific approach. Objectives are defined systematically, Teaching Units, back-ground information Units, Teachers' Guide, Field study books etc., are prepared with care.

11. In M.F. Vessel's curriculum, advanced topics like Cell, classification of species, evolution, methods of Science are prescribed for the pupils.

12. In J.S. Richardson's Curriculum, topics like atomic energy, aviation are prescribed. There is also provision for articulation of Science in the curriculum.

13. In Burnett's curriculum, topics like nature and meaning of Science, atomic energy and nature of matter are prescribed for pupils. He defines Science here as: (1) a philosophy (2) an approach (3) a body of verified data (FIGURE - 6).

14. Hennesey's curriculum prescribes advanced topics like atomic energy, map making, earth science, Rockets and space travel.

15. Interstate Board, New Delhi prescribes a seasonal course and activities like: gardening, outdoor activities, maintenance of nature diary and preparation of aquarium.

16. The State Institute of Education, New Delhi, prescribes a curriculum in the tabular form with specification of periods and concentric approach. It prescribes populat units like 'Communication system'.

17. Curriculum of Goa, Daman and Diu defines periods for topics and states units like: 'First aid and Safety', 'Measurement'.

18. Curriculum of Mizoram states 'Safety and First Aid' as a separate Unit.

19. Board of secondary Education, Orissa, prescribes a curriculum with major ideas and minor ideas.

20. Curriculum of West Bengal has units like 'Agriculture', 'Life History of some plants and animals' and 'Common Diseases', in Class III - IV Science is integrated with Geography. The curriculum lays emphasis on Science Society, Publication of pamphlets in Science, collection of book, organisation of science society and Nature study.

21. Curriculum of Orissa (1962) prescribes for the study of Scientists, equipments for the workshop and notes to teachers and pupils.
FIGURE 6: What is Science? (From R. Will Burnett)
22. The State Council of Educational Research and Training Orissa, states major ideas in sentences, minor ideas in sentences, behavioural objectives and notes to teachers.

23. Curriculum of Assam States 'Safety and First Aid' as a separate unit.

24. Curriculum of Maharashtra prescribes 'Safety and First Aid' 'Scientists' as two separate units. The curriculum gives stress on handbook for teachers, diagnostic and remedial works, additional programmes, time allotment, General Science upto class VII, broad topics/Major concepts in sentence/statement form, note to teachers, observation, Field trip, experimentation and demonstration.

25. Curriculum of Manipur States Agriculture and Nutrition as two separate units. It stresses on exploitation of child's immediate environment, working days in detail, allocation of time, allotment of marks, periods per week, medium of instruction objectives of Primary Education, hints for contents, evaluation and feedback, cumulative record, role of District Education Officer, Director and Teachers' Training Institute, teaching learning situation, implications for implementation, note to teachers and for non-technical treatment of contents.

26. The curriculum of Uttar Pradesh recommends inclusion of two new units like 'Necessities of man' and 'Preservation of the environment'.

27. The SAPA Project stresses on processes, contents on four important areas, structured units, Teachers' Guide, Students' note book, worksheets and cards, film, film loop, kitbox, exercises, objective-based test, contents from physical sciences, Biological Sciences, Earth Science, Social Science, Psychology and Mathematics.

Conclusion:

It is observed that foreign curricula and curricula of other Indian States have the following distinguishing characteristics:-

Objectives of the curriculum are defined age-wise/grade-wise, process-wise and product-wise. New Units like 'Safety and First Aid', 'Housing', 'Agriculture', 'Scientists', 'Nature and History of Science', 'Animal Husbandry', 'Necessities of man' and 'Preservation of the environment' are prescribed in the curriculum. Processes and Skills are clearly defined along with the contents. Advanced topics like the following are prescribed: Cell, electrons, motion, atomic energy, infectious diseases, oceanography, measurement, crystal, life cycle of plants and animals, relativity, evolution, ecology, aviation, rockets, space travel.
and communication. The following activities are prescribed:
gardening, nature study, practical works, setting up museum,
making maps, maintenance of nature diary and collection book,
setting up aquarium, observation, going on field trip, experi­
mentation, demonstration, editing pamphlets, organisation of science
society. Major concepts are spelt in the form of sentences and
topics are dealt quantitatively as far as practicable, Science
Topics and subtopics are articulated properly.

For effective implementation of the curriculum, provision
of Teachers' Units, background information, Teachers' Guide, Time
allocation, equipments, marks allotment etc., are done properly.
Services of District Education Officers, Training Institute and
Director of Education are utilised when and where necessary. For
successful evaluation diagnostic and remedial work, cumulative
records, evaluation procedures and feedback systems are developed.

**TAXONOMIC ANALYSIS OF THE CONTENTS**

For evaluation of the curriculum there is a need to examine
how far the objectives of the curriculum are reflected in the con­
tents of the curriculum. The contents are the objectives in the
concrete and tangible form. The author analysed the contents
as these were evident from the syllabus and text books, following
the Cognitive Domain of the taxonomy of educational objectives
and seeking the expert opinion of experts in Education. The foll­
owing pages will show the objective-content matrix of the curri­
culum in detail. The analysis is limited upto the application
level as the curriculum under scrutiny is the Primary School Sci­
ence Curriculum and the highermental processes like analysis, syn­
thesis and evaluation are not expected at this stage. For ready
reference a synoptic format of the taxonomy of educational objec­
tives upto the application stage has been provided. Such of the
items for which no taxonomic indication is available has been
omitted to avoid repetitions of non-existence.
Synoptic Form of the Taxonomy:

1.00 Knowledge

1.1 Terminology
1.2 Facts
1.3 Convention
1.4 Trend
1.5 Classification
1.6 Criterion
1.7 Methodology
1.8 Generalisation
1.9 Theory

2.00 Comprehension

2.1 Translation
2.2 Interpretation
2.3 Extrapolation

3.00 Application

Content analysis:

Class - III
Unit- I
The Earth and the sky

1.1 Terminology:
telescope, rocket, Magellan, navigator's compass, Newmoon, fullmoon, constellation, The Great Bear, Planet, satellite, star.

1.2 Facts:
The Earth is born from a star.
The Earth is spherical.
Day and night are due to Earth's rotation from west to East around its axis.
The Moon's shape varies in the sky due to its revolution around the Earth.
The stars are very big and they twinkle.
The Great Bear is a constellation.

2.2 Interpretation:

Question No.5: -
The pupil explains known natural phenomena giving reasons.

Question No.11: -
The Pupil explains known natural phenomena giving reasons.
Class - III  
Unit- I  
Weather

1.1 Terminology:—
Snow, dam, water cycle, thermometer, parachute, vapopurification.

1.2 Facts:—
Ice, steam, water vapour, rain, cloud, dew, fog and hail are forms of water.
Lightening, thunder and cyclone are harmful aspects of weather.
Water is very useful for living things and irrigation of land.
Weather changes during a day, a month and a year.
Weather is changing for sunlight, wind, rain and cloud.
Man's living pattern changes due to weather.
Thermometer is an instrument to measure temperature.

1.8 Generalisation:—

<table>
<thead>
<tr>
<th>Ice</th>
<th>heat</th>
<th>Water</th>
<th>heat</th>
<th>Steam</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cool</td>
<td></td>
<td>cool</td>
<td></td>
</tr>
</tbody>
</table>

2.2 Interpretation:—

Question No.4
The pupil detects errors in scientific statements.

Question No.5
The pupil establishes relationship between Scientific concepts.

Class - III  
Unit-III  
Force, Work and Energy

1.1 Terminology:
Force, muscular force, electrical force, magnetic force, gravitational force, friction.

1.2 Facts:
Work is done by muscular force, spring, stretched substances,
electric force, magnetic force and gravitational force.

Two forces can be compared.

A body moves fast if more force is applied.

A body moves easily on a plane than a rough surface.

2.3 Extrapolation:-

Question No. 2
The pupil explains natural phenomena giving reasons.

Question No. 3
The pupil explains natural phenomena giving reasons.

Class - III
Unit-IV
Matter and its properties

1.1 Terminology:
Matter, material, solid, liquid, gas, solution.

1.2 Facts:
There are three states of matter i.e. solid, liquid and gaseous.

Some materials dissolve in liquids.

Solubility of a solid depends on temperature of the liquid and size of the solid.

1.5 Classification:
States of matter.

Class - III
Unit- V
Cleanliness

1.2 Facts:
The dwelling house should be clean and decorated.

There should be provision for separate rooms for separate functions in dwelling houses.

Clothes should be clean.

2.2 Interpretation:
Question No. 2
The pupil explains phenomena.
1. Terminology:
Nursery, rumination, mole hill.

2. Facts:
Root, Stem, Leaf, Flower and Fruits are the organs of a plant.
Many plants are born from seeds.
Animals take food in many ways.
Animals dwell in different resting places for safe living.

1.5 Classification:
Things

2.2 Interpretation:

Question No. 2
The pupil establishes relationship between scientific concepts.

Question No. 3
The pupil classifies things as living or non-living.

1. Terminology:
Saliva, Oesophagus, stomach, small intestine, large intestine, liver.

1.2 Facts:
Carbohydrate, fat, protein, vitamins, minerals and water are the constituents of food.
Food is digested in the mouth, stomach and intestine.
Teeth are to be cleaned properly and daily.
Everybody should have toilet habit daily.

1.5 Classification:

Food

2.2 Interpretation:

Question No.2
The pupil establishes relationship between scientific concepts.

Class - IV
Unit-I
The earth and the sky

1.1 Terminology:

The solar system, comet, asteroid, rotation, revolution, gravity, Gravitation, Planetary system, orbit.

1.2 Facts:

The Earth has its origin from a start.

The solar system constitutes The Sun, nine planets, asteroids, satellites and comets.

The planet is different from the star.

Earth is revolving around the Sun making an angle with its orbit and the change of seasons is the result of its revolution. The surface of the earth and human life change in different seasons.

2.2 Interpretation:

Question No.3
The pupil establishes relationship between scientific concepts.

Question No.4
The pupil explains natural phenomena giving reasons.

Question No.5
The pupil detects error in statements.

Class - IV
Unit-II
Air, Water and Weather

1.1 Terminology:

Evaporation, Vapourisation, air, conditioning, hibernation, filter.
1.2 Facts:
Weather changes mainly due to the Sun.
Water vaporises and evaporates.
Weather affects life of plants, animals and man.
There are different sources of water.
Water is polluted by living and non-living impurities.
Water can be purified by many ways.

1.7 Methodology:
Evaporation, filtration, sedimentation, and decantation.

2.2 Interpretation:
Question No.2
The pupil establishes cause-effect relationship.

Question No.3
The pupil detects error in statements.

Class - IV
Unit-III
Soil erosion and Conservation

1.1 Terminology:
Upper soil, sub-soil, humus, loamy soil, sandy soil, clay.

1.2 Facts:
Rock is eroded by many agents of nature.
Soil is formed from rock.
Soil contains a number of living and non-living things.
There are many types of soil.
Soil is conserved by many means.

Class - IV
Unit-IV
Force, Work and Energy

1.1 Terminology:
energy, electrical energy, solar energy, heat energy.
1.2 Facts:

Electricity is a form of energy.
Solar energy does many works.
Heat energy does many works.

Class - IV
Unit-V
Matter and its properties

1.1 Terminology:

Physical change, chemical change, molecule, atom, intermolecular space, saturated solution, crystal, crystallisation.

1.2 Facts:

Matter undergoes physical change and chemical change.
Matter is composed of molecules and atoms.
Matter is solid or liquid or gaseous depending upon the dimensions of intra-molecular space.
Crystals can be obtained from saturated solutions by crystallisation.

1.5 Classification:
Changes of Matter

1.7 Methodology:
Crystallisation

2.2 Interpretation:

Question No. 2
The pupil detects errors in statements and rectifies those.

Class - IV
Unit-VI
Clothings

1.1 Terminology:
Fibre

1.2 Facts:
Clothes are woven from cotton fibre, silk, animal fur and terelene.
Clothes are prepared according to the bodysize and seasons.

Clothes should be clean and wellprotected.

2.2 Interpretation:

Question No.2
The pupil establishes relationship between scientific concepts.

Class - IV
Unit-VII
Living Things

1.1 Terminology:
absorption of water, carbohydrate, dispersal of fruits and seeds.

1.2 Facts:
The plants are useful to man.
The animals are useful to man.
The plants collect water through the root.
The dispersal of seeds is necessary for the sustenance of plant life.
The plants and animals should be looked after and conserved.

2.2 Interpretation:

Question No.2
The pupil establishes relationship between scientific concepts.

Class - IV
Unit- VIII
The Human Body

1.1 Terminology:
skull, sense organs, tympanic membrane, heart, lungs, pulse, air-conditioning.

1.2 Facts:
The brain helps in coordination of organs of the human body.
The heart acts like a suction pump for circulation of blood.
The lungs purify blood.
The food does different functions in the body.
The cooked food is digested easily.
The food can be preserved in many ways.
The digestive system simplifies the complex food.
The intoxicants are harmful for the heart.
Everybody should be economical in production, consumption and preservation of food.

1.5 Classification:
sense organs, food.

1.7 Methodology:
Preservation of food.

2.2 Interpretation:
Question No. 2
The pupil establishes relationship between scientific concepts.

Class - V
Unit-I
The Earth and the Sky

1.1 Terminology:
artificial satellite, Umbra, penumbra, sundial, eclipse.

1.2 Facts:
The moon is a natural satellite of the earth.
Many artificial satellites have been launched to the sky.
Light travels in a straight line.
Umbra and Penumbra are two types of shadow.
Time is measured by shadow and the sundial.
Eclipses are due to the shadows.
1.5 Classification:

Shadow.

2.2 Interpretation:

Question No. 1
The pupil explains natural phenomena giving reasons.

Question No. 2
The pupil detects error of scientific statement.

Question No. 3
The pupil detects error and rectifies those in statements.

Question No. 4
The pupil explains natural phenomena giving reasons.

Class - V
Unit-II
Air, Water and Weather

1.1 Terminology:

Ottovon Guericke, Magdeburg's hemi-sphere, syringe, suction pump, respiration, photo-synthesis, bacterium, exhaust fan, evaporation, distillation, decantation, sedimentation, filtration, disinfectant, solution, solvent, solute.

1.2 Facts:

Air exerts pressure.

Air pressure can move liquids and does other functions.

Air is a mixture.

Air is polluted by the living and non-living impurities.

Air is made pure naturally and artificially.

Water can be purified by many methods.

1.7 Methodology:

Sedimentation, decantation, evaporation, filtration, distillation.

2.2 Interpretation:

Question No. 2
The pupil explains natural phenomena giving reasons.
Question No.3
Question No.3
The pupil explains an experiment.

Question No.4
The pupil detects error in statements.

Class - V
Unit- III
Natural Resources

1.1 Terminology:
Ore, igneous rock, metamorphic rock, fertilizer, petroleum, subsoil, earth's crust.

1.2 Facts:
Rock contains minerals.
Minerals are useful for our living.
Coal and petroleum are essential substance for human beings.
Fertility of soil can be increased by many ways.

1.5 Classification:
rocks, fertilizers.

1.7 Methodology:
Testing mineral salts in the cow-dung.

2.2 Interpretation:
Question No.3
The pupil selects the right response.

Class - V
Unit-IV
Force, Work and Energy

1.1 Terminology:
Simple machine, lever, inclined plane, pulley, screw, screw driver, wedge, wheel.

1.2 Facts:
Simple machines help in doing works quickly with less force.
Lever, inclined plane, pulley, screw, screw driver, wedge and wheel help in doing works in daily life.
2.2 Interpretation:

Question No. 1
The pupil detects error and rectifies those in sentences.

Class - V
Unit-V
Matter and its Properties

1.1 Terminology:
Weight, volume, specific gravity.

1.2 Facts:
Materials have volume.
The volume of irregular and insoluble substances is measured by the measuring flask.
The volume of regular solids is determined by mathematical formulae.
The specific gravity of a substance is determined comparing its volume and weight in water.

1.7 Methodology:
Determining volume and specific gravity.

2.2 Interpretation:

Question No. 1
The pupil explains terms and natural phenomena.

Question No. 2
The pupil selects the right response.

Class - V
Unit-VI
Living Things

1.1 Terminology:
Carbohydrate, fat, protein, vitamin, minerals, growth, respiration, irritability, reproduction, germination, Cotyledon, Carbohydrate.

1.2 Facts:
Plants prepare their own food.
Animals depend on plants for food.
The living thing grows, respires, shows response to external stimuli and reproduces.

The living thing adopts with the environment.

The living thing takes food according to its body structure.

Temperature, oxygen, water are necessary for germination of seeds.

The embryo takes food from its cotyledons.

Fertile soil, manures and pesticides are necessary for good production of crops.

Plants and animals are interdependent.

Class - V
Unit - VII
The Human Body - nutrition and health

1.1 Terminology:
back-bone, joint, muscle, posture, exercise, balanced diet, bacterium.

1.2 Facts:
The Human skeleton gives shape to the body.
The Muscles help in movement of limbs.
The nervous system coordinates functions of the body.
Everybody should take balanced diet daily.
The food can be preserved for long time by different means.
The infectious diseases spread by water, contact, food and insects.
The communicable diseases can be prevented by vaccination and disinfection.
Bleeding, biting and burning are accidents and these need first aid.

1.5 Classification:
nerves, muscles, spread of diseases.
2.2 Interpretations:

Question No. 2
The pupil establishes relationship between scientific concepts.

Conclusion:

The discussion on objective - content matrix may be summarised briefly as follows:

TABLE XLVIII
THE CONCISE OBJECTIVE - CONTENT MATRIX

<table>
<thead>
<tr>
<th>Objectives</th>
<th></th>
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</thead>
<tbody>
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<td>Facts</td>
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<td>Terminology</td>
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<td>Interpretation</td>
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<td>Classification</td>
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<tr>
<td>Methodology</td>
<td>6</td>
</tr>
<tr>
<td>Generalisation</td>
<td>1</td>
</tr>
</tbody>
</table>

N = 22 Chapters.

Table XLVIII indicates that convention, trend, criteria, theory, translation, extrapolation, application etc. of the Cognitive Domain are not incorporated at all in the Primary School Science Curriculum of Orissa. The Curriculum framers did not include these objectives to make it less technical. There are many instances of repetition of objectives and these are justified on the ground that some contents should be repeated periodically due to their inherent and implicit importance. In line with
the curricula and text-books of foreign and Indian states, translation, extrapolation and application would have been included in this curriculum.

NOTES


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