Principles of Curriculum Construction

Introduction

Curriculum is a conceptual plan and dynamic entity to achieve the requirements of the people of a country. Science curriculum is designed as per the aspirations of the leaders and the people of the society, organized by researchers in science education, guided by the administrators and implemented by the science teachers in schools. Curriculum needs review because the subject matter of science and the views of the people are not static. Education department is a part in the Ministry of Human Resources Development. Science education is related to the Ministry of Science and Technology. In our country NCERT is the professional body, which enriches the science curriculum and reorganizes it every ten years. Resource utilization of any nation is feasible through the enhancement of professionalism in the field of science and technology. Science curriculum is designed to achieve the objectives of science.

Meaning and Definition

The word curriculum' is derived from a Latin word currere' that means course to run. This means the course to study or training leading to reach a goal. Some of the definitions of curriculum given by specialists in this field are as follows:

Kearney and Cook: "Curriculum is a complex of more or less planned and controlled conditions under which students learn to behave and do behave in their various ways".

Cunningham: "It is a tool in the hands of an artist to mould his material according to his ideals in his studio.

K.G.Sayidain: "The curriculum is primarily an aid in the process of adjusting the child to the environment in which he functions from day to day and in the wide environment in which he will have to organize his activities later.

Secondary Education Commission: "Curriculum, does not mean only academic subjects traditionally taught in the school, but it includes totality of experiences that a pupil receives through the numerous activities that go on in the school, classroom, library, laboratory, workshop, playground, and in the manifold informal contacts between the teachers and the pupils".

Alexander and Saylor: "Curriculum is the total effort of the school to bring about desired outcomes in the school and out of school situations".

Smith, Stanley and Shores: "Curriculum is a sequence of potential experience set up in school for the purpose of disciplining children and youth in group ways of thinking and action".

Beauchamp: "Whatever the mode of expression, the subject matter is the substantive hard core of the curriculum.

Concept of Curriculum

The modern concept of curriculum

Education earlier was considered as the tool to acquire a large body of information. Curriculum was considered synonymous with the syllabus, which includes the subjects of instruction. But today curriculum is considered as a dynamic process. Curriculum is not confined only to the courses of study, but is the sum total of the experiences of the students, which they come across in the classroom, in the playground etc. The informal contacts between the teacher and the student also constitutes curriculum. In short, the whole life of the student in the school is the curriculum. Science curriculum is the part of the whole curriculum and helps a student in developing balanced personality. Science curriculum not only helps in acquiring scientific knowledge but also helps in developing scientific attitudes, interest, skills etc. The many concepts of curriculum,

enunciated over the past half a century, have been classified by many experts in different ways, based on the theoretical pronouncements on curriculum.

Curriculum doesn't limit itself to a syllabus or the formal methods through which the school prepares its students for examinations or for occupations. It has as its integral part the acquisition of aesthetic experience, the development of moral sense of value development of the body, and informal contact with the society in many ways. Thus, it includes all the educational activities of the school in the widest possible sense.

The difference between curriculum and the syllabus

The basic meaning of curriculum is to teach the students. It is more than the process of learning and studying. All the experiences faced by the learner during his/her tenure in the school constitute the curriculum. The experiences which the students come across in the classroom, library, or even in the playground are also counted as curriculum. It represents more than any textbook, or subject matter or a study course. Therefore, the whole period of student learning in the school could be considered as curriculum.

The curriculum is viewed as a programme of studies to provide the learning person (student) with a coherent sequence of impressions, exercises and cognitive subjects by virtue of which he can participate consciously, conscientiously, and productively in the cultural development of the nation and of mankind as a whole.

Science Curriculum is a comprehensive concept, which takes into consideration all the possible educational activities in the school. It considers the activities for widening aesthetic experience, for developing a moral sense among the students, for the physical development of the students, for science education tours and excursions, and informal contacts between children and teachers on the playground and other places, apart

from learning the subject alone. Extra-curricular activities are now very much a part of science curriculum.

If curriculum can be taken as the base on which the activities, studies, and experiences a pupil has to undergo in his school life, the syllabus becomes the execution part of such experiences, a structure built over the base. It frames the portion to be taught, the particular tasks to be undertaken, stipulating the goals to be achieved and standards to be accomplished. Therefore, the basic steps are laid down by the curriculum and the means to achieve them are delivered through the syllabus.

The general concept of curriculum

The concept of curriculum, given by **Albert Oliver is** as follows: Curriculum is nothing but educational programme, which consists of three basic elements namely:

- Program of studies
- Program of activities
- Program of guidance

Program of studies: This deals with listing of the subjects for each grade and levels of information. Since, the listing of subjects emphasizes on cultural exploration, the basic function of school of transmitting cultural heritage of mankind to youth is served. In a curriculum the information is selected and organized properly.

Program of activities: It helps in vitalizing the curriculum; the educational programme should include students experiences represented by activities in addition to cultural experience represented by studies. Therefore, this programme helps students not only in acquiring knowledge, but also in experiencing a method of facing life.

The emphasis of this programme varies at different levels of schooling. At elementary level, the programme of studies and the programme of activities are combined so, that students while learning new concepts also experience working

activity. At the secondary level, more emphasis is given on the programme of studies and the programme of activities is termed 'co-curricular' activities. At the college level, both the programme of studies and the programme of activities are separated widely and programme of activities refers to life of the students on the campus.

Programme of guidance: Guidance is an integrative course both for an individual as well as for an educational program. The programme of guidance helps in solving an individual's problem. The problem may be an interpersonal one or occurring in-group situations. It mainly helps the student to become competent to face his/her own problem and to make proper decisions.

Characteristics of Curriculum

The following are the important characteristics of curriculum:

• **Curriculum is dynamic:** As the society's scientific beliefs and the social needs change from time to time there is a need for revision of science curriculum. No single curriculum is suitable for all the times. The curriculum has to change in accordance with the change in social strata due to industrial growth, scientific process and social advancement.

• **Curriculum is related with the aims and objectives:** Aims and objectives of the people in a society have to be fulfilled through the experiences provided. These experiences are planned and spelt out in the curriculum. The different stages involved in the curriculum process are formulation of objectives; selection of learning experiences, selection of the content, organization of the content and evaluation makes the curriculum a scientific process. It is no more based on a rigid tradition but supported by psychological, philosophical and social considerations.

• **Curriculum involves evaluation:** Evaluation is a modern concept of the traditional examination. Whereas the old system is the results with reference only, the evaluation is

concerned of the results with reference to aims and objectives. The goals and aims are balanced in evaluation.

- **Curriculum is a broad and comprehensive process:** Curriculum is much more than classroom instruction. It is not confined to the four walls of the classroom. All the experiences provided by the school both inside and outside the school are under curriculum.

Curriculum Styles

There are basically three types of curriculum styles. They are: **Instrumental curriculum:** In this type of curriculum more emphasis is placed on the utility value or vocational value of science. It makes learning an intense competition among students. The basic approach in such a curriculum is disciplinary and emphasizes the acquisition of knowledge or information. The teacher dominates the scene in this type of curriculum.

Interactive curriculum: This type of curriculum is society- oriented and lays more emphasis on the social development of child. In this type of curriculum class room instructions becomes an interactive or a cooperative process. The approach is interdisciplinary and the curriculum is loosely structured and consists of learning packages.

Individualistic curriculum: This approach is also interdisciplinary and major emphasis is laid on personal development of the child. It helps in the creative development of the child. The students base this type of curriculum on self-calculation.

Important Recommendations for the Science Curriculum in Indian Scenario

Science curriculum suggested by Indian Education

Commission 1964-1966

The Indian Education Commission has recommended that science and mathematics should be taught on a compulsory basis to all the students as a part of general education during the first ten years of schooling. In addition, there should be provision for

special courses in these subjects at the secondary stage for students of more than average ability.

For the lower primary classes I or IV, the focus should be the child's environment-social, Physical and biological. There should be emphasis on cleanliness, formation of healthy habits, personal hygiene, sanitation and development of powers of observation; school gardening should be a regular activity.

In the higher primary stage, IV to VII, the emphasis should be on acquisition of knowledge, ability to think logically, draw conclusions and to make decisions. Science now should be taught as physics, chemistry, biology, geology and astronomy.

The Commission felt that the disciplinary approach in learning science would be more effective in providing necessary scientific base to young people. It felt that the general science approach has been so far a futile attempt.

In the lower secondary classes, physics, chemistry, biology and earth sciences should be taught as compulsory subjects for all the pupils. They should be made to cover wider areas and should go deeper into the content.

At the higher secondary stage where diversification of studies will take place, science will not be studied as a compulsory subject. When option is called for, there should be no rigid grouping. For e.g. one can choose two sciences and one arts subject. Similarly it should be possible for an arts student to take up the study of physics or biology or any other subject in the science group as an elective. Such a combination will prevent narrow specialization. Provision of courses in science at higher level should be made for the talented students.

The other suggestions are:

Lower primary-class I to IV

In the lower primary classes the focus should be on the child's environment -social, physical and biological.

Personal Hygiene and sanitation

Introduction to formal areas of science such as

Plants and animals is his surroundings;

The air he breathes;

The water he drinks;

The weather that affects his daily life;

The earth he lives in; The simple machines;

The body of which he should take care; and

The heavenly bodies he looks at Gardening Roman alphabets

Higher primary stage-classes V to VII

At this stage science should be taught as

Physics Biology Astronomy

Geology

The allocation of these subjects among the three classes is

as follows:

Class V- physics, geology, biology

Class VI – physics, chemistry

Class VII- physics, biology, chemistry and astronomy

The General Science approach to the teaching of science, which has been widely adopted at the elementary stage during the last ten years, has not proved successful and hence the above structure was recommended.

Low secondary stage-classes VII to X

Physics Chemistry Earth science

Biology

All the above subjects were to be treated as compulsory.

Higher secondary stage-XI and XI,

Science will not be suited as a compulsory subject in this stage. Those who want to opt for specialization may choose three electives from the science group only or may choose two subjects from science group. Science includes physics, chemistry, biology, geology and mathematics.

One can either opt for all the three electives from the above subjects or can take two subjects from the above and one arts subject. Similarly it should be possible for an arts student to take up the study of physics, chemistry or biology or other subject in the science group.

Science Curriculum Project

UNICEF - Assisted Science Education Programme (SEP): To study the state of the education in India, a planning mission from UNESCO visited several states and Union Territories in

1964. It recommended for improvement in teaching of science in Indian schools. The Government of India started a pilot project, which was funded by UNICEF and covered primary classes and middle classes. This project was called UNICEF-Assisted Science Education Programme (SEP).

NCERT: The National Council of Educational Research and Training (NCERT) is an apex resource organization set up by the Government of India, with headquarters at New Delhi, to assist and advise the central and state governments on academic matters related to school education.

NCERT has been the key player in all aspects of science education in schools. Its first major attempt was made in 1975 when it published the curriculum framework for first ten years of schooling. This was built up around the recommendations of the Kothari Commission. The Commission emphasized that primary stage science teaching should be related to child's environment to facilitate understanding of internationally accepted symbols of scientific measurements and use of charts, maps and tables. At the upper primary stage, it recommended acquisition of knowledge and ability to think logically as well as to draw conclusions and make decisions. At the lower secondary stage science was recommended to be developed as a discipline of mind and knowledge. Newer concepts of physics, chemistry and biology as well as the experimental approach for learning of science were to be emphasized. The Commission also recommended science courses at advanced level in selected lower secondary schools for talented students with necessary facilities of staff and laboratory. It also emphasized linking science teaching to agriculture in rural areas and technology in urban areas. The new curriculum developed by NCERT was critically received, particularly for being heavy in Classes IX and X. Basic features of the curricula were appreciated and put to implementation practically throughout the country. The magnitude and extent of success at implementation however, remained a point of discussion. The 1986 National Policy on Education and its revision in 1992 took note of all the past achievements and experiences and formulated the following statements on science and mathematics education Science and Mathematics education will remam as core subjects in the first ten years of school education.

- In order to develop scientific temper and to attain other goals, it is necessary to define the objectives to be fulfilled through science education.
- Involvement of community, non-government and voluntary agencies are required to pool the resources by establishing network arrangement between different institutions. Efforts

should be made to generate manpower at the grassroots level spearhead the implementation of ideas stated in NPE.

- Special programmes are needed for the educationally backward states and educationally backward schools of the society. This is necessary for the removal of disparities, attainment of women's equality and education of Scheduled Castes and Scheduled Tribes and other educationally backward sections and areas.
- For universal enrolment and retention, improvement in the quality of education is necessary. Each student learns in a different way and each student has the right to learn. The teaching/learning of science and mathematics should be designed in such a way that it serves that basic right. Science and mathematics education at the elementary level will be so designed that instead of loading the child with content information it should provide him with the joy of learning.
- Science education will be extended to the vast numbers. Who have remained outside the scope of formal education. This is to be kept in mind while planning science and mathematics education for non-formal system. Science and mathematics curriculum will be designed for the secondary level for conscious internalization of healthy work ethos. This will provide valuable manpower for economic growth as well as for ideal citizenship to live effectively in the science/technology-based society.
- Science and mathematics curriculum for general education willbe implemented in the pace setting schools with sufficient scope for innovation and experimentation.
- Science up to Class X should be treated as one. The laws and principles of science, which are operating in the environment, should be used for creating desired teaching/ learning situations. The performance of activities will be given top priority in the teaching/learning of science.

National Institute of Education

The National Institute of Education (NIE) in New Delhi through its vanous departments carries out research and development functions related to pedagogical aspects of curriculum; prepares prototype curricula and other supplementary instructional material; develops school education-related database and undertakes experiments in preschool, elementary and secondary stages to nurture all-round development of the learner.

B.S.C.S.- The Biological Science Curriculum Study Project

The Biological Science Curriculum Study (BSCS) was organized in 1959 by the American institute of biological science. It was necessitated by the inadequacies and defects found in the conventional Bio- science teaching. BSCS differs 'from conventional method in treating biology in three different aspects.

It shows unity among topics.

Lays emphasis on molecular and physiological aspects.

More stress on practical work.

Main functions of BSCS is to:

- Evaluate the content of the present biology course.
- To produce classroom material for average students at secondary school level.
- To produce textbooks and handbooks for the teachers.
- To produce lab manuals for laboratory work. *The BSCS was mainly based on 9 major themes.*
- Science as investigation and enquiry.
- History of biological concepts .
- Complementary of structure and function
- Diversity of type and unity of pattern.
- Change of organism through time as evolution.
- Genetic continuity.

- Organism and its environment.
- Regulation and homeostasis.
- Biological basis of behavior.

The **BSCS** has developed three textbooks, teacher's handbooks and laboratory manuals as part of instructional materials. They selected three patterns of textbooks with different approaches, but all within the general framework of BSCS objectives. They are referred to as Blue, Green and Yellow versions.

Blue version: Biological science -Molecule to Man (molecular approach). This book approaches the study of biological science from molecular level with emphasis on recent advances in physiology and biochemistry.

Green version: High school biology textbook. The approach is through study of ecology and behavioral aspects of biological science. Emphasis is on biological communities and biomes.

Yellow version: Bioscience textbook –called an enquiry into life, follows cellular approach. The book is organized into four major concepts of Biological unity, Bio-diversity, Biological continuity and Biological interaction. Stress is given on cellular level of organization. In addition to all the textbooks, teacher guides and other laboratory manuals are also prepared. As part of the supplementary material teachers handbooks, evaluation aids, BSCS film programmes and BSCS research problems were also developed.

Nuffield Foundation

Nuffield Foundation Science Teaching Project arose from a general interest in curriculum development in science in U.K. It is a charitable educational foundation. The essence of Nuffield course in Biology is "science for all . The main intention was to

provide a balanced and up-to-date view of the subject suitable for pupils who leave the school at the age of 16 years. The course is designed to foster a critical approach to the subject with an emphasis on experimentation and enquiry rather than mere assimilation of facts. Issues like relationship of structure and function, adaptation and interaction of organism and environment are given stress in the course.

The main aims of the Nuffield Science Projectare:

- To make science an accessible subject to all the pupils in the schools.
- To make science a practically useful tool in the hands of students.
- To develop course material that will help the teachers in presenting the science subject in a lively and exciting manner.
- To develop the interests and curiosity to learn science.
- To develop an approach of experimentation and enquiry rather than mere assimilation of facts
- To develop in essence a new approach to teaching.

The Nuffield Biology project course falls into two categories- The Introductory course has a general approach and the second course is a Quantitative course with greater emphasis on experimentation and reasoning. The Nuffield project has developed textbooks, teacher's guides, films and visual aids. They stress on enquiry and process approach. All these provide a qualitative insight into the subject of science.

- *Textbooks:* Designed with a variety of teaching approaches, these provide a clear indication of overall structure of the course, investigatory approach to subject matter, laboratory experiments and manuals.
- *Teacher's guide:* These are available for various textbooks, which help in the methodology of teaching.

- *Films and visual aids:* Supplemented with the films, film loops are made available which are silent.

Nuffield Science Programmes emphasize on enquiry and process approach rather than facts. They stress on qualitative insight rather than quantitative approach.

Curriculum Organization

The aims and objectives of science teaching cannot be achieved mechanically by merely selecting the content as per certain accepted principles. It depends largely on how the content materials are organized and presented in curriculum. The role of the teacher is also equally important. In our country teachers depend upon textbooks prepared or prescribed by the Department of Education for the selection and organization of the content for their science courses. They have no choice. They have to follow the courses of study to letter. However, even within such rigid confines as these, the teacher will have to select and organize to some extent.

Organization of content material should provide for the effective learning of facts, concepts and principles. Facts are learned by experiences, in a variety of ways. Order is important in planning the organization of materials so that opportunity is provided for receiving experience with concepts and principles to provide for the enlargement of understanding. It should provide a natural method of learning that is psychologically sound. Materials should be so ordered, for purposes of instruction, that learning experiences lead naturally towards the objectives sought.

Determinants of Curriculum

The main determinants of the curriculum are:

- Objectives
- Content or subject matter
- Method and organization

• Evaluation

All the four determinants are in tum affected by Philosophy, Sociology, and Psychology.

1. **Objectives:** An objective may be defined as an intended learning of a curriculum or the goal towards which a school sponsored activity is directed. Educational objectives may be of three types: Philosophical, Sociological, and Psychological. The main goal of the curriculum is to achieve these three objectives.

ii. **Content or subject matter:** The content helps in determining the nature and type of learning experiences that should be provided to the students. It also evaluates the tools to be employed for this learning. Knowledge of content is essential for the rational action. Basic knowledge is essential for knowing the concepts, and principles and to discover the new facts.

iii. **Methods and organization:** Educational objective is achieved only if proper method is selected. For classroom teacher's organization of learning activities acts as functional aspect in achieving the concept of education. A teacher is responsible for creating conducive atmosphere for informal and formal interactions between teacher-student, student-student, and student with oneself. Therefore, the curriculum depends on the organization of the content and the learning experiences.

iv. **Evaluation:** Technical evaluation is the integral part of the curriculum. The achievement of the educational objectives is the measure of the effectiveness of the curriculum, which is assessed, with the help of evaluation. Evaluation is not confined to the end of the lesson or a chapter; instead it is a continuous process, i.e. during the lesson. It clearly, shows theteacher's goals and point-of-view of life science teaching.

Evaluation is one of the techniques to assess the student's progress and it helps in getting the feedback from the students. It also helps in assessing and modifying the teaching procedures. Hence we can say that curriculum is never static.

22.3 Principles of Curriculum Organization

Curriculum organization is a scientific process involving the basic principles on which the entire credibility of the curriculum rests. Some important principles of curriculum organization are: -

- **The principle of child-centeredness:** The curriculum should be able to provide suitable opportunities for fulfilling the varied needs of the learner. It implies that the curriculum should satisfy the physical, emotional and social needs of the learner.
- **The principle of utility:** Curriculum should help the learners to live a wholesome and fulfilling life. It should provide sufficient opportunities for the academic and social growth of the child. A living curriculum has to be developed to meet the demands of the fast changing realities of the life. A student should be able to use his/her knowledge in solving day-to-day problems.
- **Principle of creativity:** The curriculum should place the child in the place of a discoverer and time for creative activities should be included in the curriculum.
- A pleasant atmosphere and basic facilities to encourage the creativity has to be provided to a student so as to fulfill the objective of creative thinking.
- **Principle of activity-centeredness:** The curriculum should emphasize learning by doing. Emphasis should be on laboratory work and other field experiences. Nature should act as laboratory for the students. Real-life experiences should be given importance.
- **Principle of variety:** The curriculum should not be rigid. It should be flexible to cater to the students, the changing needs of the learners and society. It should be broad-based to satisfy the needs and interests of the individual learners. The students should be given

enough freedom to express their views and autonomy to select their course of action seemg to it that they reach the goal in the right pathway.

- **Principle of readiness:** The curriculum should be based on the sound principles of learning. They should be based on the level of maturity of the learner and the degree of receptivity.
- **Principle of social relevance or community-centeredness:** It should be based on the purposes of the society. It should be relevant to the needs and requirements of the society. While organizing a curriculum the future of the student should be kept in mind. In this technological age, inclusion of computers and Socially Useful Productive Work (SUPW) is very important. The student should be provided with the knowledge of all the new terms, so that once he/she leaves the school they should be able to face the society with ease.
- **Principle of conservation:** The curriculum should help in preserving and spreading the traditions and culture of our nation. This objective can be fulfilled if the schools include environmental education as one the subjects, which enables a child to learn about nature and its problems. This principle enables a student,
- To observe the environment and enrich his experience
- To develop skills like observing, communicating,
- measuring, hypothesizing, and experimenting.
- To develop better understanding of the facts and concepts of science through nature study.
- To develop application of science through the
- development of scientific attitude.
- To develop creativity in science.

- **Principle of balancing:** Curriculum should be able to balance the objectives and content, objectives and abilities and objectives and learning experiences. It should create a balance between the content to be presented, the teacher and the taught. It should be properly graded and broad based.

•Principle of integration: Curriculum should integrate the child's needs on one hand and needs of the society on the other. The curriculum should be based on individual needs as well as the priorities of the nation. A well-planned curriculum should provide suitable experiences to integrate the abilities, aptitudes and interests of learners with different social backgrounds and make them productive citizens of the country.

Process of Curriculum Development

Curriculum is a basic cycle involving the processes of analysis, design, implementation and evaluation. Curriculum planners set up goals, plan out the experiences, select the content and assess the learning outcomes. Curriculum development is an orderly process of coordinating the various elements of time, space, materials and equipment and personnel. The cycle of curriculum development guides the process of curriculum improvement. The cycle of curriculum development is analyzed as –

Analysis: The step of analysis identifies the values and sets up goals. The objectives are set up keeping the following in the mind. They are: -

- The curriculum should match the student's mental development.
- The introduction of the topics should be on concrete level.
- More emphasis on experimental work or learning by doing.
- Ambiguous and doubtful contents should be excluded .

Design: After framing the objectives and deciding the content the data must be organized into an action plan, which identifies what, is to be done, the changes to be made and the time needed to bring about the changes. Usually designing the curricula is

carried out in the workshops organized at the national level.Improving the infrastructure facilities in the laboratories

• Developing proper scheme of evaluation procedures.

Evaluation: The curriculum framed should be properly evaluated to assess the achievement of the desired objectives. Evaluation helps in identifying the drawbacks and aids in improving the curriculum. The role of evaluation completes with the returning of pointer to the analysis stage. This completes the development of curriculum cycle.

Implementation: This stage involves the execution of the curriculum designed. It includes the application of the resources and training for providing the required skills. The implementation of the science curriculum involves-

- Training the teachers in advanced techniques by carrying out in-service programmes for the teachers.

Approaches Involved in Curriculum Organization

Organization of curriculum is based on a number of approaches. The major approaches of curriculum organization are:

- **Topical approach:** This is simplest of all approaches. Based on the importance the topics are selected and placed in a systematic order. Topics, which are relevant to day-to-day life and today's world, are included in the subjects of higher classes. They may not provide the continuity of the knowledge. Sometimes, this may lead to defective syllabus due to imbalance, lack of sequence and lack of coherence in the curriculum. This arrangement makes the teaching- learning process very interesting and suits to their Psychological needs. In this approach, topics of immediate interests to the pupils are selected carefully and lessons are developed in an interesting way. But this approach has its own limitations. A piece of information is related to many sources. Now, where to include it to get the maximum benefit, becomes a problem. Another serious limitation is

about the teachers. They have to be all-knowing and versatile. The other danger is that the development of the topics becomes artificial and hence uninteresting.

- **Logical approach:** Science is nothing but accumulated and systematized body of knowledge. The knowledge becomes meaningful if the contents are arranged in a logical order. This way of arrangement is quite in consensus with adult thinking and in the higher stages of education this approach is based on hierarchy or level of difficulty. It is also called as funnel approach. It caters to the needs of the learner. Based on the psychological principles such as readiness, transfer of training, reinforcement etc. framing of the curriculum takes place. The curriculum includes simple topics followed by difficult topics.
- **Subject-centered approach:** Importance is given to the entire content of the subject. The topics in it are arranged accordingly. It stresses the acquisition of factual knowledge because facts lead towards the general development of the subject. The sequence involves acquisition of the facts, acquisition of concepts by students and then followed by practical work.
- **Activity approach:** The subjects are important and the teaching is centered on the activity base method in it. Any theory teaching should follow practical method. It depends on the teacher's flexibility. Learning by doing is the principle followed in this approach. Four criteria of activity Observation and interpretation of results is a part of the activities. Facts and principles taught to the students should be in accordance with the needs and requirements of the students as well as the society.
- **Integrated curriculum:** Importance is given to all the subjects. And teaching is carried out in an integrated manner. It tries to inspire the pupils to have a coherent view of science by establishing the numerous links between the various branches of science. In India, the integrated approach for science teaching is widely used.

- **Concentric approach:** This approach involves addition of knowledge from basic to advanced level. It is a continuous process. In this method the various topics, which are to be introduced, are developed gradually. The general science syllabus gives scope for this way of approach. Here all topics are taught in all classes, the difference being only in the depth of the content matter. As the child grows the subject also grows in ever widening concentric circles. The child may not be able to understand the advanced principles and concepts of a topic at lower stages. Hence in this system complicated content areas are presented only when the child is mature enough for that, simpler facts being dealt with in the lower grades.

  This system becomes highly successful if one teacher handles the subject continuously in different years. If different teachers handle the subject in different classes, there will be the danger of too much of repetition and the subject loses it freshness and power of appeal. The teacher should be very careful to see that the charm of the subject is not exhausted in the first year itself. As Elizabeth Zechariah says "there should be always new problem to be solved, new difficulties to be overcome, new mysteries and wonders to be seen". Use of experimental approach Instruction based on problem solving