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PEDAGOGY OF BIOLOGICAL SCIENCE –PART I

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UNIT - T

AIMS AND OBJECTIVES OF TEACHING BIOLOGICAL SCIENCE

Submitted

By

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MEANING OF BIOLOGY

Biology is a natural science concerned with the study of life and living organisms, including their structure, function, growth, evolution, distribution, identification and taxonomy.

Biology literally means "the study of life". Biology is such a broad field, covering the minute workings of chemical machines inside our cells, to broad scale concepts of ecosystems and global climate change. Biologists study intimate details of the human brain, the composition of our genes, and even the functioning of our reproductive system.

NATURE AND SCOPE

- Curiosity is good and should be encouraged.
- Knowledge itself is good—it is good to acquire knowledge.
- It is wrong to falsify or fabricate the data on which knowledge is based.
- It is good to keep an open mind (to be willing to examine and consider new evidence and arguments), tempered by a vigilant level of scepticism**.**

AIMS & OBJECTIVES OF TEACHING BIOLOGICAL SCIENCE IN SCHOOLS

- know the facts and principles of science and its applications, consistent with the stage of cognitive development;
- acquire the skills and understand the methods of processes that lead to generation and validation of scientific knowledge;
- develop a historical and developmental perspective of science and to enable her to view science as a continuing social enterprise;
- relate science education to environment (natural environment, artifacts and people), local as well as global and appreciate the issues at the interface of science, technology and society;
- acquire the requisite theoretical knowledge and practical technological skills to enter the world of work;
- nurture the natural curiosity, aesthetic sense and creativity in science and technology;

- imbibe the values of honesty, integrity, cooperation, concern for life and preservation of environment; and
- cultivate scientific temper- objectivity, scepticism, critical thinking and freedom from fear and prejudice.

1.Acquisition of knowledge and understanding

An important trait of humans is to wonder, observe and interact with the surroundings and look for the meaningful patterns and relations by making and using new tools and build conceptual models to understand this universe.

It is important for children to acquire the knowledge of science content, i.e., concepts and underlying principles as they provide a sound base to explore the unknown and build further knowledge, yet these cannot be passed to children directly.

Development of skills

Science is about asking questions and finding answers to them through scientific method and inquiry. The processes that scientists use in it are science process kills. Science is important to all young people for not only to acquire the knowledge associated with it, but also to imbibe its inquiry and process kills.

Doing experiments require certain skills, which are called laboratory skills. In order to do experiments, students have to handle apparatus carefully, set up the apparatus to perform the experiment and make correct observations.

3. Development of scientific attitude

Scientific attitude is a composite of a number of mental processes or tendencies to react consistently in certain ways to a novel or problematic situation. These include accuracy, intellectual honesty, open-mindedness, respect for evidence, scepticism, suspended judgement, critical thinking, perseverance and looking at true cause and effect relationship. Scientists, because of their thirst for knowledge become perpetual learners. They are constantly curious and continually seeking knowledge by inquiring. This in turn nurtures the trait of scientific attitude.

4. Development of thinking abilities

In science, critical thinking increases science learning potentials. It requires deliberate review of the way in which activities are carried out, the ideas emerges and the way these can be improved. It is the ability to analyse information and experiences in an objective manner. Reflecting on the processes of thinking does not come readily to young children as it involves abstract thinking as well. Teachers can facilitate this by engaging the children in discussions through activities. The process of linkage of the past experiences in terms of cause and effect relationship on a model of set rules, i.e. thinking with reasoning is known as logical thinking. Children should be helped to reason out consistently before arriving at conclusion. Scientific temper is the refined logical thinking.

5. Nurturing curiosity

Thus curiosity led to questions in her mind like why, what and how. When students ask such questions, the teacher should not discourage them. She should facilitate them to find answer using scientific principles. Science is nothing but all that happens around us. Students come across many questions out of curiosity. Curiosity leads to inculcation of *learning to learn* aspect of education. Curiosity can be generated in the learners by taking them to science centres; providing opportunities to work on science projects and to read scientific literature; facilitating interaction with persons having scientific attitude; encouraging to participate in science exhibition and science quiz, etc. Science activities can be designed to encompass several factors making up curiosity. Curiosity gets aroused as a result of doubt, perplexity, contradiction, cognitive conflict, ambiguity, lack of clarity, etc. A teacher needs to create suitable learning situations for this.

6. Nurturing creativity

Creative thinking is a novel or innovative way of seeing or doing things. Creative thinking enables a learner to explore available alternatives and consequences of actions or non-actions and contributes to decision-making and problem solving.

Creativity has been defined in different ways. It is the production of relevant and novel product and process. Also, it involves classification and assessment of different components of the problem or

delineation, manipulation and linkage of ideas in a novel manner to solve a problem, or to deal with an idea or to confirm a conclusion. Creativity is doing or seeing the things differently. It cannot be taught, but developed in children by using planned strategies and techniques.

The teacher plays an important role for nurturing creativity in learners. From pedagogical perspective of physical science, inquiry and activity oriented, process based teaching-learning can facilitate in nurturing creativity. Therefore, the role of the teacher should be to–

- assist students in developing models of inquiry and discovery;
- guide students in the use of multidisciplinary approach;
- recognise and appreciate creative ideas and products of students;
- provide rich variety of learning experiences to students;
- encourage students to frame questions and browse variety of reading materials; and
- express to the students that their ideas have value

7. Nurturing aesthetic sense

Aesthetics deals with the creation and appreciation of beauty that gives us happiness. Harmony, order and pattern are some of the criteria which define beauty. A learner of science is also concerned with them. She gets motivated to see some patterns in the properties of substances and other things in her surroundings. She appreciates her creation and derives joy when finds that a particular toy or a gadget works on same scientific principle that she has already learnt.

For nurturing aesthetic sense through science teaching learning, the teacher may encourage students to consider the following steps:

- Observe keenly while doing any work. For example, observing the flowers while walking in the garden one can appreciate their colour and wonders why the flower is of that particular colour. Observe, analyse and reject what is not scientific.
- One should be conscious of one's inner being.
- Learn to be generous. One should develop the sense of sacrifice and self-righteousness.

8. Development of Problem solving skill

Problem solving means that an individual has learned the skills and acquired relevant information necessary to solve problems that are not only curricular, but also related to everyday life.

Various skills required for problem solving can be enhanced by providing opportunities to students to ask questions, think aloud, look for alternative explanations and procedures, isolate and control variables, keep record, apply reasoning and analogy, make models, and apply process skills in teaching-learning of science. Students can explore such potentiality while working on the problem. They feel a sense of achievement on getting success and develop self-confidence.

In order to provide opportunities of problem solving we need to inculcate the following abilities among the learners:

- Flexible and divergent thinking;
- Decision-making and generating self-confidence;
- Accepting/rejecting hypothesis;
- Correlating between various quantities/phenomena;
- Checking the validity of results;
- Expressing the task in terms of goals;
- Searching for innovative practices;
- Creating new challenges for life; and
- Developing positive and cooperative attitude.

NEED AND SIGNIFICANCE OF TEACHING BIOLOGICAL SCIENCE

- Utilitarian value of day to day use
- Intellectual value
- Disciplinary value
- Cultural value
- Moral value
- Aesthetic value
- Social value
- Vocational value
- Psychological value
- Develops problem-solving skills
- Awareness about technology
- How to conserve natural resources
- Instils survival skills

VALUES OF TEACHING BIOLOGICAL SCIENCE

Teaching science inevitably involves value messages for instance in the management of the curriculum and the particular selection of knowledge which is included in the curriculum .

In many parts of the world today there is a concern about the role science education may play in establishing a sense of personal and social identity for a student. Implicit in this concern is the recognition of

- The powerful social, economic and cultural impact of contemporary science world-wide;
- The importance of the process, ideas and products of science to individual citizens irrespective of their particular role and status in society; and
- The urgent need to harness science to human welfare.

Continue……

Baez (1984)- in discussion issues of science, environment, education and basic human needs identifies survival needs such as food, shelter, health and safety, development needs such as education and employment, and perceived needs such as wealth, security and growth. He notes that all these are in some form or other dependent upon the physical environment in which we live.

However he goes further in his identification of basic human needs making the point that....'Man does not live by bread alone. His needs go beyond the purely physical and include such things as leisure time and the human qualities of respect, care and affection. Deprived of these a person may languish as surely as if he were deprived of food and water'.

Jennings (1983) - in discussing the place of biology in the curriculum and its role in the education of the individual argues that the respectability of school biology as a scientific study was hard earned and the rigour and precision of modern biology make it important for schools to sustain the scientific process dimension to the biology curriculum. However he adds that the key issue is that while retaining this scientific biology curriculum it is necessary to extend it adequately along a human social dimension. He presents an interesting distillation of objectives associated with biology programmes in which he identifies affective as well as cognitive aspects.

According to Kelly (1980) - It is one of the greatest challenges to biological education to formulate a biosocial synthesis in a way that gives it credibility and a rightful place in the curriculum'.

The affective dimension of biological education has often been more effectively developed in terms of translating affective aims into effective teaching strategies when biological science has been placed in a broader curriculum context such as that of environmental education, health education or personal and social education.

The perception of the relevance of biological processes and concepts to the individual has in such programmes been sharpened by the need to look more at the whole education of the person and so individual and social need rather than deriving teaching programmes solely based on the internal logic of the subject.

Environmental education programmes for instance often focus upon issues which involve scientific knowledge within a frame work of social values and aesthetic personal life, through their community, culture and environment. In such contexts as these it has been necessary to explore teaching strategies which go beyond the cognitive and give scope for affective development.

Tones (1981) - in discussing this aspect of health education suggests that the options open to teachers in Affective Education and Health. It is attempted to be implemented in science programmes that the values context of the cognitive processes starts to be recognised creating problems for the teachers' role in relation to imparting particular sets of values. Teachers may not wish to impose their own values**,** or those of a particular class or culture in the com- munity.

Simon 1972 has defined value clarification as involving a hierarchy of seven sub-processes:

Prizing: 1. Prizing and cherishing.

2. Publicly affirming, when appropriate.

3. Choosing from alternatives.

Choosing 4. Choosing after consideration of concern

5. Choosing freely.

Acting 6. Acting

7. Acting with a pattern, consistency and repetition.

CONCLUSION

Biology teaching seen in this way can be developed to contribute to linguistic, mathematical, scientific, personal, aesthetic and physical development, rather than at times actually inhibit or even conflict with some of these development aims an effective science education will be one that is placed in a values context and contributes to the education of the whole individual. Science and in particular biology teaching has affective aims which are essential contexts for the cognitive aims. Science teaching in a whole curriculum perspective can be effectively organised and lead to a useful rethinking of the purpose of science programmes for individuals especially at the Upper Secondary level where, increasingly, the number of students who will go on to professional or technical level careers in science, technology or related fields is limited (Unesco,1980).