

CREATIVITY

Torrance and others consider problem-solving as similar to creativity. (Torrance defines creativity as "the process of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements, disharmonies, and so on; identifying the difficulty; searching for solutions; making guesses, or formulating hypotheses about the deficiencies; testing and retesting hypotheses and possibly modifying and retesting them; and finally communicating the results") Problem-solving as a method of teaching science requires all the elements of inquiry practiced by scientists. Not all topics lend themselves to the problem-solving approach. However, if problem-solving activities are given periodically to students in middle school, they should be able to develop other affective and psychomotor objectives.



Children deserve to seek a setting in school that stimulates learning; invites their attention and evokes their curiosity. The class environment should satisfy the innate interests and needs children bring with them. Teachers can encourage children to state the problem directly rather than have the teachers pose it as a question. If creativity is to be fostered, children should be given the chance to recognise, identify, and state the problem. Frequently this initial phase in problem-solving is neglected because very few children are experienced in the skill in identifying and stating the problem.

Children are naturally creative, but their creativity is often nipped in the bud by our stereotype classroom environs. Teachers, by over-reliance on the lecture method, give very little chance to develop creativity in their students. By teaching science creatively, a teacher can help a child develop his potential to the full.

Torrance has listed the personality traits of a highly creative person. Among the traits are: affectionate, inclined towards the mysterious or esoteric, willing to attempt tough jobs, bashful, courageous, determined, discontented, critical, aloof, not a stickler for time, persistent, self-starter, shun power, sincere, not original, thorough, versatile, risk-taking.

The above list makes clear that everyone is creative to a certain extent. There are variations from individual to individual. It is a natural endowment, which needs stimulation and nourishment. Most of the creative talent in students is wasted due to lack of proper training and inadequate opportunities for expression.

In this setting, it becomes all the more essential for science teachers to realise the need of providing proper environment and create conditions for the full growth and development of the creative abilities of children. Originality, flexibility, fluency, divergent thinking, self-confidence, persistence etc. are some of the traits that are attached to creative output.

Suggestions for Nourishing Creative Thinking

(i) Freedom to respond: Teachers expect a routine fixed response from their students which 'kills' creativity in the bud. Adequate degree of freedom to respond in a variety of ways to a given situation should be provided.

(ii) Opportunity for ego involvement: Creative children are more self-assertive and dominant. A science teacher should provide suitable opportunities—like projects making, brainstorming sessions of problem-solving—wherein they can derive satisfaction on this scope.

(iii) Encouraging originality and flexibility: Teachers should encourage original thinking and discourage mass copying, rote memorising, automatic acceptance of facts. In solving a problem or doing a task, children should be encouraged to try out their own ideas. Positive reinforcement should be given wherever possible. Science teachers should allow students to work at their own pace and their own way, without hampering their creative thinking.

(iv) Providing an appropriate physical environment: Children need a healthy atmosphere in their classroom. There should be adequate space and materials to work with. For instance, an innovative science teacher could greatly inspire her class by using just a simple science kit and large number of experiments can be performed both by her and the students.

Children should be encouraged to set up a small science corner in their classrooms, where they can display charts, models and reports of their field trips. The science teacher should encourage the students to read—both reference books and other supplementary readers. A small box with basic tools—like hammers, nails, nuts, bolts etc. could be maintained along with the science kit.

(v) Developing healthy habits among children: Persistence, self-reliance, self-confidence and industriousness are some of the qualities Torrance has mentioned as traits of creative people. Children should be encouraged to imbibe these qualities. They should also be taught to be proud of their creations, it may be, a model or a chart.

(vi) Using the creative resources of the community: Educational trips to museum, science fairs, model exhibitions, science lectures, science quizzes, debates etc. may be organized which help stimulate the creative thinking of students and develop a creative urge among them.

(vii) Providing a good example: A science teacher shall be an ideal example for her students. By taking active interest in creative activities, viz. model-making, apparatus improvising (making and repairing), organizing exhibitions, wide reading, nurturing the science club, maintaining the science kit etc. she can mould the entire class and infuse creativity skill in them.

A Summary of Teaching Activities to Promote Creative Thinking

Type of Activity	Component Activities
Introductory activities for students to start with	Study trips; walks; tours, visiting museums; planetariums. Participation in exhibitions, displays, poster making contests
Investigative ventures	Assisting projects, model making, collecting data and information. Organisation and presentation of activities
Creative undertakings	Improvisation of apparatus; Brain-storming; Dramas and plays; dumb charades (science based)
Group experiences	Quizzes; Debates; plays; Excursions

7 (1.0) - aims and Objectives of Teaching Natural Science at Different Stages - Primary, Secondary & Higher Secondary =

There have been many attempts from time to time in our country as well as abroad by the educationists to think about the aims of science teaching at different stages of school education. Two such attempts made in our country are worth mentioning. One of these attempts was made in 1956 at Tara Devi Hills through an All India Seminar organised on the topic "Science Teaching in Secondary Schools". The other one relates to the recommendations made by Kothari Commission in 1966. Recently some serious observations have also been made in the new educational policy. In the light of all such attempts the following aims can be set at different stages of school education.

Aims of Science Teaching at Primary Stage (From Class I to IV)

1. To make the children interested in the study of nature and to help them in getting acquainted with their natural surroundings.
2. To educate them regarding the application of science in their physical and social environment.
3. To inculcate good habits of cleanliness and healthful living among children.
4. To develop their faculty of observation.
5. To provide opportunities for the development of their inventive and creative faculties.
6. To give them the basic knowledge of numerals and alphabets for the comprehension and understanding of scientific vocabulary and language.
7. To provide essential knowledge regarding the personal and social hygiene.
8. To cultivate the habit of doing work systematically and neatly.
9. To make them able to read and understand simple graphs, charts, maps and statistical tables.
10. To encourage the children to read and listen to the life story of great inventors and scientists.

Aims of Science Teaching at Middle or Higher Primary Stage (From Class V & VII)

1. To help the students to get acquainted with the impact of science over the environment surrounding them and to develop their interest in the study of science.
2. To provide knowledge about the basic primary facts, principles and theories related with science.

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3. To cultivate the habit of systematic and logical thinking.
4. To develop scientific attitude among children.
5. To help the students in disciplining their mental faculties.
6. To develop the habit and ability of drawing correct inferences out of the available facts and evidences.
7. To provide essential base for the further studies in the higher classes.
8. To acquaint the students with the history of the development of science and help them to understand and appreciate the progress and development made in this sphere.

Aims of Science Teaching at the Lower Secondary Stage (From Class VIII to Class X)

1. To provide the students deep insight (more than the previous classes) with the facts and principles of science.
2. To develop their ability to perform scientific experiments more skillfully and to help them in getting better insight into the application of science.
3. To provide appropriate opportunities for the development of the inventive and creative faculties of the students.
4. To provide essential base for the higher specialized studies in the areas and fields of science and technology.
5. To equip the students with all the basic scientific knowledge and skills helpful in day to day life.
6. To help them in adopting and learning some useful scientific activities as hobbies and leisure hours purposeful activities.
7. To create in them proper attitude and faith regarding the values and contribution of science.

Aims of Science Teaching at the Secondary Stage (Class XI & XII)

1. To attain desirable proficiency in the specialized areas or branches of science.
2. To acquaint them with the latest concepts and advancement in their respective specialized branches or fields.
3. To get them prepared for the study or work related to some specialized vocation like engineering, medicine, etc.
4. To encourage the students to get engaged in the independent deep study of their specialized areas or branches.
5. To provide opportunities and inspiration through relevant reference material and specialized magazines to the students for

the understanding as well as creation of something new in the field of science.

OBJECTIVES OF SCIENCE TEACHING

Difference between the terms 'Aims and 'Objectives : *realizato / definite*

The terms 'aims and objectives' are usually taken as synonymous terms and used interchangeably. However, in a deep sense both differ significantly. Let us try to know this difference.

Values and aims are quite interrelated and interdependent. We aim at a thing because we value it. The values or advantages that can be drawn by achieving a thing become our purposes or aims. We strive for the realization of the values or advantages by setting our goals and aims. Therefore what can be expected in the form of advantages or values from the teaching of science make the very basis of the aims of teaching science. These may be taken as the broader purposes, goals or targets that can be roughly anticipated through the teaching of science. These are like ideals, the high expectations, realization of which may or may not be possible to the expected extent. They need a long term planning and some serious functional efforts on the part of a teacher.

In order to proceed for the realization of the aims or broader purposes, these are usually divided into some definite, functional and workable units named as objectives. These objectives may be termed as short term immediate goals or purposes that may be achieved within the specified limited resources and time by a subject teacher. They can be easily evaluated through the expected behavioural changes or learning outcomes.

Objectives, in this way are the ways and means of achieving the aims in a more practical and definite way. The aims of teaching science may thus be broken into some specified objectives for providing definite learning experiences to bring desirable behavioural changes. Consequently, objectives of science teaching may thus provide certain clear cut well defined short term purposes or tasks before a science teacher at the time of teaching a particular topic or providing a particular type of learning experience.

Objectives of Teaching Science at the School Stage

Science is taught or learning experiences in the subject of science are given to children for bringing desirable behavioural changes. These changes are expected from all the three behavioural domains, namely—cognitive, (knowing) conative (doing), and affective

(feeling). Therefore when we try to mention the objectives of teaching Physical or life sciences, we have to take care of these three domains in which behavioural changes are expected as an outcome of the teaching and learning of these subjects. Moreover, the different instructional objectives set for this purpose must also be stated in behavioural terms *i.e.*, the expected changes in the behaviour of the pupil. Let us mention the major objectives of teaching physical and life sciences in behavioural term.

1. Knowledge objective. The pupil acquires knowledge of the terms, facts, concepts, definitions, principles and processes related with physical and life sciences.

2. Understanding objective. The pupil develops understanding of terms, facts, concepts, definitions, principles and processes related with physical and life sciences.

3. Application objective. The pupil applies his knowledge and understanding of the subject physical and life sciences to the day to day life activities, and the new or unfamiliar situations.

4. Skill objective. The pupil develops mathematical skills. Skills like manipulative skills, drawing skill, dissecting skills, collecting mounting and preserving skills etc.

5. Interest objective. The pupil develops interest in the world of physical and life sciences.

6. Attitude objective. The pupil develops scientific attitude through the study of physical and life sciences.

7. Appreciation objective. The pupil appreciates the contribution of sciences to human welfare.

~~Let us now discuss about the various specific behavioural changes~~

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