Research article Available online www.ijsrr.org ISSN: 2279–0543

International Journal of Scientific Research and Reviews

Inculcation of Values Through Science Experiments at Secondary Level

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ABSTRACT

Science is a systematic study and knowledge of natural and physical phenomena. In this era, scientific education is much emphasized in all societies the world over. The main goal of science education is to prepare the right type of environment for the individual, to allow learners grow physically, mentally and spiritually in order that learner can develop harmoniously within time together fellow human beings. According to NCF-2005 teacher should act as a facilitator and not as a transformer of contents where they can think, realize, analyze and develop their own way of learning which something beyond the text book.NCF for school education brought out by NCERT (2005) mentions that school education in the country seems to have developed some kind of neutrality towards the basic values. The NPE (1986) clearly emphasized the need of learning of science as a part of general education without compartmentalizing into its different disciplines. The NPE (1986) clearly reflects the governments, desire to make readjustments in the curriculum in order to make education a forceful tool for the cultivation of social and moral values. Science operates through its processes. Hence, science teaching is to be different from that of the other subjects. Mere question answer method will not be enough. Thinking based upon keen and minute observations with the help of activities/experiments skill is to be generated amongst the learner. Teaching learning of science needs to be characterized by focused emphasis on processes of science. Learning of science increases the spirit of enquiry, creativity and objectivity along with aesthetic sensibility. It aims to develop well-defined abilities of knowing, doing and being. It also nurtures the abilities to explore and seek solution to the problems related to environment and daily life situations and to question the existing beliefs, prejudices and practices in society. Science concerns itself with the fundamental knowledge of universe, world and its environment. In the light of NCF, it is now being felt that technology (Science of mechanical and industrial arts) is increasingly influencing our quality of life. Hence, a need of the component of technology in the science course at the upper primary and secondary stage to emphasize upon the applications of various principles of science to technology in our day-to-day life in view of the strong organic linkages between the two, by the promotion of values through science using practical skills. The main objective of this abstract is to develop practical skill in order to enrich the science teachers in learning the systematic performance of science experiments to relate the science concept values effectively in school level.

KEY WORDS: Value, science and technology, practical/experiment skill, scientific process.

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INTRODUCTION:

Science teaching through value education and society are inseparable. Society equips education with the values to be transmitted while science education exposes each generation of young people to the existing beliefs, norms and values of their culture. This demands a careful selection of the values that would help to integrate the society and promote the mutual relationship between man and man and his environment. Science operates through its processes. Hence, science teaching is to be different from that of the other subjects. Mere question answer method will not be enough. Thinking based upon keen and minute observations with the help of activities/experiments skill is to be generated amongst the learner. Teaching learning of science needs to be characterized by focused emphasis on processes of science which may consist of the following steps,

(i) Careful observation

(ii) Sensing of problems

(iii) Making hypotheses

(iv) Literature survey/consulting teachers or and friend

(v) Identification of a particular problem

(vi) Experimentation for seeking solution

(vii) Data collection and analysis

(viii) Interpretation of data (ix) drawing inferences

(x) Modification of hypotheses and scope for further studies.

In our classroom teaching, we will have to perform activities for removal of misconceptions, if any, develop and strengthen the concepts on the basis of seeing, doing and thinking. This will lead to development of one very important value i.e. truth besides the other related values of critical thinking and reasoning. The experiment should be so designed that its results are clearly interpretable. Interpretation becomes difficult if the variables are not identified and suitably controlled. The initial design of the experiment must be carefully looked into so that some of the possible sources of error can be located and steps taken in the design to correct. Before actually starting the experiment, a list of materials required must be prepared and all the materials procured according to the list. It would also be convenient if a method of recording the data has been decided upon, so that the necessary tables etc. , could be prepared before the experiment is started. During the experiment, accurate observations must be made and duly recorded, exactly as they happen. The data collected should be arranged in a methodical manner so that interpretations would be facilitated. The results and conclusions of the practical will have to be presented finally as a report. There are a number of ways

in which the experiments can be modified and improved. If these practical skills can generate ideas not only for improvement ofthe suggested designs but also for new experiments, their purpose would be amply served. The science teachers at school level must be trained properly to perform some basic experiments in order to inculcate scientific temperament and appreciation for science. Use of the practical skills for science concepts may be helpful to understand several science terms which include the following:

1. To stimulate an interest in science subjects.
2. To improve their experimental and communicational skills and to develop scientific attitude and interests.
3. To inculcate divergent thinking and cooperative attitude among the students.
4. 4. To make science subjects more create enjoyable and a sound fundamental knowledge of facts and principles.
5. To satisfy scientific curiosity.
6. To encourage independent thinking.
7. To make use of environment.
8. To give practice in critical thinking.
9. To develop problem solving techniques.
10. To make scientific principles more meaningful.
11. To increase self-confidence.

The value of experiments skill for science concepts can make the study of science more exciting, enjoyable and educational. This provides an opportunity to teachers and learners to get a first hand experience of the process involved in scientific concepts at school level. It represents one method of helping learners, explore their special interests in depth. The resulting finding are often for more valuable to the students who are involved than the information presented in regular class periods.

VALUES

The word, value is derived from the Latin word, 'Valeric' meaning to be strong and vigorous. Values means' worth, 'importance' and utility. To be of value is to have certain virtues. A widely accepted definition considers value to be conceptions of the desirable influencing selective behavior. A value is a belief upon which a man acts by preference. Values are attributes that confer on man humanism and peace. Values are concepts that conserve, comfort, promote and protect life. They shape the moral personality of an individual. Values enhance the finer side of one's potential. A value is a real relationship between a person and an environmental situation which evokes an appreciative response in the individual. Kirectjoshi (1981) mentions that the education that promotes among

youth the values of self-control, discipline and right habit of thought and conduct is necessary. True education is a man making education. Values foster peace, order, dignity, grace and delight. Values in one word are the divine side of a man. Real education should become an instrument of social change and national development. It should move towards humanism, liberalism and universalism. Any human activity, thought or idea, feeling, sentiment or emotion which could promote self-development of the individual in all its dimension could be said to constitute a value. Value should also confine to the welfare of the larger social units such as the family, the community, nation and ultimately the whole world of which the individual is a member. Value education is not simply a matter of choosing a set of values from among competing values and then transmitting them to the students but internalizing those values in one's personal life.

The National Policy of Education (1986) lays emphasis on value education. The NPE clearly reflects the governments desire to make readjustments in the curriculum in order to make education a forceful tool for the cultivation of social and moral values. National curriculum framework for school education brought out by NCERT (2005) mentions that school education in the country seems to have developed some kind of neutrality towards the basic values. The curriculum further emphasizes that a comprehensive program me of value inculcation must start at the very earliest stage of school education as a regular part of schools daily routine. The entire educational process has to be such that the boys and girl of this country are able to know 'good', to love 'good' and to do 'good', and grow into mutually tolerant citizens.

SCIENCE PRACTICALS AND VALUES

Five days training program me (24-28 Set.2018) on practical skills for secondary science teachers of western region states (Madhya Pradesh and Maharashtra) were conducted by the authors for implementation of NCF (2005) in their respective state. The participants were taken to the Chemistry laboratories at Regional Institute of Education Bhopal for conducting a few simple Science activities/experiments to discuss whether some values can really be developed by performing some experiments. The following experiments were conducted:

1. Determination of pH of various solutions.
2. Determination of chemical properties of metal and non metals with oxygen and nature of their oxide.
3. Separation of mixture compound(by Sublimation method).
4. Cleaning of muddy water.
5. Separation of two immiscible liquids

Participants of the groups were of the view that a large number of values can be developed among learners through various science experiments, provided they are conducted scientifically. The values, which the groups feel can be inculcated through science experiments, as are under:

1. Systematic procedure
2. Keen and minute observations
3. Analytical thinking
4. Scientific attitude
5. Open mindedness
6. Mutual co-operation
7. Patience
8. Sense of belongingness
9. Social concern
10. Self-confidence etc.

Details of a few simple experiments along with list of various values developed through each of them are given below:

1. Determination of pH of various fruit juices/solutions

Principle: pH of solutions (lemon juice, tomato juice, baking soda and washing soda solution) can be determined with the help of pH paper. A substance is said to be acidic if its pH lies below 7 to 1 and alkaline if pH lies above 7 up to 14. The pH bears a spectrum of colors corresponding to different pH values.

Mental Processing: Preparation of given fruits and salts solutions thinking of solution.

Procedure: The pH of solution can be determined by dipping the pH paper in the solution and matching the color thus obtained with the standard colors indicated on the pH paper. When the fruit juices of commonly available fruits like lemon, orange ,tomato, baking soda and washing powder solutions were used for determination of their pH, the results as given in table -1 were obtained by the participants. The values which can be developed as a result of this activity as reported by the participants are given below:

1. Keen observation
2. Confidence
3. Mutual co-operation
4. Scientific temper
5. Reasoning
6. Truth
7.

Table-1: pH and color change with the pH paper of different solutions

S. N.	Fruits juice/solution	Color change	pH
1.	Lemon	Orange	4
2.	Tomato	Orange	4
3.	Baking soda	Dark green	9
4.	Washing soda	Dark blue	11

2. Determination of chemical properties of metal and non metals with oxygen and nature of their oxide:

Principle: When magnesium ribbon/metal burns in the air (burner) it forms magnesium oxide. If MgO dissolves in water it form Mg (OH0)2 which turns red litmus blue.

$$2Mg+O_2 \rightarrow 2MgO$$

$$MgO+H_2O \rightarrow Mg(OH)_2$$

Whereas, sulphur is burnt in the air it forms sulphur dioxide or sulphur trioxide. Sulphur dioxde when dissolves in water form sulphurus acid, which turn blue litmus red.

$$S+O_2 \rightarrow SO_2$$

$$SO_2+H_2O \rightarrow H_2SO_3$$

Mental Processing: Metal and non metals are occur in ore and mineral. They contain different type of properties which indicate their specific behavior or character during experiment.

Procedure: Hold magnesium ribbon using tong & burn it on Bunsen burner. Collected the ash in a watch glass; note its color and state. Collected the ash dissolve in 15 mL distil water in a beaker and check the nature of this solution with Red litmus. For sulphur take a deflagrating spoon with sulphur power and burn, and immediately introduce in the gas jar containing water, cover the lid tightly. When the fumes cover the whole jar remove the deflagrating spoon. Shake and stir the jar gently, so that the gas gets completely dissolved in water. Check the nature of the solution with blue litmus.

Values Developed

1. Reasoning
2. Problem solving
3. Systematic approach
4. Critical thinking
5. Learning by doing
6. Decision making
7. Scientific temper

3. Separation of mixture compound (by Sublimation method):

Principle: Some substances change directly from solid to the vapour state on heating and on cooling vapour change in to solid. This phenomenon is called sublimation.

Mental processing: Thinking, reasoning and changing the state of substance.

Procedure: The mixture of two compounds (Iodine and sand) was taken and its physical properties were observed. One compound was found soluble in water and having unique smell. The smell resembled that of iodine. We were told that one of the compounds converts into gaseous state directly on heating. The mixture was taken in a beaker and placed on tripod stand. Cold water and ice containing conical flask kept on beaker. On heating, iodine changed into vapours directly and condensed into a solid substance on the surface of the conical flask wherefrom it was collected easily. Sand was left as such inside the beaker. In this way, the two compounds got separated.

Values developed

1. Patience
2. Thinking
3. Reasoning
4. Systematic approach
5. Critical thinking
6. Confidence
7. Pleasure
8. Mutual Co-operation

4. Cleaning of muddy water:

Principle: Aluminum cations present in the potash alum fasten the process of coagulation as a result of which heavy suspended particles settle down at the bottom of the container.

Mental processing: Thinking of a solution and cleaning

Procedure:

1. Treatment of muddy water with a small amount of alum to load the a smaller insoluble particles and allow them to settle down at the bottom of the container.
2. Decantation.
3. Separation of impurity to get pure water.

Values developed

1. Societal concern
2. Sense of belongingness
3. Patience
4. Development of a procedure
5. Development of reasoning and critical thinking
6. Importance of pure water
7. Problem solving ability

5. Separation of two immiscible liquids

Principle: This experiment is based on the principle of difference of specific gravity. Liquid with low specific gravity remains in the upper layer while the one with higher specific gravity remains in the lower layer.

Mental processing: The liquids provided were clear. Each of them left some mark on the walls of the container, one of them having an offensive odour.

Procedure: We named two liquids as A and B and took 20 mL of each liquid with the help of a measuring cylinder in a beaker. Two layers were formed. Then this solution of two immiscible liquids was transferred to a separating funnel kept on our seat. Shook the two liquids vigorously for same time and then allowing the separating funnel to remain undisturbed for some time on a tripod stand till two distinct immiscible layers appeared. Opened the pinchcock of funnel and transferred the lower layer of in one beaker and upper layer in the other beaker. Thus two layers of immiscible liquids were separated.

Values developed: After completion of this simple activity we feel that the following values can be inculcated:

1. Handling of the glass apparatus and successful separation of the two liquid develops self-confidence.
2. Initiation for performing other scientific experiments.
3. Understanding of the environment and applying application of this principle in daily life.
4. Development of reasoning and logical thinking.
5. Development of scientific temper.
6. Patience ultimately leading to truth.
7. Seeking solution of problems.

Educational implication/inculcation of values

1. It develops the observation skill and insight of a person.
2. It proves that whole is always important than parts.
3. We had a whole situation and on its overall observation we succeeded in reaching a logical conclusion.
4. Such type of an activity develops handling of apparatus, reasoning, scientific attitude and creativity.

CONCLUSION:

The teachers and the practitioners for inculcation of values through science teaching can think of such type of classroom activities and problems in science and technology. However, it may be remembered it is not an over nigh exercise. Values are learnt or inculcated by a long and continuous process. Values can be inculcated only when we practice them, follow them in

schools/colleges and society. Students consider teachers as their models. Therefore, before taking up the task of value inculcation amongst our students, we teachers, teacher educators and administrators will have to present ourselves as models for our students and get rid of us from the clutches of politics and selfish motives. It is thus hoped that we will be successful in changing destiny of our country by producing good citizens with good values.

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