

Impact of Critical Thinking in Learning Science

Ms. Sefali Patel

Lecturer,

Waymade College of Education, Vallabh Vidyanagar, Gujarat,

Dr. Dipali Gandhi

Assistant Professor,

Waymade College of Education, Vallabh Vidyanagar, Gujarat.

Abstract:

School students are curious in nature, which makes science a best subject for them to learn and gets knowledge about it. Through science, students can explore their world and discover new things. It is a dynamic subject which makes students to perform some activities such as hands-on labs and experiments. It helps to makes science well-suited to active younger school students. Science is an essential and important part of the basis for education for all children which makes students to develop certain important skills in order to functioning in this world. A person needs to use knowledge of science as a powerful tool for solving their problems related to scientific concepts. The importance of science education in society is vital and cohering, that is why society and knowledge cannot be ever separated into two different categories.

Key Words: Education, Science, Critical thinking.

Introduction:

Due to advancement in science and technology, Indian society is going through a massive change. But, for the sustainable growth and development of human, we needs to incorporate innovative ways of teaching and learning in the field of science and technology so that it leads to transform intelligence of human into knowledge production. India is a country of diversities. So it is difficult to cater needs and aspirations of the each human beings of the nation. For that we need to focus on improving science education of India for improving quality of education.

In the era of the 21st century, all people are making efforts to compete this global world. To fulfill this goal, everybody is giving more importance to the education as it emphasizing more on using updated science and technology. It makes us think critically over some issues and use scientific investigation in solving the problems.

Education is considered as a powerful weapon for achieving goals of country. Education makes an individual fully developed. Education is a process of living not a preparation for future living. Dewey has regarded that “life is a byproduct of activities and education is born out of these activities”. We can educate the people by the process of teaching.

Earlier teaching is considered as a bipolar process. The teacher and subject being its two poles and children were ignored. No attentions were given to the needs and desires of child. The child was evaluated on the basis of his memory power. The content is taught by teachers and child has to just memorize it. According to Hugh and Duman, “Teaching is an activity” a noble profession rather than human activity where knowledge is used to promote the learning.

Modern education focuses more on practical training rather than academic attainment. The entire subject is taught by teacher in school because it gives liberal education. They are the part of preparations for life which we expect from school to give to the students. Science is one among those subjects which is important element in education.

All Human beings are governed by their instinct which remains unchanged, and men are able to build power of observation to learn, to think and solve problems of their life. All people have different interest, motives, power of observation, memory, and learning which is a kind of intellectual activity called “thinking”. The great philosopher Descartes said, “I think, so I exist”. Therefore thinking signifies complex psychological process. Thinking abilities present in human in various forms such as critical thinking, creative thinking, logical thinking, inductive-deductive thinking and productive thinking. Individual who think critically can think for themselves, they can gather and analyze information in proper way, draw out the reliable conclusion by themselves. So, the goal of science education in today’s era is to build capacity to think critically over particular area and problems by keeping in mind from its different perspectives.

Nature of Science as a Subject

Science has definite characteristics which differentiate it from other spheres of human enterprise. These characteristics define the nature of science as a subject. These also set the terms on which you can engage with science. These are given below.

- Science is a particular way of looking at nature
- Science is a rapidly expanding body of knowledge
- Science is an interdisciplinary area of learning
- Science is a truly international enterprise
- Science is always tentative
- Science promotes skepticism; scientists are highly skeptic people
- Science demands perseverance from its practitioners
- Science act as an approach for investigation and as a process of constructing knowledge

Science Teaching at School:

Teachers in school need to use different types of teaching methodologies to provide scientific knowledge to the students by keeping in mind its application in their daily life for solving problems.

In the present time, Teaching of science at school must enable and encourage students to:

- ❖ Develops critical thinking, and curiosity about science
- ❖ Acquiring and understanding knowledge about natural world
- ❖ Develops value of honesty and respect for themselves, others and their shared environment
- ❖ Develop skill of designing and carry out scientific investigations, solving the problems, evaluating scientific evidence to draw conclusions, judging the arguments and making informed decisions in scientific and other perceptions
- ❖ Understand international nature of science and their interdependence of science, technology and society
- ❖ Provides unique training in observation and reasoning

Type of skills required to learn Science:

Discovery Works organizes science skills into three separate groups: Process Skills, Reasoning Skills, and Critical Thinking Skills. These groups match to three distinct types of cognitive skills. **(1)Process skills:** They are used to collect information about the world. It includes skills such as, observing, classifying, measuring, inferring, predicting, recording, interpreting and experimenting.

(2)Reasoning skills: It helps children to make sense of the information they have collected by fostering an open mind, curiosity, logic, and a data-based approach to understanding the world. It includes skills such as, longing to know and understand, questioning of scientific assumptions, search for data and its meaning, and consideration of premises and its consequence.

(3)Critical thinking skills: It requires students to apply information in new situations and in solving problems. It includes skills like analyzing, synthesizing, evaluating, applying, expressing ideas and solving problems.

Concept of Critical Thinking:

Critical thinking refers to thinking that combines rational judgment, perception, creativity and practical common intellect to discover and apply critical truth that helps a person become successful in solving problems, accomplishing goals and getting results. Critical thinking is a scientific method applied by ordinary individuals to the ordinary world. According to Dewey, “critical thinking involves active persisted and careful consideration of any belief or supposed from of knowledge in the light of the grounds that support it and further conclusions to which it tends.” According to Robert Ennis, “critical thinking is reasonable reflective thinking that is focused on deciding what to believe or do.” According to John Peer, “critical thinking is a frame of mind, set of attitude and disposition.” Critical thinking is critical inquiry to investigate and solve the problems. Main purpose of teaching critical thinking in science is to improve thinking skill of students.

Characteristics of Critical Thinkers: According to Raymond S. Nickerson (1987), characteristics of critical thinkers are: (1) understand difference between reasoning and rational, (2) Apply problem solving techniques, (3) habitually questions one’s own views, (4)distinguish between logically valid and invalid inferences, (5)use evidence skillfully, (6)organize and articulates thoughts,(7) understand idea of degree of belief, (8) can strip verbal argument in its essential terms, (9) can structure informally represented problems by using formal techniques to solve problem.

Components of Critical Thinking: According to Passy (2004), components of critical thinking are as followings:

- ❖ Comparison: Process of examining attributes of two or more element to discover similarities and difference between them
- ❖ Hypothesizing: Process of formulating tentative solutions to a problem
- ❖ Logical reasoning: Process of arriving at truth from both unknown and already known truth), classification: Process of distributing elements into different class
- ❖ Interpretation: Process of presenting meaning of vague concepts
- ❖ Justification: Process of defending arguments based on relevant criteria
- ❖ Observation: Act of recognizing and noting a fact from what one has observed
- ❖ Prediction: Process of anticipating an outcomes by using one’s personal knowledge, observations or experiments
- ❖ Sequencing: Process of arranging elements in desired order of their occurrence
- ❖ Summarizing: Process of giving gist of an ideas by using your own words
- ❖ Identifying propaganda: Process of identifying unbiased ideas, facts, faith and information
- ❖ Setting criteria: Process of selecting parameters for making guidelines and measure the outcomes
- ❖ Reorganizing: Process of again organizing, arranging, planning of something systematically
- ❖ Estimating: Process of calculating approximate value position of an element
- ❖ Evaluation: Process of giving value to an element according to some criteria or standard

Ways to Develop Critical Thinking: Critical thinking is an active process which needs students presence of mind because it deals with active intellectual activities such as analysis, synthesis, reflection, interpretation etc. There are various ways to develop critical thinking in science classroom. Some of the techniques given below:

- ❖ Laboratories: Using laboratories play vital role in teaching critical thinking as many science concepts have laboratory connected with them. Students learn the scientific method by actually practicing it.
- ❖ Homework: Critical thinking can be encouraged by homework assignments. General questions provided to students before they start reading and insist that they organize their notes around these questions. It required students to transform information and make it their own by requiring them to paraphrase, summarize or outline all reading assignments.
- ❖ Lectures: Critical thinking can be developed during lectures by asking students questions about content you have just presented and wait for some times to get their response.
- ❖ Examinations: In examination, questions were chosen to go beyond the lecture material and use of books/lecture notes to reach at and phrase reasoned answers to complicated questions.

- ❖ Quantitative exercises: Courses like chemistry, physics needs solutions of various mathematical problems. When students solve these math problems, they are practicing critical thinking.
- ❖ Term papers: Students develop critical thinking by acquiring, synthesizing, logically analyzing information and presenting this information and conclusion in written form.

Impact of Critical Thinking in Learning Science: Clement and Lochhead (1980) says that, “We should be teaching students how to think instead, we are teaching them what to think”. All education consists of transmitting to students two things: ‘What to think and how to think’ because today’s education system focuses on teaching students a proper ways to obtain new reliable knowledge. Main impact of critical thinking in learning science are: (1) Deeper engagement in learning science through critical inquiry and understanding of concepts (2) Develop in students’ self-dependent and self-regulation habits (3) Stronger competence with scientific inquiry skills which includes initiating, planning, performing, recording, analyzing, interpreting and communicating. (4) Construct in learner the basic ideas, principles and theories that are inherent in content (5) Foster reflections among students by asking questions that stimulates thinking needed to construct knowledge (6) Developing reasoning and problem solving abilities.

Conclusion: Critical thinking in science teaches a variety of skills that can be applied to any situation in life that calls for reflection, analysis and planning. Thus critical thinking in science helps to identify gap in students understanding of information, quantify their abilities to compose knowledge of material as well as understanding content enough to create insightful knowledge by using critical thinking.

References:

- Schafersman, S. (1991), *An Introduction to Critical Thinking*, Page No. 1-13
- J. K. Sood (2005), *Teaching of Science*, Second Addition, ISBN-81-7457-352-6, Page No.-32
- Beaumont, J. (2010) *A sequence of Critical Thinking Tasks*, TESOL Journal, City University New York
- Gurubasappa, H. D. (2010), *A Study of Critical Thinking Emotional Intelligence Creativity and their Effect on Academic Achievement in Science of Secondary School Students*. Ph.D. (Edu.), Kuvempu University
- Yoo, S. (2011), *Enhancing Students Critical thinking in Science*, Ph.D. (Edu.), Pennsylvania State University
- Zhou, Q., Huang, Q., Tian, H. (2013), *Developing Students Critical Thinking Skills by Task Based Learning in Chemistry Experiment Teaching*, Creative Education journal, Vol.4
- Patel, D. (2015) *Development of a Critical Thinking Program and its Effectiveness for Students of class IX*. Ph.D. (Edu.), S.P. University
- Fernando, L. (2017), *The role of Critical Thinking in Science Education*, Journal of Education and Practice, Vol.8