

## **Applicational perspectives of Science Process Skills in enhancing Science learning among high school students**

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### **Introduction**

Education through science is an important foundation for future development as it has number of proposals and recommendations contributing to the advancement of science learning at all levels. In general the factors that explicitly contribute to science learning are defined and have been discussed widely based on the nature of the subject area; science learning is attributed to curiosity, reasoning, interest in science, scientific aptitude etc. The aim of the present study is to establish the sublime factors that contribute to science learning and further understanding how science learning happens, that which is referred to as, 'Science Process Skills'. Research studies in specific have come up with identification of significant factors of science process skills namely observing, Classifying, measuring, communicating, predicting, inferring (American Association for Advancement in Science (AAAS), 1993). An essential component of every scientific endeavour is the presence of scientific process abilities at the study, experimentation and implementation stages. The scientific method is a set of techniques that scientists use to organise and conduct all of their investigations. The focus of all new initiatives worldwide is on getting kids involved in research and the development of processes rather than just giving them exhaustive understanding of science (UNESCO, 1969).

### **Science Process Skills as a learning approach**

Science Process skills are crucial practical abilities to establish scientific knowledge and are vital in the process by which students develop scientific information. It requires the individual to assume liability for actively engaging in and learning diverse methods. Scientific investigation refers to a wide range of procedural and conceptual activities including questioning, using equipment, speculating, planning experiments, making predictions, observing and measuring. Additionally, it entails gathering and analysing data, reviewing data repositories, assessing evidence, validating conclusions, addressing contradictions or anomalous data, presenting and reviewing arguments, and constructing explanations for the phenomenon. Science framework lays highlighting on competencies by explaining the phenomena scientifically; evaluating and designing scientific enquiry; interpreting data and evidence scientifically.

### **Cognitive attributes of science process skills**

Science process skills are very important practical abilities to create scientific understanding, and they play a significant part in the process by which students produce scientific information. Also enables understanding of the scientific process and makes it possible to apply evidence-based knowledge. The pupil is required to actively participate and assume responsibility for learning numerous techniques. The term '*process skills*' was used by Champagne and Klopfer (1981) to describe the problem-solving techniques that an individual employs when processing information. Science process skills are significant on the basis that science ought to focus on the knowledge and ideas that aid students' comprehension and their capacity to apply this understanding to resolve challenges. Scientific knowledge and its application

are referred to as scientific literacy which allows for a comprehension of the scientific method and enables the application of information based on evidence. Gagne (1965) emphasizes science education should be based on the 'processes' that scientists employ in their own scientific endeavours. Science involves observation, categorization and measurement, inference and hypothesis-making, and experimentation.

Learning science requires both activity and thought processes, and the end result can be understanding of both the procedural skills required and a collection of scientific ideas and concepts. The steps taken to develop the scientific ideas without the use of science process skills leads only to rote learning. Science education must inspire the child to develop the skills so that they get chance not only to alter their ideas but also learn to be sceptical of alleged truths until there is indication to contribute their understanding of the concept. Harlen (1999) opined that, 'Scientific process skills should be a fundamental objective of science education because they play a critical role in the development of learning with understanding'. Because the mental and physical abilities referred to as science process skills play a crucial role in learning with understanding, it is claimed that assessing science process skills is significant for formative, summative, and monitoring purposes.

### **Objectives of the study**

- (i) To find out the significant relationship between the acquisition of science process skills and science achievement of IX standard students.
- (ii) To find out the significant difference in the acquisition aspects of science process skills of high school students with relation to the following variables such as gender, Medium of instruction, learning strategy, Curiosity, Cognitive representation.

### **Hypothesis**

- i. There is no significant relationship between the acquisition of science process skills and science achievement of IX standard students
- ii. There is no significant difference in the aspects of science process skills of high school students with relation to the following variables such as gender, Medium of instruction, learning strategy, Curiosity, Cognitive representation.

### **Method and sample of the study**

The methodology adopted for the present study is descriptive survey. The study has been conducted on the sample of 140 IX standard students studying in Thiruvallur district. Stratified sampling techniques was followed for the study.

### **Tool used in the study**

A self-constructed scale was developed by the researcher for Science process skill which comprises of six dimensions such as observation, questioning, collecting data, analysing, explain and communicating with 4 point rating scale.

### **Facets of Science Process Skills**

Students should have the opportunity to practice the scientific method as they learn about it. Students will be able to design and produce scientific tasks and products with the aid of good science process skills. In other words, improving students' process skills is the key to effective scientific science learning. The best strategy for enhancing science process abilities is by inquiry. Rendering to the statement, it is significant for a person's life to be able to solve everyday problems using scientific methods since society continues to evolve quickly. The person who is skilled in the scientific method will be able to enhance society. Under the direction of the teachers, the science process skill is parted into basic and integrated science process skill. Because they are interconnected, the entire future depends on concept development, and concept development rely on process skill.

When the process competence is improved, the notion will be developed gradually. Teachers in science education aspire to assist students in the learning process in accordance with their needs so that they can actively engage, connect science with daily existence, make learning relevant, develop science process skills, and assume responsibility of their education. To do this, a variety of strategies, methods, and procedures are employed to speed up the learning. This is based on advice from education professionals. It strives to support both students and teachers in carrying out the learning process correctly, connecting learning to real-world situations, revealing prior knowledge, and transferring new information or research topics at the conclusion of learning. Consequently, it is feasible that the science process skills will progress.

### **Nurturing an individual's science process skill**

- Science is about asking questions and finding answers to them through scientific method and inquiry. Science process skills are the procedures that scientists employ in it.
- The prospects for debate in individual classes, with peer students, or both must be imparted whereby learners have chance to listen to others, explain, debate, express, and share their thoughts, which encourages them to reflect on what they've done, relate it to the evidence, and evaluate various solutions to a problem.
- Learners should have a variety of options to improve their scientific process abilities. Thinking is embedded in practice through action.
- All young people should value science in order to develop their critical-thinking abilities as well as their understanding of it.
- Critical thinking process in science learning is influenced by student science process skill.

#### **Science learning beyond classroom environment**

- Hull (1993) presents learning takes place when students interpret new information with necessary skills or knowledge in ways that give it significance in their context.
- Darmaji et.al (2020) critical thinking process in science learning is influenced by student science process skill. Additionally, urban pupils have superior critical thinking and science processing skills than rural kids.
- Students with scientific process abilities and creativity develop their learning progress by implementing inquiry-based learning. Students who can complete projects requiring knowledge of science processes are likely able to complete assignments requiring scientific creativity (Panjaitan&Siagian2020).
- Mustafa et.al (2021) investigated how elementary kids' science process abilities were calibrated in order to assess the difficulty of each question. The investigation revealed that while inferring and classifying were the most difficult skills to learn, observing and communicating were the easiest. The study's implications were examined, particularly as they were related to the classroom teaching and acquisition of science process skills. When developing their teaching and learning tactics in the classroom, teachers should give careful consideration to the science process skills.
- Learning through outdoor school ground sessions can help students create more complex cognitive frameworks with tangible actions in relation to everyday classroom activities. Through observing how the environment interacts, students may have acquired the skills necessary to apply scientific methods to common situations.

#### **Link between science process and science learning skills**

Science knowledge is always accompanied with knowledge of science as they are inextricably linked. The distinction between science procedures and content that has been created in school science curriculum, in accordance to Driver and Millar (1987), is erroneous. It is not supported by science itself, science education, science history, or science philosophy. The notion of understanding science domain is to be able to employ its forms of discourse is another concept that could be useful in defining the Nature of Science in a method is better for school science teachers. Asking questions that can be investigated, describing phenomena, arguing to support a scientific conclusion, and explaining contextual phenomena using more micro-level concepts are some of the critical discourses in science.

Therefore, it is useful and significant for scientific teachers to exhibit these skills and to constantly provide their pupils the chance to put them into practice. Although the science process competencies are not a particular subject, they do help to develop that subject's knowledge. To accomplish the skill, there should be an assignment, some information to take account of, or a task to solve (Sunarti, 2020) It is invalid to evaluate pupils' process skills without taking into account their concept understanding. Therefore, it's crucial to conduct an assessment of the process abilities that require conceptual understanding or a certain domain. In any scenario, the assessment of a person's skill set is determined not just by how well they can apply those skills but also by how well they understand the subject matter. The sole purpose of learning science is to apply the science process skills i.e., to be able to define the problems around them, to observe, to analyze, to hypothesize, to experiment, to conclude, to generalize, and to apply the information they have with the necessary skills (Aktamis and Ergin, 2008). Studies carried out by Thiel and George (1976) and Tomera (1974) advocates the following teaching strategies which proved effective in applying science process skills are,

- applying a set of specific clues for predicting

- using activities and pencil and paper simulations to teach graphing
- using a combination of explaining
- practice with objects
- discussions and feedback with observing
- experimenting abilities need to be practiced over a period of time
- if taught process skills and abilities, not only learn to use those processes, but also retain them for future use
- the basic (simpler) process skills provide a foundation for learning the integrated (more complex) skills (Padilla, 1983)
- teachers' knowledge to recognize science process skills are important in capitalizing on opportunities in the day-to-day teaching learning activities to practice and implement science process skills
- there is still a widespread unawareness of the science process skills and there is a wide gap existing in implementing science process skills in the teaching learning

### **Science process skills as a futuristic approach**

As per evidence, careful and deliberate preparation of curriculum and instruction is required to promote the understanding of abstract scientific concepts. Scientific concepts should be taught effectively at all ages by concentrating on key concepts and fostering their understanding. This endorsement includes the following tactics: Considering the pupils' prior beliefs (both problematic and beneficial) and making an effort to rectify them. Numerous periodicals in the field of scientific education provide reports on student misunderstandings. Giving students access to relevant occurrences, either directly through practical exercises or demonstrations or indirectly through the use of texts or videos, can help them see the plausibility of scientific theories. Students frequently require a range of phenomena before they acknowledge a theory as feasible. Utilizing concrete illustrations in science process skills enables the students in grasping the concepts effectively. Giving students' ample contingency to share, debate, and put forth what they've learned into practice manifest oneself in learning outcomes of science learning. To quote Gabriela Ramos (UNESCO, 2022), "it is urgent to make the right to science a reality, and to recognize it as the cornerstone of healthy science ecosystems. Our goal is to have more and better science informing our choices". Appreciating the intrinsic value of science and to understand its process skills is a sense of duty for every learner which will have a collective realization of science and its endless contributions to the society.

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