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Scientific Attitude – An Overview

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Abstract
Science has become a vital part of our daily lives, and the scientific environment and its applications have affected modern society. The importance of science education is becoming increasingly recognized in the current setting of the science and technology revolution. In fact, student accomplishment in science has become one of the most important quality indicators. Our way of thinking, attitudes, hobbies, and outlook, among other things, have all shifted dramatically. One of the most important outcomes of science is the development of a scientific attitude. This paper explains about scientific attitude, its traits, components and ways to improve scientific attitude and research studies revealed about the importance of scientific attitude. A scientific mindset is a logical, reasoned manner of thinking that is free of bias or disruption. It's crucial because irrational thinking can lead to troubles in our lives. As a result, we must think wisely. Science instructs us on how to think properly. Teachers in today's world are seen as the primary educators responsible for preparing students to attain their goals and ambitions. Knowledge of numerous operational dimensions of scientific attitude may assist a science teacher to determine inclination of science students toward various scientific endeavors.
Key words: scientific attitude, thinking, science teacher, students

Introduction
The globe has shrunk as a result of science, and people's perspectives have shifted dramatically. In reality, science currently has a profound impact on every aspect of human life. Furthermore, modern science is no longer confined to the earth's surface, with its achievements extending beyond it. In recent years, the field of science has seen a fast expansion of knowledge. Science learning teaches the scientific method and aids in the development of a scientific mindset and scientific aptitude in the learner. As a result, science is now a required subject in every system of schooling, beginning at the primary level. A person with a scientific attitude is observed to be extremely curious about the objects, people, and events that around him. A man with a scientific mindset believes that nothing happens without a reason. He is not a believer in bad luck or superstitions. He believes that every occurrence is governed by some specific physical force, that events follow a precise pattern that follows

scientific rules and principles, and that events are never influenced by supernatural or mysterious forces. A person with a scientific mindset accepts just those things that are proven true based on evidence, and he accepts facts in their actual color and form. A scientific attitude is a thinking that can be acquired through science education. One of the most significant results of science and science education is the development of a scientific mentality, which allows us to think rationally. It is a person's blend of numerous qualities and virtues as manifested in their conduct and actions. As the name implies, a scientific attitude is one that is based on scientific evidence.

Scientific Attitude: Meaning and Importance

Scientific attitude is a method of thinking and living based on specific ideas. When science courses are taught as mental disciplines, it develops. If youngsters develop a scientific mindset, they will live, think, and operate in a scientific manner. The drive to know and comprehend, the questioning of all statements, the search for data and their significance, the hunt for verification, and the examination of repercussions are all characteristics of a scientific approach (Gardner, 1975; Osborne, Simon & Collins, 2003). Scientific attitude is defined by the National Society for the Study of Education (NSSE) as open-mindedness, a desire for accurate knowledge confidence in procedures for seeking knowledge and the expectation that the solution of the problem will come through the use of verified knowledge. The word 'scientific attitude' includes curiosity towards the surrounding environment, belief in cause effect relationship, patience, truthfulness, impartiality and open-mindedness etc.

It leads to rational, systematic, and well-planned actions in any situation. It reduces the risks and obstacles that come with a prejudiced, subjective, and partial perspective. Particularly in developing countries like India, where there are several issues such as population growth, unemployment, addictions, religious and other disputes, dowry systems, child marriages, and so on. It is critical to instill a scientific mindset in children. If a scientific mindset is instilled in children at a young age, they will develop the habit of thinking logically from an early age and will be able to comprehend the nature of the world, including them. Using scientific technique, he will be able to tackle his own problems as well as societal ones. As a result, cultivating a scientific mindset among school students will aid in the development of a wealthy and peaceful community.

Traits of Scientific Attitude

The traits of Scientific Attitude are as follows:

a. Open-mindedness, b. Curiosity, c. Judgment based solely on scientific facts, d. Willingness to test & verify conclusions, e. Faith in cause and effect relationships, f. Honest reporting of observations/experiment.

Scientific Attitude's Components

The following elements of scientific mindset have been proposed by Paul B. Dederich:

- Skepticism,
- Belief in the ability to solve issues,
- Desire for experimental proof, precision,

- A fondness for new things,
- Willingness to modify one's mind,
- Humility,
- Loyalty to truth,
- Aversion to superstition,
- An objective approach,
- Linking for scientific explanation,
- Suspended judgment,
- Awareness of assumptions,
- Distinction between hypothesis and solution,
- Judgment of what is fundamental and of general significance,
- Respect for theoretical statement,
- Respect for qualifications,
- Acceptance of probabilities, and
- Acceptance of warranted generalization.

Ways to Improve Scientific Attitude

Perhaps the science teacher is most responsible for instilling scientific attitudes in students. He should provide for independent extra-reading, laboratory work, apparatus improvisation, problem solving, and other activities.

- Encourage people to read a lot of scientific literature.
- Suggestions for project work relating to the curriculum are welcome.
- Create a democratic atmosphere in the classroom. It encourages students to have positive attitudes. It instills a spirit of constructive criticism.
- Teach students not to accept things at face value, but to think about them, reason them out, gather proof, and then accept them.
- Encourage students to do their own experiments in order to discover the truth.
- Provide opportunity for additional reading, laboratory work, apparatus improvisation, problem solving, and other activities;
- Explain popular superstitions, analyze them, and expose the truth behind them.
- Encourage students to learn the methods and shortcuts for completing experimental/practical work in science.
- Organize events such as science fairs, exhibitions, declamations, science clubs, trips, and project work, among other things.
- Satisfy kids' curiosity by teaching them genuine facts, processes, and concepts.
- Encourage self-experimentation, as well as a practical and scientific attitude.
- Encourage them to find out the facts for themselves.
- In the classroom, try to create a scientific atmosphere.
- Use scientific teaching approaches, which include the use of appropriate instructional instruments, strategies, and maxims.
- Involve students in science conferences, scientist speeches, science museum construction, and practical science activity, for example.
- Adopt a scientific attitude in order for students to adopt the needed scientific approach.
- Introduce kids to the importance of science in human lives.

- Explain to them how man has progressed from ancient times to the present.
- Discuss the lives of famous scientists in an engaging manner, emphasizing how they were able to produce breakthroughs or creations.

Development of Scientific Attitude by the Teachers

A scientific mindset is only a state of mind and a way of living. We are unable to recommend a specific method for its development. The teacher is the only torch bearer or artist capable of molding students' sensitive minds in such a way that science develops as a subject, as a mental attitude, and as a tool that they may use to their everyday issues. Science teachers all across the world have long recognized that one of the most essential results of science education is good scientific attitudes. They are realizing that if scientific attitudes are to be acquired through scientific research, they must be taught directly and consistently in the same way that we try to grasp scientific ideas. The following methods can be used to cultivate a scientific mindset:-

1. Discussion: The teacher can explore numerous popular superstitions in the country and explain the root causes of these beliefs. For example, it is thought that there are spirits in the area and that we should not travel by or sleep under the tree at night. The teacher can openly argue that trees emit carbon dioxide at night, which is harmful to one's health. As a result, there was a superstition.

2. Wide Reading: Curtis believes that wide reading can aid in the development of a scientific mindset in kids. Students' stories should not end with their textbooks. Only the knowledge contained in a few pages of their school textbook should not be enough to satisfy their need for knowledge. Extra study and reading should be used to broaden students' mental horizons. A science library, as well as a central library, should be available. After each topic is completed, the teacher should offer book titles for further reading. He should instil a passion of reading in his students. Reading should be done throughout one's life. Science can be pursued as a pastime. Students themselves are enthusiastic about gaining additional knowledge. Scientists gather photographs as well as newspaper and magazine clippings. Students might amass a collection of scientific papers of interest.

3. Practical work: When undertaking practical work, the teacher should not utilise unethical methods or shortcuts to accomplish the experiments; otherwise, the pupils would be as unethical as the teacher. Practical activity should be carried out in a manner that is intellectually honest. The laboratory should be used properly. Students should not be given pre-made results, but should instead form their own conclusions based on scientific reasoning.

4. Co-curricular Activities: These aids in the development of a scientific mindset. Students' knowledge is greatly enhanced by science fairs, exhibitions, declamations, clubs, debates, tours, excursions, and projects. The importance of science in their lives is given to them in a classroom setting. Students learn to plan, execute, organize, and collect data on their own. A welcoming environment, a democratic atmosphere, and

a pleasant environment aid in the development of scientific attitudes among students.

The ability to accomplish the following could be used to illustrate the growth of scientific attitudes:

- To see facts objectively;
- To be free of dogma and superstitions.
- To change one's mind as new data emerges
- To have an inquisitive mindset
- To have an open mind.

The success of teaching scientific attitudes is ultimately determined by the teachers, and it is critical for science teachers to remember that pupils create attitudes based on experiences from everyday life rather than abstract principles. Rural populations, particularly in Third World countries, have superstitions regarding diet, astrology, medicine, and other topics. When students convey the truth to the population, these superstitions and beliefs should be dealt with effectively with the support of students. With an emphasis on open-mindedness, tolerance, and objectivity, a revitalised study of science will eventually lead to the development of a more secular viewpoint in the real sense. The discussion above implies that developing attitudes such as self-confidence and self-reliance, as well as having a holistic view of science, which includes social, cultural, moral, and ethical components of science, is necessary. The teacher is a key figure in the development of a scientific mindset. Only he has the ability to set up the circumstance in such a way that pupils can discern between scientific and non-scientific attitudes. The instructor should be open-minded, objective, and honest, and should not believe in superstitions. He should value children's viewpoints. Only then will he be able to leave a lasting impression on children.

Related Studies of Scientific Attitude

Raja (2016) discovered that scientific attitude of secondary school students is high. Students in government schools develop a positive scientific attitude as well. As a result, teachers and parents teach their children that developing a scientific mindset requires careful observation and a thorough comprehension of subjects. When a kid has a positive attitude toward science, he will excel in all other courses. Ediger Marlow (2006) investigated the level of scientific aptitude and attitude among secondary school pupils in the tenth grade. The scientific attitude and aptitude of secondary school students were determined to be average. Secondary school students' scientific aptitude was average. However, there was a strong link between scientific attitude and scientific aptitude in both males and girls. In addition, there was a strong link between scientific mindset and scientific ability among students in both private and public schools. The study also discovered a strong link between scientific mindset and scientific aptitude in students from both urban and rural schools. According to Punia and Bala (2009), scientific student-teachers should have a positive attitude so that they can instill it in their students. Similarly, non-science pupil-teachers bear the same responsibility for instilling a scientific mindset in pupils because the world is becoming increasingly technical and

scientific in all aspects, and only those with a scientific mindset can successfully live in this ever-changing environment. Every teacher, whether from a science or non-science background, must promote science and scientific attitudes among students in order for our country to get to the top of the list of industrialized nations.

Firdaus and Darmadi (2017) investigated the action component of scientific attitude that students demonstrate in the science classroom. There will be nine scientific attitudes identified in action: 4) Honesty, 5) Objectivity, 6) Willingness to Change Opinions, 7) Open-Mindedness, 8) Questioning Attitude, and 9) Tolerance of Uncertainty Using a check list observation instrument, a direct observation strategy was used. The descriptive-quantitative method was used to analyze the data. The findings reveal that students' scientific attitudes, open-mindedness, and questioning attitude are less critical in the early stages of learning activities. Academic accomplishment was good and substantially connected with a scientific attitude, according to Singh, Singh, and Geri (2017). It suggests that when female students' academic achievement improves, so does their scientific attitude. The finding could be explained by the fact that at the higher secondary level, students' overall scientific attitude develops to its optimal level; it appears that students with a scientific attitude are critical minded, honest, objective, open-minded, and have a questioning attitude, as well as respect evidence, all of which are necessary for optimum academic achievement, particularly in science subjects. According to Jeyanthi (2016), there is no substantial difference between boys and girls, rural and urban students, or government and aided school students. It means that gender, location, and school type have had little impact on middle school pupils' scientific attitudes. There was a strong link between scientific attitude and academic performance. According to Rajendran and Anandarasu (2020), there are more B.Ed., Trainees who have an average scientific attitude. The development of scientific attitudes among B.Ed. trainees is a critical aspect in improving their academic performance, particularly in science topics. It would aid in the development of an open-minded attitude in them, allowing them to search for truth and the desire to gain right knowledge. According to Ahuja (2017), a scientific attitude improves students' cognitive areas, allowing them to analyse in depth, account for events, and acquire a habit of not accepting things at face value. As a result, when such students, who have a well-developed scientific attitude, go through the learning process, they have an advantage over their peers, and a positive link between scientific attitude and science achievement is expected.

According to Flegg and Hukins (2010), the assessment of scientific attitudes has been largely ignored in the evaluation of student development in science classes. Poor scientific orientations among science students may be caused by a lack of assessment of students' scientific attitudes, which manifest in various facets and aspects of their daily activities, such as declining productivity, haphazard development,

disorderliness in society, non-functioning utilities due to inadequate maintenance, and distorted values. Scientific attitudes were discussed by Ataha and Ogumogu (2013) as characteristics, traits, or attributes of a good scientist. Science teachers should make it a priority to assist students in developing scientific attitudes, as learning should focus not only on cognitive and psycho motive domains, but also on affective domains (scientific attitudes). This study found that the level of scientific attitudes among secondary school science students is average, and that the level of scientific attitudes among secondary school science students is not significantly influenced by sex. Pitafi & Farook (2012) characterised attitude as a mental state that is more or less persistent and represents a predisposition to react favourably or unfavourably to a specific class of stimuli. If this reaction is consistent with scientific ethics, it is a scientific mindset. The scientific mindset looks into a specific scientific act or concept. Secondary school pupils had a moderately scientific attitude toward the concept of "curiosity." Secondary school students' attitudes toward the elements of rationality, willingness to suspend judgement, open mindedness, critical mindedness, objectivity, honesty, and humility were marginally scientific. The following recommendations appear acceptable and appropriate in view of the study's results and conclusions. It is necessary to identify and plan the attitude that will be taught. For the student, the meaning of words used to describe attitudes or conduct related to them must be clarified. The acquisition of attitudes should be accompanied by a pleasant emotional experience. Pupils should be allowed to experiment with their own exportation patterns. Learning experiences must be chosen based on the knowledge, skills, and attitudes that will be acquired. The teaching of science should be prioritised, coupled with the use of inexpensive handmade materials for various experiments. Students should be encouraged to build their own experimental apparatus. Scientific attitude, according to Mukhopadhyay (2014), has three main components: belief, sensation, and action. A person's feelings and beliefs about science, scientists, and scientific inventions, for example, lead him or her to act appropriately. Science studies will only lead to the acceptance of dogma rather than the creation of a proper perspective toward various scientific efforts. Whereas, in the absence of it, any amount of scientific knowledge will contribute little to national growth or the process of social change. Not only that, but scientific attitude is one of the most important drivers of students' science accomplishment - and has therefore become a major quality measure of a student in today's scientific society.

Conclusion

We live in a civilization that is deeply engrossed with the scientific world. Science has become an inextricable element of our daily lives. We can no longer imagine a world without science. Teachers of contemporary day are looked at as the key guide to prepare the students to achieve their objectives and aspirations; and teachers' attitude directly impacts students' attitude. They make destiny of our nation. Science has done miracles in our lives and possibly it

seems that every one who is associated with education must have some form of scientific attitude irrespective of stream. A scientific mindset is a logical, reasoned manner of thinking that is free of bias or disruption. It's crucial because irrational thinking can lead to troubles in our lives. As a result, we must think wisely. Science instructs us on how to think properly. A scientific approach entails rejecting any claim that is not backed up by evidence. Never accept a statement until it is accompanied by proof.

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