

## **CHAPTER V**

### **MAJOR FINDINGS AND DISCUSSION**

#### **5.0.0. INTRODUCTION**

In the present study, the main purpose of the researcher was to develop strategies that can be helpful in enhancing the scientific temper of secondary school students. This chapter is devoted to the major findings of the present study and its discussion..

#### **5.1.0. MAJOR FINDINGS OF THE STUDY**

On the basis of analysis and interpretation of data of the present study, following major findings were drawn.

1. No significant difference were found among the mean pre-test and post-test scores of scientific temper of control group those were taught in traditional method of teaching. These were found in case of scientific temper as a whole and in all the eight components of scientific temper viz. healthy scepticism, objective intellectual honesty, rationality, perseverance, freedom from superstition, curiosity, open mindedness and observation. Hence, traditional method of teaching did not help in enhancing scientific temper of secondary school students either as a whole or in any of it's components.
2. Mean post-test scores of scientific temper of experiment group those were taught through developed strategies were found significantly higher than their mean pre-test scores in scientific temper. These were found in case of scientific temper as a whole and in all the eight components of scientific temper viz. healthy scepticism, objective intellectual honesty, rationality, perseverance, freedom from superstition, curiosity, open mindedness and observation. Hence, teaching through developed strategy helped in enhancing scientific temper as a whole and in all the eight components.
3. Post-test scores of scientific temper of experiment group those were taught through developed strategies were found significantly higher than the post-test scores of scientific temper of control group those were taught in traditional method of teaching. These were found in case of scientific temper as a whole and all the eight components of scientific temper viz. healthy scepticism, objective intellectual honesty, rationality, perseverance, freedom from superstition, curiosity, open mindedness and observation. Hence, teaching through developed strategies was

found superior and effective in enhancing scientific temper among secondary students in comparison to the traditional method of teaching.

4. The developed strategies were also found effective in enhancing scientific temper among secondary students in terms of favourable reaction of students towards different aspects of the strategy.

### **5.2.0. DISCUSSION OF THE MAJOR FINDING**

The discussion is based on a review of related literature and the main points listed in the subheadings below.

#### **5.2.1. Enhancement of Scientific Temper among the Students of Control Group due to Traditional Teaching Learning Process**

To know whether regular teaching helped in the enhancement of scientific temper or not, the pre and post-test mean scores of control group students were compared. The result showed that no significant differences were found in the mean scientific temper scores of pre-tests and post-tests of students who were taught through traditional teaching-learning. These were found for scientific temper as a whole and for all the eight components, which were: healthy scepticism, objective intellectual honesty, rationality, perseverance, freedom from superstition, curiosity, open-mindedness, and observation. The above result revealed that the students who were taught through traditional teaching showed no improvement in any dimension of scientific temper. The students were found to be at the same level of scientific temper even after the study for the whole second semester while teaching through traditional teaching. The reason for the above findings may be due to the fact that in a traditional classroom, the teaching-learning process is mostly content-centered and teacher-centered. The same reason was also given by Sharma (2020), who concluded that we fail to develop a scientific temper because the traditional classes are more oriented towards content knowledge and their belief systems hinder the successful implication of scientific content among students. Usually, in traditional teaching, much of the time was devoted to giving and getting answers to questions given at the end of chapters without giving an opportunity to think outside of the textbook. In a traditional classroom, very little chance is given for flexible questioning, which can induce inquisitiveness among students. In traditional teaching, no time is given for checking the belief system, and full focus is given to content delivery only, while school is a place where the students can get in touch with multiple people having different beliefs, which can make them think rationally and ponder the differences, making

them open-minded and inculcating the habit of discarding superstitious practices. In traditional classes, students are usually exposed to the most challenging situations where they have to perform the task in a desired way. The trait of perseverance can be developed where the opportunities for complex tasks are given. Even very little time is given for the discussion part, while the development of curiosity requires various kinds of open-ended questioning followed by in-depth discussion. These small efforts make huge differences in the academic lives of students. The above finding also revealed that as the students grow, they tend to become confirmers with time rather than ask questions and indulge in open discussion of various issues, as no differences were found in their curiosity.

### **5.2.2. Enhancement of scientific temper among the students of experimental group due to the implication of the developed strategies**

To know how much the developed strategies helped in the enhancement of scientific temper among students, the pre and post-test scientific temper mean scores of the experimental group were compared. The result showed a significant difference between the mean scientific temperament scores of pre and post-test of students who were taught through developed strategies. The results were applicable to scientific temper as a whole and all the eight selected dimensions like healthy scepticism, objective intellectual honesty, rationality, perseverance, freedom from superstition, curiosity, open-mindedness, and observation. These results are supported by the findings of Rajammal (2003), Nigam (2007), Nautiyal (2017), and Priya (2020), who found significant differences in the pre and post-test mean scientific temper scores of students who were taught by specially designed methods. One of the reasons behind this might be the fact that students were given the full opportunity to be active participants in the whole teaching and learning process. In these processes, the teacher only acted as a facilitator and provided support from time to time so that students could develop skills in questioning and discussion. Throughout the teaching using these methods, conscious efforts were made to develop the scientific temper in students. In this process, teaching-learning was majorly based on questions and answers so that traits like healthy scepticism and rationality could be developed. Besides these, they were shown stories of various people belonging to different fields, like Sarvepalli Radhakrishnan, Gandhiji, Subhas Chandra Bose, etc., through videos so that by the example of hard work and non-giving up attitude of these personalities, the students could learn the art of perseverance. For this, they were even given complex problems to solve so that they could practise even with the same trait. Curiosity can make a child a life-long learner and self-learner. Hence, for this purpose, they introduced

various inventions, people, and events taking place in the world around them. Like the person named Neil Harbisson, who was suffering from Achromatopsia (total colour blindness) and developed a device to see colours by listening to the vibration of the colours. Moreover, in most of the classes, students were given the task of working in groups so that their open-mindedness and objectivity in intellectual honesty could be enhanced. During the course of experimentation, a solar eclipse occurred, which was discussed the next day in the class, and many such news related to superstitious practises were also discussed in the classes of social science and science to know their reasons. Classes were not only restricted to the four walls of the classroom. Students were taken out to observe the nature around them so that their observation skills could be developed. For the minute observation, feedback and tips were given to students so that this skill could be enhanced to a greater extent. All these small cumulative deliberations might be the reason for the present finding.

### **5.2.3. Effectiveness of the strategies in terms of post-test of students in control and experimental group**

To know whether the developed scientific temper strategies were effective or not, the post-test mean scores of the control group and experimental group students were compared. The result showed significant differences in the mean scores of post-test of students belonging to the control group and experimental group for scientific temper as a whole and all the eight selected dimensions, which were healthy scepticism, objective intellectual honesty, rationality, perseverance, freedom from superstition, curiosity, open-mindedness, and observation. This result was found in line with the findings of studies conducted by Joshua (2015), Anbuchlevi (2014), and Causey (2016). They all found that the developed programmes and strategies were effective in developing the scientific temper and attitude among students. The study of Choukade (2014) also revealed that a scientific attitude improvement programme was useful for students in daily life and helped to enhance their critical and logical thinking. This may be due to the fact that while in traditional classrooms most of the teaching takes place in the normal mode where content and course completion are the primary goals, in the experimental group the classes were mainly focused on the enhancement of scientific temper besides the goal of course completion. The classes in the experimental group were full of active learning based on the student-centric approach. Students were given ample opportunity in the class to work with each other, interact with nature, and observe for the purpose of developing inquisitiveness among them. Keeping the points in mind given by Pritchard (2005) that adults as well as children change their

reasoning and thinking patterns as per the context and domain, only the right kind of environment is provided to the students to develop all the domains of scientific temper. Besides that, most of the activities were performed in groups, which made them open-minded and cooperative. The same has also been reported by Price & Lee (2013), whose study discovered that the scientific attitudinal change was related to participant social activity.

#### **5.2.4. Effectiveness of the strategies in terms of the reactions of the student**

The reaction of students in the experiment group towards the implemented strategies was measured as an indicator of their effectiveness. For this purpose, the reaction scale was administered to them at the end of the implementation of strategies. To analyse the obtained data, the intensity index was found. The findings indicated that students showed positive and favourable reactions toward the strategies in all the statements. These positive and favourable reactions showed that the developed strategies were effective. The researcher could not come across any similar study where the same construct with the same combination of subjects was studied. However, the studies conducted by Shete (2007), Sharma (2015), Bhatia (2016), Panicker (2016), Maitra (2017), and Biswal (2019) on similar kinds of constructs like value and thinking by using interventions found that students enjoyed the whole teaching-learning process when taught through interactive methods like storytelling, experiential learning, and ICT-enabled learning. The related findings of the present study might be due to the fact that they really enjoy the whole teaching and learning process during the execution of strategies. Their concept clarity might be increased by the use of various strategies like questioning, discussion, time line, and ICT-enabled learning. During the implementation of strategies, the students were given ample opportunities to work in groups, which would remove their fear to a great extent and make them active in their classes. It also helped them to increase their social skills. Although they were taught three subjects using this approach, they agreed that all the activities were exciting and it was not causing fatigue or any disturbance in their regular classes. The students agreed that the strategies helped them to think rationally and logically and that they made them analyse any situation in an unbiased manner. They all agreed that they have developed a curiosity towards various things, and even their interest in the selected subject has also increased. This might happen because during the execution of the strategy, the students were exposed to working in the outdoors and analysing real-life situations in depth. This may be the reason that their horizons of thinking have increased and expanded and to think outside of the textbooks. As the main task of scientific temper is to get rid of superstitions, attempts were made through strategies to put forward the inception and

reasons for such activities, which made them aware of all such things. They all agreed that this type of intervention is good and they would like to study this approach further as well.

### **5.3.0. CONCLUSION**

The study revealed that the integrated strategies were useful in enhancing scientific temper among secondary school students, and they were also liked by the students, which is evident from their positive and favourable reactions towards the developed strategies. It was believed that science subjects were the only ones that could develop a scientific temper, but this study proves that in all subjects there is a possibility of developing a scientific temper among students. Though the present study is a small effort to develop scientific temper within a limited span of time, significant improvement has been witnessed through the enhancement of scientific temper. It was also found that teachers were unaware of scientific temper. This might be due to the fact that in textbooks, the development of scientific temper is done in an implicit manner, and mostly experimentation and observation components are only mentioned explicitly. Based on the results of this study, it can be said that secondary school teachers can be trained to help students develop a scientific mind, no matter what subject they teach.