CHAPTER- V

FINDINGS AND DISCUSSION

5.1.0 INTRODUCTION

The objective of the present study was to develop and implement an integrated strategy to inculcate productive thinking among elementary school students. Effectiveness of developed integrated strategy was studied in terms of posttest scores of productive thinking and achievement of experimental and control groups and also in terms of reaction of experimental group students towards developed integrated strategy. For this, data were collected and analysis and interpretation of data is presented in chapter IV. This chapter presents findings and an elaborate discussion of the result obtained by analysis and interpretation of the data.

5.2.0 FINDINGS

Following findings are derived from analysis and interpretation of the collected data:

1. Developed integrated strategy along with the productive thinking model (FIESI) was found significantly effective in inculcating productive thinking among elementary school students.
2. Developed integrated strategy along with the productive thinking model (FIESI) was found effective in terms of achievement of the students alike the traditional method of teaching.
3. Developed integrated strategy along with the productive thinking model (FIESI) was found effective in terms of reaction of the students towards the integrated strategy.

Along with these major findings researcher also found following points related to developed integrated strategy:

1. The developed integrated strategy along with the Productive thinking model was found effective in inculcating creative thinking among elementary school students.
2. The developed integrated strategy along with the Productive thinking model (FIESI) was found effective in inculcating critical thinking among elementary school students.
3. The developed Productive thinking model (FIESI) was found effective in inculcating creative thinking, critical thinking and productive thinking among elementary school students
4. SCAMPER technique was found effective in producing divergent ideas.

5. Brainstorming technique was found effective in producing creative ideas.
6. Conducive classroom atmosphere and teacher's motivating behavior were found favorable component of productive thinking cycle.
7. Evaluative discussion was found effective as a critical thinking component.
8. Evaluative discussion was also found effective in improving the quality of ideas.
9. Restrictive criticism was found as a hindering component which hinders the ideation process.
10. This Productive thinking model (FIESI) can be used through the subject content in an integrated way.

5.3.0 DISCUSSION

Present study was aimed at inculcating productive thinking among elementary school students. It leads to the development of an integrated strategy. In the developed strategy a teaching model FIESI (Productive thinking model) was developed having five phases i.e., Foundation, Ideation, Evaluation, Stabilization and Implication. Different techniques were also used at different phases of this model. The findings of integrated strategy along with the model was directly or indirectly supported by Hutchinson (1967), Olton (1969), Schuler (1974), Patel (1988) and Aranda, Lie & Guzey (2019) who developed productive thinking programmes by considering four common components of productive thinking i.e., cognitive memory, divergent thinking, convergent thinking and evaluative thinking. FIESI model considers creative thinking and critical thinking as the main components of productive thinking and memory and motivation as the supportive components. By keeping these components in mind the FIESI model was developed and implemented in the classroom to inculcate productive thinking through science teaching.

Hutchinson (1967), Olton (1969), Schuler (1974), Patel (1988), Chin (2007), Aranda, Lie & Guzey (2019) and Thambi (2018) implemented different productive thinking programmes having common components of productive thinking in the classroom. Similar to the present study they also concluded that when we develop a strategy where students get sufficient freedom to think out of the box, where restrictive criticism is not allowed and students are motivated by teacher to think freely, helps students to think in a desired way. In the present study, significant result was found in terms of productive thinking may be because of the techniques used in the productive thinking model (FIESI) where students worked in the group to think divergently. It created a space for free flow of ideas and helped students to think creatively, critically and productively. Mehrotra (1995) highlighted the use of convergent

thinking questions only in traditional classroom teaching. So students rarely get opportunity to think divergently and students' divergent ideas are rarely welcomed. But the classroom atmosphere created through the productive thinking model (FIESI) welcome the students to share their ideas without considering the quality aspect.

In the present study Brainstorming and SCAMPER techniques were also found effective in generating divergent ideas. It may be due to the fact that questions framed using both the techniques challenged students' cognitive equilibrium and created a scope for thinking out of the box. Chin (2008) revealed that if teachers use innovative questioning techniques to design challenging and higher order thinking question in the classroom then it will stimulate productive thinking among students. Fact based questions are having fixed answers and allow students to think in only one direction. This type of questions used in the traditional classroom is the biggest hindrance in the direction of thinking productively. Therefore, ambiguity was the essence of productive thinking which lead students to think in multiple directions to get the best ideas. In the present study, to encourage students to think divergently, brainstorming was used as one of the techniques and found effective at ideation stage in terms of thinking creatively. Students reacted strongly favorable towards it and found interesting in working in group while doing brainstorming activities (statements 4, 13, and 17 of reaction scale). It is directly or indirectly supported by Hutchinson (1967), Patel (1988), Sharma (1994**),** Pandit (2006), George (2016) and Raj (2016) who used brainstorming to train the students to think creatively.

SCAMPER was also found effective in producing divergent ideas at ideation stage and students reacted strongly favourable towards it (statement 5 of the reaction scale). Students felt that SCAMPER was a useful and effective technique to think divergently. Ozyaprak (2016) found the usefulness and effectiveness of SCAMPER technique in developing creative thinking skills and Gundogan (2019) found it effective in developing creative thinking overall but more effective in developing fluency component of creativity. In the SCAMPER technique, focus was on generating as many ideas as possible without considering the quality of ideas. SCAMPER always involves constructive discussion. Constructive discussion found its place in productive thinking cycle. It was found very important during generation of ideas as it involves multiple views of the group members. It was supported by Amin (1988), Shah (1981) and Paltasingh (1998) who highlighted the importance of discussion at the time of idea production and concluded that it was good for creativity development. It helped students to consider multiple dimension of a problem at hand.

Productive thinking model (FIESI) creates an environment that encourage students to think freely and express their views. Generated ideas are always welcomed and encouraged by teacher without any restrictive criticism. Productive thinking model (FIESI) was found effective in terms of students' reaction who reacted strongly agree towards classroom environment. Rajagopalan (1988) also found that conducive classroom climate is necessary for productive thinking. Pany (2014) asserted that autonomy given to the students in the classroom and various activities in the classroom are necessary for productivity and lead to creativity development. In this direction, Gupta (1977) stated that a democratic classroom environment is better for productive thinking where students are free to ask and share their experiences. Developed model was found effective may be because of teacher's active engagement and encouraging behavior. It is supported by Schuler (1974) who concluded that success of productive thinking programme can be seen when teachers are more actively engaged with students and encourage them to think differently.

Developed model was also found effective in terms of creative thinking and critical thinking. It may be because creative thinking and critical thinking are the integral component of productive thinking and developed model provides scope for developing these skills through different phases of developed model at specified places. Different techniques used at different phases and designed lesson plans create scope for developing creative and critical thinking skills. This study is directly or indirectly supported by Vora (1984) and Gupta (1985), Patel (1987), Amin (1988), Kachhia (1990), Paltasingh (1998), Pandit (2006), Hu, Wu, Jia, Yi, Duan, Meyer & Kaufman (2013), Kumari (2014) and Ramesh (2015) who developed programme for creative thinking and found effective in developing creative thinking among students. In the present study, ideation phase was to generate ideas where brainstorming and SCAMPER techniques were used to think out of the box and thereby divergent ideas were produced. To select the best promising idea evaluative discussion was used as a critical thinking technique. Meghani (1999), Patel (2011), and Seeja (2012) conducted study on critical thinking and found that when a model is designed to develop critical thinking it creates opportunity for the students to think in a particular way. It can be said that developed model provides opportunity to the students to think in a particular way at different phases of developed model. Present study is directly or indirectly supported by study conducted by Patel (2010) who developed a programme by considering creative and critical thinking skills in one programme and found it effective.

Developed model was also found effective in terms of thinking pattern of elementary school students. Productive thinking process has levels of thinking which start from reproductive thinking and the highest level is productive thinking through critical thinking and creative thinking in an order. It was found that more students of experimental group answered towards productive thinking and less students towards reproductive thinking but in case of control group less students answered towards productive thinking and more towards reproductive thinking. It may be because of the effect of Productive thinking model. In the traditional classroom teaching, most of the questions are focussed around memory level or questions that have fixed answers. In the traditional classroom, most of the questions are from text-book and students are aware about the answers of the question and therefore they hardly think in a different way. Mehrotra, S. (1995) stated that a desire to be right always and acceptable by the teacher are again the hindering components in the traditional classroom. On the other hand, present model is a way to give freedom to the students to think differently where restrictive criticism has no place and teacher always welcome new and different ideas. These are some of the factors that make developed model a successful means to inculcate productive thinking along with creative thinking and critical thinking as the integral part of productive thinking.

In terms of academic achievement in science, both the groups were found equally good. It means that the present study in which science was taken as the subject to be taught through the FIESI model mainly to develop productive thinking, did not found any negative impact in the academic achievement in science. The experiment group showed the level of achievement in science that can be compared to the control group who were taught through traditional classroom teaching. It directs the use of integrated strategy to develop thinking skills among students without thinking much about the achievement. It will be good for the students to learn the subject content through the productive thinking model (FIESI) as the thinking skills are the integral part of the teaching learning process. The present study was supported by Nayar (1971) who identified six variables that predict achievement in science viz. verbal reasoning ability, numerical ability, comprehension and interpretation, problem solving, critical thinking and spatial ability. Present study use the specified variables while teaching science through FIESI model. Passi (1972) & Shah (1981) highlighted the importance of training for developing creative thinking and Manjula (2013), Siburian, Corebima & Saptasari (2019) & Ramesh (2015) highlighted the importance of training for developing critical thinking that lead to better achievement also. In present study, both the groups were found equivalent in terms of achievement but the students who taught through developed FIESI model significantly

performed better in terms of productive thinking. It suggests that teaching through the developed strategy provides opportunity to learn the specified subject content and productive thinking skills in the same class.

Model of productive thinking (FIESI) was found effective in teaching science and helped students to learn science in a better and different way. Students found it interesting and thought that it could be used to teach other subjects also along with science. It may be because researcher used learner centred techniques like use of videos, power point presentation, interactive discussion and activities to create the foundation in the foundation phase of model of productive thinking and also because of cognitive lesson plan which was focused around higher order thinking skills. After being taught with the developed strategy students thought that now they are able to think in productive manner and will use it in the future whenever they encounter a problem in real life. By discussing findings obtained in the present study it can be concluded that developed strategy is an effective way of inculcating productive thinking and other higher order thinking skills in an integrated manner.

5.4.0 CONCLUSION

Developed integrated strategy was found effective in terms of productive thinking among elementary school students. It was found that the experimental group which was taught through the developed strategy performed better on productive thinking and it is because of the teaching through developed strategy. It was also found effective in terms of reaction of students. The achievement of both group of students were almost equivalent indicating that teaching through developed strategy is not negatively affecting the achievement of the students. It establishes that it is a better way to train students in an integrated manner. It can be said that developed integrated strategy in the form of FIESI model creates motivating environment for the development of productive thinking skills which is not possible in regular classroom teaching.