CHAPTER-VI

SUMMARY AND CONCLUSION

6.1.0 INTRODUCTION

We have seen many changes in our civilization that are the result of creative endeavor of human beings. It means thinking skills are the demanding competencies for the development of the world. We cannot ignore the role of education in harnessing this aspect of human brain. Effective teaching learning process is the best way to do it. OECD (2018), World Bank (2011), and World Economic Forum (2018) all have stressed upon the importance of creative thinking, critical thinking, and problem solving skills in education to prepare our students for future. Kothari commission (1964-66) also recommended reforms for institutions to give opportunities to the students to think, read, study and discuss. In the same line, National Curriculum Framework (National Curriculum Framework, 2005) and National Education Policy (NEP, 2020) also give importance to creative and critical thinking in teaching learning process. Velayati, Muslem, Fitriani & Samad (2017), Flores, Matkin, Burbach & Quinn (2012) and Afifah & Retnawati (2019) reported the incompetency among our students in using higher order thinking skills and our teachers also face difficulties in instruction based on higher cognitive skills. This gap in objectives of education and present situation can be addressed through changes in teaching learning practices and by giving place to thinking skills in education.

6.2.0 EDUCATION IN 21st CENTURY

Our students are living in the world which is full of challenges. NPE (1992) highlighted the need of harnessing creativity among students. In the same line, Delors (1996) established the following 4 pillars of learning in 21st century.

- Learning to know: It involves development of sufficient general knowledge with the opportunity to work in-depth and not in superficial way.
- Learning to do: It involves development of occupational skills for the future along with the competence to deal with many situations and work in team.
- Learning to live together: It involves development of understanding for other people and respect for interdependence so that people can live in the society by shared experiences.

- Learning to be: It involves development of whole personality so that a person can work with full autonomy, free judgment, apply logical reasoning, develop physical capacities and communication.

Delors (1998) stated that based on these pillars, purpose of education was emphasized as the holistic development of an individual. It could be achieved through better teaching-learning process where everyone is developed a critical mind and sense of responsibility, ability to use knowledge in order to solve problems, ability to make transition from concrete to abstract and vice versa, creativity, reasoning and communication.

In the same way, NCERT (2011) suggested core values for students to be successful in all the areas of life in 21st century and creative and critical thinking also found place in the required core skills. Afifah & Retnawati (2019) said 21st century bring various complex challenges and our young generation should be trained for not only to earn money for a better life but also required various skills ranges from core subjects to innovation, information and communication technology skills to life skills, and most importantly higher order thinking skills.

Partnership for 21st Century Skills (2009) provided 21st Century Curriculum and Instruction plan and stressed on core subjects and higher order thinking skills both in education. Schleicher (2007) highlighted the role of OECD's Programme for International Students Assessment (PISA) in assessing the competencies like capacity of young adults to access, manage, integrate and evaluate information, to think imaginatively, to hypothesise and discover, and to communicate their thoughts and ideas effectively. It is designed to test whether students are able to transfer what they have learned to the novel situation. It highlighted the equal importance of transfer skill along with content knowledge and highlighted the need of learning situation to transfer the knowledge in real time.

World Economic Forum (2018) surveyed about the core competencies required in the future and results showed half of the candidates surveyed realized critical thinking and creativity are the most demanded skills along with complex problem solving. It means, in our education system there is a need to integrate creative thinking, critical thinking and problem solving skills which are the foundation for other competencies. The need of these higher order thinking skills prepared the foundation for the present study.

After achieving universal access to education at primary level the new objective is to provide quality education for all. It is highlighted in sustainable development goal 4 i.e. quality education. Kothari Commission (1964-66) highlighted the role of uninspiring teaching methods at school behind unsatisfied results in education. It was suggested by National Curriculum Framework (2005) that the learning situation should be arranged to cater the learners' creative abilities and ensure active involvement in meaning making process with reference to the real world experiences and examples. Mehrotra (1995) highlighted the use of convergent thinking in the classroom by the teachers since their outcomes are objectively visible and they confirm to the expectation of the society. Therefore, teachers never go beyond the fact based conversation in the classroom which start from closed ended question and ended with an expected and most acceptable response. Teachers also need to provide situations where students can transfer the knowledge and thereby giving emphasis on transfer and retention skills both. For this, we need competency based skills like creative thinking, critical thinking, collaboration, communication and problem solving in the teaching learning process. For that we need an approach that can train the students to learn the demanded higher order thinking skills along with subject content. Present study is an attempt in this direction by focusing on higher order thinking skills at one place as productive thinking. It enables individuals to solve problem in a productive manner. Thereby, students develop their retention and transfer skill along with productive thinking, creative thinking and critical thinking skills.

6.3.0 PRODUCTIVE THINKING

Productive thinking is the cognitive ability that has its definite place in education. Wertheimer (2020) was the first to define productive thinking as insight based reasoning. Rusbult (1997) explained productive thinking as combination of creative and critical thinking. Covington, Cruthfield & Davis (1966) (as cited in Olton, 1969) defined productive thinking as process that involves creative thinking and problem solving. Gallagher and Aschner (1963) (as cited in Aranda, Lie & Guzey, 2019) considered productive thinking as the combination of creative and critical thinking skills where memory creates the base for higher cognitive activity. Hurson (2011) described creative thinking and critical thinking as the two basic elements of productive thinking. It can be deduced from the discussion that productive thinking has two main components creative thinking and critical thinking and two supportive components memory and motivation. It means productive thinking needs a minimum knowledge level and a motivating environment in the background also which facilitates productive thinking process.

It is a process of solving problem creatively. Lumbelli (2018) conceptualized productive thinking as creative problem solving process that involves a restructuring of the problem elements to solve a problem creatively.

To solve a problem using productive thinking starts with critical thinking – analysing a problem and then shift to the creative thinking – imagining solutions. Step three includes planning for the solution that how the solution would be applied and how it would work. Fourth step is to apply the generated solution in a different way or some other way than traditional way of doing. Fifth step involves evaluation of the solution to examine whether it would match with the success criteria or not. Sixth step involves improving the solution by keeping in mind the failure occurred in the fifth step. Last step is implementing the solution to solve the problem is a critical thinking phase. Likewise, by shifting back and forth between the two types of thinking, a person eventually arrive at a solution through productive thinking process.

6.4.0 COMPONENTS OF PRODUCTIVE THINKING

Productive thinking is the cognitive process that refine creative product with constructive evaluation by critical thinking. As Rusbult (1997) explains productive thinking as combination of creative and critical thinking and Davis & Scott (1971) (cited in Patel, 1988) described productive thinking consisting in those convergent, divergent and evaluative operation. By considering different definitions and explanations given by researchers and psychologist it can be said that productive thinking is the blending of creative thinking and critical thinking to make use of positive components of both the elements. Therefore, elements of productive thinking are:

a) Creative thinking
b) Critical thinking.

6.5.0 PRODUCTIVE THINKING IN SCIENCE EDUCATION

Science is not the collection of facts rather it is the result of human cognition that continuously changing our life. It is the field of knowledge which is regularly updating itself. Therefore, by considering it as fixed set of facts will not serve the purpose of science teaching learning. It should be considered as a way of thinking which creates a room for investigation, observation, hypothesis formation, verification, evaluation and finally a conclusion is drawn. Analysis, synthesis, and evaluation are the higher order thinking components which are integral part of

science. Science is the subject to play with and enjoy it by experiencing the link between textbook and real life. But still in our society science is no more than a factual knowledge. This makes science one of the difficult subject and students use rote learning for getting marks without internalizing it.

It was also realized and emphasized by National Policy on Education (POA, 1992) "that we need to improve and strengthen our science education that develop well defined abilities and value such as the spirit of inquiry, creativity, objectivity, the courage to question, and aesthetic sensibility." It was also recommended by NPE, 1992 that science education programs should enable learners to foster problem solving and decision making skills by making links with real life phenomenon." But unfortunately, school science teaching learning process is still at lower order thinking level as it is emphasized by National Curriculum Framework (2005) that in India science education does not develop competence like innovation skills. To improve the present practices in science teaching we first need to understand and identify the key skills that could be imbibed with science as a subject. Keeping in view this objective NCERT (2015) suggested process skills of science which includes observation, pose question, searching various resources of learning, planning investigation, hypothesis formulation and testing, analyzing, interpreting data, critical thinking to consider and evaluate alternative explanations, reflecting on their own thinking.

But, it was observed that teachers consider science as fact based subject and ignore students' participation in the teaching-learning process. Teachers need to introduce process skills of science in learners while teaching the content rather than simply putting information before students. This type of atmosphere never encourage learners to relate science content with the real life phenomenon and they never think beyond the four walls of classroom. Therefore, it is necessary to introduce a strategy that foster higher order thinking ability in the students at one platform through science learning. In this line, productive thinking process opens the door for higher order thinking abilities (analysis, synthesis and evaluation) in science and ensure learners' participation in the knowledge construction. Along with this, it is also helpful in developing creative abilities and critical thinking power of the learners in classroom while learning science.

6.6.0 IMPLICATION OF THE REVIEWED STUDIES

Reviewed studies highlighted the importance of thinking skills and made it clear that thinking skills can be developed through various thinking training programmes. There were total 51 studies reviewed out of which 6 studies were conducted in the area of productive thinking, 39 studies were conducted in the area of critical thinking and creative thinking, 2 studies on higher order thinking skills and 4 on creative problem solving skills. But investigator come across very less number of studies on productive thinking and found no tool to measure productive thinking for elementary school students. Hence, this study addressed the need of development of strategy for productive thinking in elementary education through science as the subject. For this, a tool was developed through which effectiveness of strategy was assessed.

6.7.0 RESEARCH QUESTIONS

1. Whether productive thinking can be inculcated in students?
2. Whether specific strategy can be developed to inculcate productive thinking among students?
3. Whether inculcation of productive thinking will have an impact on academic achievement?
4. Whether it will be feasible to complete to course using strategy for the inculcation of productive thinking?
5. Whether productive thinking can be inculcated among school students?

6.8.0 RATIONALE OF THE STUDY

Innovation is the best gift of human cognition on the earth. Each and every second we enjoy and feel the essence of innovations but what power is standing behind this cognitive ability that direct all the mental processing. Here comes the role of thinking ability that makes human being superpower and make superior to other animals. We are living in the 21st century where several thinking skills are expected from our students to address the challenges of the changing scenario. Creative thinking, critical thinking, collaboration and communication are 4 C's that are required to bring our students beyond 3 R's i.e. reading, writing and arithmetic. It is needed to develop classroom atmosphere that will lead to prepare our students for 21st century. Siburian, Corebima & Saptasari (2019) highlighted the role of educators, researchers, and curriculum developers to integrate the above discussed skills in the teaching-learning process. In the same line National Education Policy (2020) framed one of the guiding principle on

creativity and critical thinking to encourage logical decision making and innovation at institutional level and stated that we need to reduce curriculum content to enhance such thinking skills.

Thinking skill is innate in every human being but the ability to think in a particular way is acquired. According to Piaget's cognitive development theory, biological maturation leads to cognitive maturation also but Kuhn, Langer, Kohlberg & Haan (1977) argued that "maturation establishes the basis only but a special environment is required to attain this stage." Therefore, it is inevitable to create environment that stimulate development of cognitive ability. Unfortunately, our school system is getting failed in creating environment that stimulate cognitive development and thinking process. It was well reported that our school practices focused on rote learning and very less focus is given to higher order thinking skill. Pany, S. (2014) opined that most of the schools are preparing their students for getting very high score in examinations by getting the subject matter may be by cramming and for this, schools provide very little scope for thinking critically and divergently in the existing teaching-learning process. It creates no scope for novelty, originality and innovations.

To get rid of this situation, productive thinking is a way of integrating higher order thinking skills in the teaching-learning process. As Davis & Scott (1971) (cited in Patel, 1988) defines productive thinking as the ability that include creative and critical thinking dimensions of cognitive ability. It consist of divergent, convergent and evaluative operation whereby the individual drew upon available past and present acts, ideas, association and observation in order to bring forth new facts, ideas and conclusion. It is the ability that bring learner beyond mechanical application of previously learnt behavior in every new situation and make ready to see the new situation from a different perspective. It creates scope for novelty in the teaching-learning process in the classroom and creates scope for thinking beyond memory level.

As we know that creative thinking and critical thinking are the two components of productive thinking having opposite nature and therefore we need to separate these two in the productive thinking process. Birch & Rabinowitz (1951) highlighted the hindering effect of our past experience which blocks creative endeavor and reduces it to stereotyped and fruitless essays channelized through reproductive thinking. But critical thinking can be fruitful also when it is acted on correct place like Gallagher (cited in Hoffman & Hoffman, 1964) highlighted the role of critical thinking component which enables the individual to select the most appropriate solution out of number of solutions for the particular problem. Barua & Chakrabarti (2017)

highlighted the importance of critical thinking in promoting creativity by saying critical thinking plays a crucial role in evaluating new ideas, selecting the best ones and modifying them if necessary. It can be said that productive thinking is the skill to imbibe knowledge with creative thinking and critical thinking to give productive results followed by high motivation and no criticism. So, we need a strategy by which this can be done and positive components of both thinking skills can be used at one place.

In India, researches were conducted over various thinking skills like; creative thinking, critical thinking, reflective thinking, evaluative thinking, problem solving and many more. But investigator could find only one research in India and very few researches in abroad on productive thinking development. This study will focus on developing strategy for teaching through productive thinking. The teaching strategy for productive thinking will also guide teachers about their role in the process, classroom atmosphere and role of the students. The strategy will use different techniques that can be combined to strengthen knowledge foundation, creative potential and make use of critical thinking to refine creative potential.

Productive thinking can be developed through separated from school subjects or in an integrated manner with all school subjects like science, mathematics, language, social sciences, etc. NCERT (2015) described the nature of science that include process skills like observation, pose question, searching various resources of learning, planning, investigation, hypothesis formulation and testing, analyzing, interpreting data, critical thinking to consider and evaluate alternative explanations, reflecting on their own thinking, etc. The present science teaching is over burdened by factual knowledge where a little room is provided for discussion and creative and critical thinking process which are the heart of science education. So, in this study science is taken as the subject through which productive thinking development can be done in an integrated manner because science provides tremendous opportunity for the higher order thinking skills. Since present study aimed at developing productive thinking through science as the subject of teaching, achievement of students in science is also need to be considered. When a particular skill is taught through subject content researcher should keep it in mind that achievement of the students should not be negatively affected. So in the present study science achievement of the students will also to be studied. It will help the researcher to draw the conclusion about use of integrated strategy for the development of productive thinking through a subject.

Upper primary stage of elementary school education is the foundation for secondary and higher secondary level as well as for future. According to Piaget (1952) this is the stage where students' cognitive mechanism shift from concrete operational stage to formal operational stage. Simatwa (2010) said at this level, students are able to consider abstract ideas and manipulate them also. Researches shown that this is the stage where students' creative potential is its peak therefore, in this study upper primary stage is taken for the productive thinking development.

To implement this in the classroom role of a teacher is inevitable. Schuler (1974) emphasized active role of teacher in the classroom for the effective implementation of the productive thinking program. Teacher need to be active, vibrant, ready to model creative behavior, and very importantly a constant motivator who is away from destructive criticism and who can channelize creative thoughts on the correct track.

Thinking operations determine the way of doing things and the perspective of looking things. A person needs enough time to change the way of looking at things and it cannot be done immediately in some days. A person who use reproductive thinking everywhere to solve problems he/she cannot change the way of solving problem in the training of some days. Therefore, in this study students were taught through productive thinking for the whole academic year.

6.9.0 STATEMENT OF THE PROBLEM

DEVELOPMENT AND IMPLEMENTATION OF AN INTEGRATED STRATEGY TO INCULCATE PRODUCTIVE THINKING AMONG ELEMENTARY SCHOOL STUDENTS.

6.10.0 OBJECTIVES OF THE STUDY

The present research study has following objectives:

1. To develop an integrated strategy to inculcate productive thinking among elementary school students.
2. To implement the developed integrated strategy to inculcate productive thinking among elementary school students.
3. To study the effectiveness of the developed integrated strategy in terms of productive thinking of elementary school students.

4. To study the effectiveness of the developed integrated strategy in terms of achievement of elementary school students in Science.
5. To study the effectiveness of developed integrated strategy in terms of reaction of elementary school students.

6.11.0 HYPOTHESES OF THE STUDY

The following null hypotheses were constructed and tested at 0.05 level of significance.

$H_0$1: There will be no significant difference between the mean scores of productive thinking of the experimental and the control groups.

$H_0$2: There will be no significant difference between the average thinking pattern of experimental and control groups.

$H_0$3: There will be no significant difference between the mean scores of achievement of the experimental and the control groups.

6.12.0 EXPLANATION OF THE TERMS

Integrated strategy: In the present study, integrated strategy is the interweaven of the subject content with a developed productive thinking model for the development of higher order thinking skills among elementary school students. Integrated strategy involved different activities having opportunities for students to develop higher order thinking skills through the teaching of content.

Traditional method of teaching: It is a teaching method in which a teacher regulates and control the process of teaching and learning.

6.13.0 OPERATIONAL DEFINITION OF THE TERMS

Productive thinking: Productive thinking is the score obtained by elementary school students in productive thinking scale developed by the researcher.

Effectiveness: Effectiveness of the integrated strategy is the significance of difference between the post-test scores of the experimental and control groups in productive thinking and achievement in Science.

Effectiveness in terms of reaction: Effectiveness of the integrated strategy is the average intensity index of 3.5 and more on a five point reaction scale prepared by the researcher towards the developed strategy and its implementation.

Thinking pattern: Thinking pattern is the average frequency score obtained by the students in the productive thinking scale developed by researcher by considering the components of productive thinking starting from reproductive thinking, critical thinking, and creative thinking to productive thinking.

6.14.0 DELIMITATION OF THE STUDY

The present study was delimited to the English medium elementary school students of standard VIII affiliated to Central Board of School Education, New Delhi. Teaching subject was also delimited to the teaching of Science subject.

6.15.0 RESEARCH DESIGN OF THE PRESENT STUDY

As the present study was an experimental study where randomization was not possible to choose the sample, quasi-experimental pretest-posttest non-equivalent control group design was followed in the present study. The research design can be represented as follows:

O_1 X O_2

O_3 C O_4

Where, O_1 and O_3 are pretest,

O_2 and O_4 are posttest

X represents experiment group

C represents control group

6.16.0 POPULATION OF THE STUDY

Population of the present study consist of all the students of standard VIII studying in English medium schools affiliated to CBSE (Central Board of Secondary Education) in Gujarat state in the session 2019-2020. As per the CBSE annual report (2018-2019) there were total 471

schools (as on 31/03/2019) in the Gujarat state affiliated to CBSE. So all the students studying in standard VIII (2019-2020) in those schools comprise the population for the present study.

6.17.0 SAMPLE OF THE STUDY

As per the research design, sample was selected using convenient sampling technique of non-probability sampling. Two Kendriya Vidyalayas those who were ready to participate in the study were selected from Vadodara city of Gujarat. Kendriya Vidyalaya no. 4, ONGC, Makarpura, Vadodara was selected as experimental group and Kendriya Vidyalaya no. 3, Airforce Station (AFS), Makarpura, Vadodara was selected as control group. One intact section of standard VIII from each school was selected as the class for the sample for the experimental and control group.

6.18.0 TOOLS FOR THE DATA COLLECTION

Following tools were used by the researcher for the purpose of data collection.

1) Productive thinking scale
2) Achievement test
3) Reaction scale

6.19.0 DEVELOPMENT OF INTEGRATED STRATEGY

In the present study to achieve the defined objectives, a strategy was developed. It was developed by keeping in mind the specified places of different thinking skill in productive thinking process. Therefore, a teaching model which can directs the teacher to separate the thinking process in a productive thinking process was needed. With this aim, a model of productive thinking (FIESI) was developed which provided opportunities to think specifically at different phases of this model. Then, suitable techniques directed towards specific thinking skill are selected and integrated with the FIESI model. The integrated strategy which was developed by using integration of thinking techniques with productive thinking model (FIESI) was used to teach science in an integrated manner where students learn productive thinking skills through science subject content.

Different techniques used in FIESI model while teaching were as follows:

a) **Activity based learning**

Activity based learning is a technique to engage learners meaningfully in the cognitive task. This technique provides a platform for the students to explore the phenomenon by themselves. It involves engagement of all the senses that ensure learning. It provides opportunity for learning by doing and thereby students engaged meaningfully and enjoy learning process.

b) Open ended questioning

Open ended questions are helpful to break the cognitive equilibrium of the students and provoke them to think beyond the text given in the textbook. It creates space for discussion where students learn to accept ambiguity.

c) ICT

Information and Communication Technology (ICT) is known for addressing the diverse needs of the learners. It is also useful to connect classroom with the real life setting. In the present study, it was used to motivate the students towards thinking differently and to ignite the spark of creativity in the students.

d) Brainstorming

It is a good technique to create a promising and creative idea for the problem. It can be conducted in the group as well as individually. In the brainstorming session a problem is put to work upon in front of the groups. A specific time was given to brainstorm within the group. When a long list of ideas was ready, leader invited the secretary to present the ideas before the class and then suggestions and critical evaluation were welcomed to improve the solution.

e) SCAMPER

It is the technique of generating divergent ideas and widely used as a creative thinking technique. SCAMPER is an acronym in which each letter represent different mode of generating idea like; Substitute, Combine, Adapt/Adjust, Modify, Put to another use, Eliminate, and Rearrange/Reuse.

f) Concept map

It is a good technique to summarize the concept as well as to retain the concept in mind for long time. It is because information in the concept maps are presented in some patterns and represent the relationship between the components in an effective way.

g) Evaluation

This is the convergent thinking or critical thinking component. Evaluation could be done by presenting the long list of ideas in front of panel to get critical judgment and

suggestion to improve the ideas. The purpose of this technique was to select best promising idea out of a long list of ideas to solve the problem at hand.

6.20.0 IMPLEMENTATION OF INTEGRATED STRATEGY

In the present study, Standard VIII students of experimental group was taught by developed integrated strategy by investigator for one academic year 2019-2020. Investigator selected topics that can be taught through developed strategy and accordingly lesson plans were developed for teaching. In the present study cognitive lesson plan for each chapter was prepared by investigator by using FIESI model of productive thinking. Investigator changed classroom seating arrangement for group activities. Investigator taught all the chapters of science subject and act as a subject teacher. So along with focusing on thinking skills students were also prepared for their regular school test and maintained their notebooks.

The syntax of FIESI model has five phases viz. Foundation, Ideation, Evaluation, Stabilization, and Implication. Therefore, teaching started with creating knowledge foundation in the classroom. Investigator first create knowledge foundation for each chapter by using child centred techniques like activity, demonstration, discussion, use of technology, and many more that helped students to create knowledge. Then a situation was put to be solved in front of the students and students had to think divergently in the groups. Here brainstorming and SCAMPER techniques were used. Then the list of ideas were evaluated and best promising idea was selected that can solve the purpose. The selected idea was then implied to some real life situation to connect classroom learning with real life settings.

6.21.0 DATA COLLECTION

As the present study was an experimental study following quasi-experimental pre-test post-test control design, data were collected in two phases.

1. Administration of pretest

   At the starting of the session 2019-2020, investigator established a rapport with the students. When students get comfortable in the new class, productive thinking scale was administered as pretest over the experimental and control group students.
2. Administration of posttest

After the completion of syllabus, the same productive thinking scale and the achievement test prepared by the Kendriya Vidyalaya were administered as post-test on both the groups to study the effectiveness of developed strategy.

3. Administration of reaction scale

   A Likert type five point reaction scale was administered on experimental group at the end of the experimentation. Students had to tick the preferred rating against five ratings viz. strongly agree, agree, average, disagree and strongly disagree for each statement.

6.22.0 DATA ANALYSIS

Data analysis was done using quantitative statistical techniques. Posttest data of productive thinking scale were analyzed using mean, standard deviation, Mann-Whitney U test, and chi-square analysis, achievement test data were analyzed by using mean, standard deviation, Mann-Whitney U test and reaction scale was analyzed using percentage, frequency and intensity index.

6.23.0 MAJOR FINDINGS

Following are the major findings of the present study.

1. Developed integrated strategy along with the FIESI productive thinking model was found significantly effective in inculcating productive thinking among elementary school students.
2. Developed integrated strategy along with the FIESI productive thinking model was found effective in terms of achievement of the students alike the traditional method of teaching.
3. Developed integrated strategy along with the FIESI productive thinking model 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 FIESI productive thinking model was found effective in inculcating creative thinking among elementary school students.
2. The developed integrated strategy along with the FIESI productive thinking model 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 FIESI productive thinking model can be used through the subject content in an integrated way.

6.24.0 IMPLICATION OF PRESENT STUDY

The findings of present study revealed the effectiveness of developed integrated strategy in the form of FIESI model in inculcating productive thinking among elementary school students. It was also found that productive thinking model (FIESI) was effective in inculcating creative thinking, critical thinking, and problem solving skills. It can be said that present developed strategy was effective in developing higher order thinking skills which is the need of the hour. The present study has following implication for policy makers and teachers:

- Implications for policy makers: The need of 21st century skills are emphasized by many educational documents. The NEP, 2020 also talks about the need of creative thinking, critical thinking and problem solving skills based instruction. The developed model FIESI creates scope for the development of discussed skills and opens the door for development of 21st century skills. Use of FIESI model at different education level can solve the purpose.
- Implications for teachers: Productive thinking model (FIESI) is a teaching model that helps teacher to create motivating environment in the classroom where students are encouraged to think differently. It helps teachers to make lesson plans and create creative situations to think upon. In present study, VIII standard students were taught science through the developed strategy in an integrated manner. Similarly this strategy could be implemented to other levels of school education and through other subjects

also. It is a mean to harness creative potential in students. It is the time to give equal emphasis on productive thinking skills along with the basic knowledge level and accordingly we need to reframe our educational objectives at all levels to prepare our students for challenging future.

In future, the most demanding skill will be creative problem solving which is popularly known as productive thinking. So in order to prepare our students we need to introduce thinking components in classroom teaching. Teaching through FIESI model can solve the purpose and foster productive thinking through critical thinking, creative thinking, and problem solving skills in a sequence.

6.25.0 SUGGESTIONS FOR FUTURE STUDIES

The present study was delimited to teaching of science to VIII standard CBSE school students of Vadodara city. Investigator implemented the developed strategy in Kendriya Vidyalaya no.4, ONGC, Vadodara and found effective in inculcating productive thinking among VIII standard students. The similar study could be conducted in the following area in future.

1. The integrated strategy could be implemented through other subjects also.
2. It could also be implemented at secondary, higher secondary and higher education levels of education.
3. The effectiveness of integrated strategy could be studied in terms of achievement of the students giving more emphasis on the achievement part during experimentation.
4. It could also be studied in relation to variables like, learning style, thinking style, higher order thinking skills, and other cognitive abilities.
5. The similar study could be conducted by using different techniques in productive thinking model FIESI.
6. The present status of productive thinking level among students could also be studied.
7. The effectiveness of FIESI model could be studied in developing 21st century skills among students.

6.26.0 CONCLUSION

We are living in 21st century that demand some specific skills like thinking skills. To prepare our students for complex future we need to give stress upon skills like creative thinking, critical thinking, and problem solving. By combining these three cognitive skill we will have

productive thinking. It can be said that productive thinking is a creative problem solving that use critical thinking and creative thinking in a sequence in order to arrive at the solution of the problem. These demanding competencies should be the part of regular classroom teaching learning practices but somehow these skills are neglected in the classroom and stress on knowledge and memory only is well reported. It leads to rote learning and fixed set of responses from students. It ignores thinking power of our students. This is the typical pattern of traditional classroom environment. It could be changed by inculcating thinking skills among students through productive thinking. Present study was an attempt in this direction in which an integrated strategy in the form of a teaching model which is named as productive thinking model (FIESI) was developed to inculcate productive thinking among elementary school students. Science is the subject with the process skills that opens the door for productive thinking. Standard VIII students of experimental group were taught science through the developed model using different techniques for one academic year and it was found effective in inculcating productive thinking among students in terms of productive thinking score. It was also found effective in terms of reaction of experimental group students. The developed integrated strategy allows students to make use of creative thinking and critical thinking simultaneously. Students are encouraged and motivated to think in a specific way in order to arrive at productive idea. Teaching through the developed strategy did not affect achievement of the students and the achievement of the experimental group was very equal to the achievement of the control group. Therefore it can be used in an integrated manner. The findings suggested that developed strategy is effective in developing creative thinking, critical thinking, and problem solving along with productive thinking. The present study has an implication in preparing our students for the demanding cognitive skills through their subject content. The developed strategy could help the teachers to inculcate productive thinking and other higher order thinking skills through science as well as through other subjects.