5.1 SUMMARY

The growth of a nation mainly depends upon its human and non-human resources. The quantity of non-human resources is limited but the creativity is unlimited. So, it is need of the hour to cultivate and nurture the creativity of a child and an individual, for the development of a nation at micro level and of the world at macro level. Walberg (1998) suggested that developing children’s creativity during their years in education is the start of building “human capital” upon which depends the wealth of a nation.

In era of Info-tech, Dr. A.P.J. Abdul Kalam, the XI President of India said that the curriculum and the education system of 21st century should emphasize on creativity, innovation, entrepreneurship and management skills among students to make India happy, prosperous and strong.

The main goal of education in school is to develop child’s logical thinking, ability to handle abstraction, problem solving ability, divergent thinking, increasing the level of motivation and developing proper attitude towards learning.

Dickhut quoted that as a response to such calls, there has been a shift in educational policy around the world and efforts are being made to combine creativity and knowledge (cited by Shaheen, 2011). National Knowledge Commission (2005) recommended that in India, the pedagogy should be modified to impart creativity and global vision training. This commission also recommended that the system should move from examination based evaluation to more open assessment mechanisms. Memory, comprehension and creativity should be given equal importance in evaluation. Vong (2008) wrote that in China, creativity has become an important component of education since
2001 and its development has become a priority. Marsigit (2011) reported that in China, the context of mathematics teaching indicated that the students should possess some degree of creative spirits. They should be able to develop four dimensions of creativity i.e. mathematical thinking, problem solving, affection and attitude. Shaheen (2011) discussed that in Hong Kong, the educational policy proposal includes creativity as a higher order thinking skill and the development of creativity is becoming their chief priority. Litwin pointed out that in Hong Kong, the context of mathematics teaching stressed that mathematics teaching should aim at developing pupils’ creativity cited by Marsigit (2011). Shaheen (2011) also discussed that in Korea, the National Curriculum defines an educated person as “healthy, independent, creative and moral”. Jung (2007) expressed that in South Korea, the students should be able to experience the joy of discovery and maintain their interest in mathematics; to use open ended questions in order to stimulate students’ creativity, divergent thinking and to value the application of mathematics in order to foster a positive attitude towards it.

According to Effandi and Normach (2009), students’ attitude towards mathematics is very much correlated to attitude towards problem solving in general. Akien (1970) also found that attitude plays a crucial role in the learning of mathematics and a significant positive correlation of attitude towards mathematics and achievement in mathematics was found. Karnes et al. (1961) in a study found that creativity was significantly related to achievement. MaCabe (1991) revealed that there was a relation between mathematics I.Q. scores and high creativity.

Fiori et al. (2010) remarked that anxiety is the most common disorder affecting millions of adolescents around the world. Carlsson (2002) concluded that creativity provides a defense mechanism to anxiety and helps in reducing anxiety. This is also supported by Passer et al. (2009) who indicated that by implementing creative thinking technique, anxiety can be reduced.
Amabile (1983) pointed out that individuals may have certain traits and abilities that are favourable to creativity. Prabhu et al. (2008) found self-efficacy to be closely related to creativity, with intrinsic motivation completely mediating this relationship.

**Creativity**

Creativity is usually defined as the capacity to generate ideas that are jointly original and adaptive. Original ideas are those that have low statistical likelihood of occurring in the population, aesthetic or practical criteria. An idea that is original but maladaptive is more likely to be considered as a sign of mental disturbance rather than creativity, while an idea that is adaptive but original will be dismissed as mundane rather than creative (Simonton, 2003). Creativity may be applied to many areas of our life, may it be in agriculture, athletics, arts, music, poetry, science, mathematics etc.

According to Micharko (1998), Creativity is defined as something different from intelligence. Feldhusen and Goh (1995) defined that creativity is often defined as a parallel construct to intelligence, but it differs from intelligence in that it is not restricted to cognitive or intellectual functioning or behaviors. Instead, it is concerned with a complex mix of motivational conditions, personality factors, environmental conditions, chance factor, and even products”.

According to Boden (1998), there are three main types of creativity, involving different ways of generating novel ideas:

a). The “combinational” creativity that involves the generation of new ideas by the exploration of structured concepts.

b). The “exploratory” creativity that involves new combination of familiar ideas.

c). The ‘transformational’ creativity that involves the transformation of some dimensions of the structure so that the new structure can be generated.

Taylor (1959) has described five types of creativity: expressive, productive, inventive, innovation and emergentive.

De Haan and Havighurst (1961) have advocated three fields of
creative activity:

   d). Affective creativity in which emotions, senses and feelings of the creator act as media.

   e). Functional or problem solving creativity which is related to solution of social and mechanical problems.

   f). Abstract creativity that deals with the concepts, definitions, abstractions, and generalizations.

Ghiselin (1963) has mentioned two levels of creativity: (a) Creative action of higher order which alters the universe of meaning, or some new order of significance, and (b) Creative action of lower order which gives further development to an established body of meaning by initiating some advance in its use.

Investment theory of Lumbart and Strenberg suggested that creativity requires the confluence of six but interrelated resources: intellectual abilities, knowledge, styles of thinking, personality, motivation and environment. Although levels of these resources are sources of individual differences, often the decision to use a resource is more important source of individual difference (Sternberg, 2006).

A widely known and accepted concept of creativity, called the 'Four P' model, is based on the assumption that creativity can be defined as a holistic multi-dimensional concept.

![figure 5.1: person, process, product, press](source: Firestien (1993))

odes (1961) developed a framework for a unifying approach to creativity; forming four strands. These strands were - **creative person**
(clustered around personality-related traits and the mental ability of the person to create something new), the creativity process (the function of the mind in creating ideas in the creative person like searching, combining and synthesizing), creative product (the outcome or product being original, unique, valuable and novel), and the creative press (or environment) which influences the ecological press on the person and upon his mental processes and outcomes. Similarly, Mooney and Rhodes have referred to these kinds of definitions as the "Four P" creativity.

Krutestskii (1976) characterized mathematical creativity in the context of problem formation (problem finding), invention, independence and originality. Thus, mathematical creativity is the process that results in unusual and insightful solutions to a given problem, irrespective of the level of complexity. Hadamard (1945) believed that creativity in mathematics requires an intuitive mind with ample reflection and incubation of ideas.

Envynck (1991) described mathematical creativity in terms of three stages. The first stage (stage 0) is referred to as the preliminary technical stage, which consists of "some kind of technical or practical application of mathematical rules and procedures, without the user having any awareness of the theoretical foundation." The second stage (stage 1) is that of algorithm activity, which consists of an explicit application of an algorithm repeatedly. The third stage (stage 2) is referred to as creative (conceptual, constructive) activity. This is the stage in which true mathematical creativity occurs and consists of non-algorithmic decision making. The decision that has been taken may be of a widely divergent nature and always involves a choice.

The notion of fluency, flexibility and novelty were adapted and applied in the human domain of mathematical creativity by Balka (1974), who asked subjects to pose mathematical problems that could be answered on the basis of information provided in a set of stories about real world situations. Problem solving is central to the discipline
of mathematical thinking (Lee et al., 2003).

**Self-efficacy**

Self-efficacy is defined as people’s belief about their capabilities to produce designated levels of performance. According to Bandura (1997), self-efficacy judgements are dependent on a particular domain. In other words, they are domain-specific. This means that high self-efficacy judgements in a particular area are not necessarily indicative of high self-efficacy in other domains. It has been found that a strong sense of self-efficacy is related to better health, higher achievement, creativity, and better social integration (Bandura, 1997). Individual’s performance is based on his/her ability and thus, is related to his perceived self-efficacy. Bandura (1997) explained that the construct of self-efficacy provides a mechanism that would account for changes in students’ confidence taking place at the same time as changes in achievement. Individual’s performance is based on a set of domain specific self-beliefs about one’s ability to organize and execute the actions required to perform some particular tasks in future. Bandura described four sources of information that contribute efficacy beliefs: mastery experience, vicarious experiences, verbal persuasion and affective states. Mastery experiences are success obtained from actual practice. Vicarious experiences are acquired by observation of specific behavior. Verbal persuasion is an extrinsic motivation, such as encouragement or praise. At last, the affective state, such as stress and emotions, influence efficacy and related behaviors. Bandura suggested that the efficacy beliefs are influenced by above mentioned four sources of information.

Pajares (1996) defined self-efficacy in terms of individual’s perceived capacities to attain designated type of performance and to achieve specific results.

Most of the researches indicated that self-efficacy predicts performance and contributes to higher achievement and it is interpreted by students as evidence that they have the ability to
perform similar tasks in the future.

**Anxiety**

People differ specifically in their predisposition to suffer anxiety. It is a subjective experience of an individual, painful uneasiness of mind. Anxiety is based upon experience of the past incidences and future consequences.

The existence of anxiety as a basic human emotion has been recognized across cultural boundaries (Bodas and Ollendick, 2005). Sigmund Freud used and developed concept of anxiety. He wrote “Anxiety, then, is in the first place something that is felt. We call it an affective state, although we are ignorant of what an affect is. As a feeling, anxiety has a very marked character of unpleasure..... not every unpleasure can be called anxiety, for there are other feelings, such as tension, pain, or mourning, which have the character of unpleasure. Thus, anxiety must have other distinctive feature. Analysis of anxiety state, thus, reveals that the existence of specific character of unpleasure, act of discharge, and perception of these acts” (Cited by Edward, 1999).

Ohman (1993) described that anxiety is a state of undirected arousal following the perception of threat. According to American Psychiatric Association (2000), “anxiety is a psychic condition of heightened sensitivity to some perceived threat, risk, peril or danger. It is an emotion characterized by apprehension and anticipation of future danger or misfortune accompanied by feeling of dysphoria or somatic symptoms of tension. Mogg and Bradley (1999) defined that “anxiety is a cognitive bias, and anxiety-prone people are likely to develop clinical anxiety while under stress. Goldstein (1940) explained that anxiety is a normal reaction to situation where immediate danger exists and may result in physical harm. Tellegen (1985) explained that anxiety, in the absence of marked depression, is commonly associated with a future –oriented externally focused cognitive mode that continuously scans the environment for threats and anticipates
possible threats.

Anxiety is a sense of uneasiness and distress that is experienced by an individual. It produces the feelings of apprehension of danger or misfortune and tension. High level of anxiety can adversely affect performance.

Beck (1976) marked that anxiety prone persons are characterized by a hyperactive danger schema that results in increased attention to external threat cues, a tendency to interpret ambiguous information in a threatening manner, and an increased propensity to remember dangerous experiences. Adamas and Bromley (1998) defines anxiety as a disorder within a person arising when there is clash between conflicting tendencies, such as impulse to love or hate and in which abnormality or anxiety interferes with daily living.

Anxiety is one’s psycho-emotional reactions when one thinks about or performs a particular task (Ashcraft, 2002; Hembree, 1990; Pintrich and DeGroot, 1990; Sarson and Sarson, 1990 and Spielberger, 1985).

Freud describes various kinds of anxieties which differ by the conditions that produce them: reality anxiety (normal fear comes from real external threats), moral anxiety (comes from the interaction of the ego and super ego, producing guilt or shame), neurotic anxiety (focus on a specific phobic symptom, unattached and free floating unpleasant state and panic), cited by Hall et al. (2012).

Anxiety is of two types- a trait and a state. Spielberg (1966) refers state anxiety as transient feelings of anxiety at a given moment in time (i.e. “I feel anxious”). Trait anxiety, on the other hand, reflects individual differences in anxiety proneness or people’s tendency to appraise situations as threatening and to respond to those situations with state anxiety behaviour (i.e. I am an anxious person).

According to Covington and Zeidner, trait anxiety is when individual tends to be anxious in many situations; but when some
situations are especially anxiety-provoking, then it is state anxiety cited by Woolfolk (2009).

**Mathematical Attitude**

Attitude is one of the sources which determine individual’s success and happiness. It is an approach, an outlook, a position and a viewpoint or a feeling about someone or a way of behaving that follows from this.

Encarta (2006) defined attitude as, “relatively enduring beliefs or opinions that predispose people to respond in positive, negative or ambivalent way to a person, an object or an idea.”

Allport (1935) explained that attitude is a “mental and natural state of readiness organized through experience, exerting a directive or dynamic influence upon the individual’s response to all objects and situations with which it is related.”

Woodworth explained that an attitude is a set of disposition (readiness, inclination and tendency) to act towards an object according to its characteristics so far as we are acquainted with them.

Thurstone (1946) writes, “attitude denotes the sum total of a man’s inclination and feelings, prejudice or bias, preconceived notions about any specific topic.” He further viewed that man’s attitude is admittedly a subjective and a personal affair and it is related to all he feels and thinks.

Cater (1959) states that an attitude is a readiness to react towards or against some situation, person or thing in a particular manner e.g. with love or hate; fear or resentment to a particular degree of intensity.

Hannula (2004) wrote that the attitude has been divided in social psychology into beliefs, emotions and behaviour.
Mathematics is a very important subject in our curriculum. Nations’ progress depends upon its science, technology and mathematics achievement. Mathematics is a tool that helps and trains the mind to think. This process of thinking will then help the mind to understand and acquire the idea of good, which is the ultimate aim of philosophy. Plato did not deny the important applications of mathematics in people’s daily life. But, to Plato, the philosophical importance of mathematics is more important and more rewarding as it may affect one’s understanding of his being.

Attitude is the positive or negative degree of affect associated with a certain subject. This point of view suggests that the attitude towards mathematics is just a positive or negative emotional disposition towards mathematics (McLeod, 1992 and Halayna et al. 1983).

McLeod (1992) provide affective cognitive continuum and assigns different levels of stability to them.

![Figure 5.3: McLeod’s (1992) Classification of Concepts of Affective Domain](image)
Ruffell et al. (1998) found attitude as an observer’s construct. This gives a view that attitude construct is functional to the researcher’s self-posed problem. In these terms, Zan and Martino (2007) consider it to be useful in the context of mathematics education; as long as it is not simply borrowed from the context in which it appears i.e. social psychology, but is rather outlined as an instrument capable of taking into account peculiar problems in mathematics education.

Daskalogianni and Simpson (2000) defined that attitude towards mathematics is the pattern of beliefs and emotions associated with mathematics.

Mathematical attitude is that attitude which deals with one’s confidence, anxiety, enjoyment, motivation to pursue mathematics in his/her personal and professional life. Attitude towards mathematics is highly related to a student’s perception of the previous mathematics. Neale (1969) suggested that attitude plays a crucial role in learning mathematics.

Hannula (2002) defined attitude towards mathematics as an inclination to evaluate mathematics favourably or non-favourably ('I like ...', 'It is important'). He further explained that attitude (defined as liking) may be affected by:

i) Situation variables (e.g. teacher behaviour),
ii) Automatic emotional reactions of the student (based on some traumatising event(s) in the past),
iii) Expectance of outcome (beliefs), goals of the student (e.g. career aspirations), or social variables (attitudes of the family).

The Problem

Mathematics is a very important subject in our school curriculum. In 21st century, our society is moving into a technological era where only memorization of mathematical facts and principles is not sufficient. The role of mathematically creative person for the
continued growth of the world is indispensable. Creativity is a very important area of mathematics education which needs attention of educators and researchers. In spite of great recognition of mathematical creativity in the life of a human being, only a few research studies have been conducted in the area of creativity.

“SELF-EFFICACY, MATHEMATICAL ATTITUDE AND ANXIETY AS CORRELATES OF CREATIVITY AMONG SECONDARY SCHOOL STUDENTS”

Significance of the Study

Indian Education Commission (1966) pointed out that “India needs more scientists, technicians, educators and administrators of the superior quality to head manpower in all fields to keep herself abreast of the latest advances taking place in the world. On the other hand, she is trying to give a new shape to her age old peasant economy and is taking steps to reduce social and cultural stagnation and social backwardness besides, making determined and practical efforts to establish herself as a leading nation in the galaxy of advanced and developed nations. Hence, the earlier we spot out potentially creative scientists, technologists, educators, administrators and technocrats, the better it would be.”

Sternberg (2008) explained that creativity is not a mere appendix to other cognitive skills rather it is a pre-requisite for survival in this rapidly changing highly stressed world. Our society needs citizens and leaders who are not mere memorizers but also who are more analytically adopted. We need people who are practical, wise and creative.

It has generally been realized today by all nations, whether developed or underdeveloped, that the survival of human civilization depends upon the creative individuals. Behind every act or product, there is often a creative mind.

The future of a developing country like India depends upon the creative imagination of our children. Creativity is the tool in the hands
of man for the solution of his problem and for the society at large. So, creativity has proved to be an ability for a healthy and progressive individual and society. Barron (1952) remarked that “inspite of such high importance of creative thinking, it remains a sad fact that among educators, there are many who look upon creative thinking in the school or the college as threatening and dangerous. They quickly point out that creative thinking leads only to trouble in the classroom. They call highly creative persons as ‘a little crazy’.

In our school education, we try to suppress the creative talent of the child by asking closed ended question and not giving students any possibility for expressing his imaginations. In mathematics curriculum also, there is little or no space for child to experience the creative environment. The potentialities of creative students are generally left unexplored. The Indian Education Commission (1964-66) also observed that “the schools have failed to enroll a large number of talented students”. Chawala (1976) suggested that it is necessary, therefore, that the teachers should be sensitive towards creative ability among their students. Such pupils need understanding and stimulation for creative performance. Teacher should try to provide an ‘open’ and not ‘closed’ environment if they aspire to bring about maximum possible creative development of their students. It is almost universally agreed that creativity is more developable than intelligence or other abilities.

**Objectives of the Study**


7. To study creativity of secondary school students of Himachal Pradesh in relation to mathematical attitude.

8. To study creativity of secondary school students of Himachal Pradesh in relation to anxiety.

9. To study gender differences in creativity of secondary school
students of Himachal Pradesh in relation to self-efficacy, mathematical attitude and anxiety.

10. To study predictors of creativity of secondary school students of Himachal Pradesh from the given set of three psychological variables self-efficacy, mathematical attitude and anxiety.

**Hypotheses of the Study**

1. There will be a significant positive relationship between self-efficacy and creativity of secondary school students in Himachal Pradesh.

2. There will be a significant positive relationship of mathematical attitude with creativity of secondary school students in Himachal Pradesh.

3. There will be a negative relationship of anxiety with creativity of secondary school students in Himachal Pradesh.

4. There will be a significant gender differential in relation of self-efficacy, mathematical attitude and anxiety with creativity among secondary school students of Himachal Pradesh.

**Delimitations of the Study**

6. The study was delimitated to Government Secondary Schools of Himachal Pradesh, affiliated to Himachal Pradesh Board of School Education, Dharmshala.

7. The study was delimitated to secondary school students studying in class IX.

8. The study was confined to only three out of twelve districts of Himachal Pradesh, namely, Hamirpur, Solan and Chamba.

9. Correlation and regression analysis was applied to study the relationship and hence prediction of creativity.

10. Analytical approach was applied for the analysis of data
by using ANOVA (3-way and t-ratio).

**Operational Definitions**

5. **Self-efficacy:** Self-efficacy is defined as people’s belief about their capabilities to produce designated levels of performance. The concept of self-efficacy is the focal point of Albert Bandura’s social cognitive theory, self-efficacy is a belief in one’s capabilities to organize and execute the course of action required to produce given attainment or in other words, it means coping with daily hassles as well as adaptation after experiencing all kinds of stressful life events as measured by Schwarzer and Jerusalem (1995).

6. **Anxiety:** Anxiety is an emotion characterized by heightened autonomic system activity, specifically activation of the sympathetic nervous system (i.e. increased heart rate, blood pressure, respiration and cognition that involve apprehension, dread, panic, tension and worry as measured by IPAT Anxiety Scale by Cattell, Krug and Scheier (1970).

7. **Mathematical Attitude:** Mathematical attitude refers to emotional disposition towards mathematics i.e. the positive or negative degree of affect associated with learning of mathematics, measured in terms of three components—emotional responses, belief regarding the subject and behaviour related to the subject as measured by How I Feel About Math scale by Maan (2005).

8. **Creativity:** Creativity is the generation of information from given information where the emphasis is upon variety of output from the sources (innovation, originality, unusual syntheses or perspective) including the factor of fluency, flexibility, originality and elaboration; and in the present study, it connotes creativity as measured by students’ responses to problems presented or in terms of the development of mathematical problems in situational data (Balka, 1974).
**Universe of the Study and Sampling**

The secondary schools of Himachal Pradesh were the universe of the study and 42 secondary schools were selected from 3 out of 12 districts of Himachal Pradesh. These districts were selected on the basis of literacy status being high, average, and low (as compared to state literacy rate). Further, all IX grade students were selected as a cluster sample. A sample of 1110 students was included in for the conduct of the study. From each district, three educational blocks were selected at random and in each educational block of Hamirpur and Solan district, two schools from urban area and three schools from rural area were selected. In case of Chamba district, one school from urban area and three schools from rural area were selected as schools from urban area were co-educational. All the IX class students in these schools were taken as cluster sample. The number of schools from Hamirpur and Solan districts was fifteen each and from Chamba district, it was twelve.

**Method and Procedure**

Descriptive method of research was used for the conduct of present study. The purpose of the study was to study the self-efficacy, mathematical attitude and anxiety as correlates of creativity. Accordingly, representative sample of 1110 secondary school students were selected from three districts of Himachal Pradesh.

All the four selected tools in the study were administered to the subjects. The data for the present study was personally collected by the investigator from the students of secondary schools for the collection of the data. The environmental testing situation and procedure for all the subjects were kept as uniform as possible to have true, correct and required information. In this way, data was collected from all the subjects selected from secondary schools of Hamirpur, Solan and Chamba districts of Himachal Pradesh.
**Research Tools**

1. Creative Ability in Mathematics Test (CAMT) developed by Balka (1974) was used to assess mathematical creativity among secondary school students.
2. Hindi Self-efficacy Scale by Sud, Schwazer and Jerusalem (1998) was used to measure self-efficacy among secondary school students.
3. Hindi version of Cattell’s Self-Analysis form or IPAT ASQ prepared by Kapoor (1970) was used to measure general anxiety in terms of emotional instability, suspiciousness, guilt proneness, low integration and tension among secondary school students.
4. How I Feel About Math by Mann (2005) based on Fennema-Sherman Mathematical Attitude Scale was used to assess attitude of secondary school students.

**Organization of Data**

The filled in test booklets/answer-sheets were scored strictly according to the directions and instructions given in the respective manuals of the scales. The low and high self-efficacy groups were formed on the basis of $P_{25}$ and $P_{75}$ cut points on self-efficacy scores. The students scoring above 35 (i.e. $> P_{75}$) were treated as high self-efficacy group and students scoring below 27 (i.e. $< P_{25}$) were treated as less self-efficacy group. The less and more favourable mathematical attitude groups were formed on the basis of $P_{25}$ and $P_{75}$ cut points on mathematical attitude score. The students scoring above 168 (i.e. $> P_{75}$) were treated as more favourable mathematical attitude group and students scoring below 136 (i.e. $< P_{25}$) were treated as less favourable mathematical attitude groups. The low and high anxiety groups were formed on the basis of $P_{25}$ and $P_{75}$ cut points on anxiety group scores. The students scoring above 42 (i.e. $> P_{75}$) were treated as high anxiety group and students scoring below 32 (i.e. $< P_{25}$) were treated as low anxiety group. Statistical treatment was given thereafter.
Figure 5.3: Distribution of Total Sample
Testing of Hypotheses

On the basis of the results of the study, as reported earlier, testing of hypotheses was made and reported under:

14. Since the gender and mathematical attitude interaction effect turned out to be significant in all the analyses, the hypothesis, "There will be a significant gender differences in relation to mathematical attitude among secondary school students of Himachal Pradesh" has been accepted. The results revealed that in case of boys’ group of secondary school students, less and more favourable mathematical attitude shows a significant difference. However, such difference for girls group of secondary school students is not significant.

15. The interaction effect of gender and anxiety turned out to be significant. Hence the hypothesis, "There will be a significant gender differences in relation to anxiety among secondary school students of Himachal Pradesh" has been accepted. The results brought out the fact that girls group of secondary school students with low anxiety score have more mean creativity scores than their counterpart girls’ group with high anxiety. But there is a reversal of it in case of boys group of secondary school students i.e. boys group with high anxiety score have more creativity scores than the boys group with low anxiety score.

16. Gender and Self-efficacy interaction came out to be significant. Therefore, the hypothesis, "There will be a significant gender differences in relation to self-efficacy among secondary school students of Himachal Pradesh" has been accepted. The results inferred that high self-efficacy girls’ group of secondary school students have more mean creativity score than low self-efficacy girls’ group but there is a reversal of it in the case of boys.

17. Interaction effect of Mathematical Attitude and Anxiety turned out to be significant and therefore, the hypothesis,
“There will be a significant mathematical attitude differences in relation to anxiety among secondary school students of Himachal Pradesh” has been accepted. The results explained that in case of low anxiety, group of secondary school students having more favourable mathematical attitude scores have higher creativity scores than their counterparts having less favourable mathematics attitude. On the other hand, in case of high anxiety, less and more favourable mathematical attitude does not contribute much in the difference of mean creativity scores.

18. Since interaction effect of Mathematical Attitude and Self-Efficacy turned out to be significant. Therefore, the hypothesis, “There will be a significant mathematical attitude differences in relation to self-efficacy among secondary school students of Himachal Pradesh” has been accepted. The results report that only high self-efficacy group of secondary school students shows differences in creativity with less and more favourable mathematical attitude i.e. the high self-efficacy group with more favourable mathematical attitude scores more than their counterparts having less favourable mathematical attitude. On the other hand, such differences are not significant in case of low self-efficacy group.

19. The interaction effect of Anxiety and Self-efficacy turned out to be non-significant. Thus, the hypothesis, “There will be a significant anxiety differences in relation to self-efficacy among secondary school students of Himachal Pradesh” has been rejected.

20. There was significant triple interaction effect of gender, mathematical attitude and anxiety. Therefore, the hypothesis, “There will be a significant gender, mathematical attitude, anxiety differences in relation to creativity among secondary school students of Himachal Pradesh” has been accepted. The results revealed that when seen conjointly with gender and anxiety, the
difference between less favourable mathematical attitude and more favourable mathematical attitude became true for secondary school boys both at high and low levels of anxiety. In case of girls, only low level of anxiety shows significant differences but at high level of anxiety, there exists a non-significant difference in the reverse order.

21. Triple interaction effect of gender, mathematical attitude and self-efficacy turned out to be significant. Thus, the hypothesis, “There will be a significant gender, mathematical attitude, self-efficacy differences in relation to creativity among secondary school students of Himachal Pradesh” has been accepted. The results explained that when seen jointly with gender and self-efficacy, the difference between less and more favourable mathematical attitude became true only for secondary school boys at low level of self-efficacy.

22. There is a significant third order interaction effect of gender, anxiety and self-efficacy. Thus, the hypothesis, “There will be a significant gender, anxiety, self-efficacy differences in relation to creativity among secondary school students of Himachal Pradesh” has been accepted. The results revealed that low anxiety group of students with high self-efficacy have significantly higher level of creativity than their counterparts with low self-efficacy. But in case of boys and girls, low and high self-efficacy does not show any significant difference in creativity score. In case of high anxiety, a level of self-efficacy plays a significant difference in creativity only in case of girls’ group. But in case of boys’ group such differences are not significant. In case of high anxiety level, boys with low self-efficacy score more than boys with high self-efficacy on mean creativity scores and for girls group, there is a reversal of it i.e. high self-efficacy score more than low self-efficacy group.

23. There is a significant third order interaction effect among
mathematical attitude, anxiety and self-efficacy. Thus, the hypothesis, “There will be a significant gender, anxiety, self-efficacy differences in relation to creativity among secondary school students of Himachal Pradesh” has been accepted. The results revealed that in case of high anxiety group, the mean difference on creativity between less and more favourable mathematical attitude groups of students is not significant. Similarly, such differences are non-significant for low anxiety group at low self-efficacy. However, more favourable mathematical attitude group of secondary students has significantly higher level of creativity than less favourable mathematical attitude group in case of high self-efficacy. It may be noted that the differences between less and more favourable mathematical attitude groups are much prominent when coupled with high self-efficacy in combination with low anxiety.

24. Self-efficacy is positively and significantly related to creativity of total group. Thus, the hypothesis, “There will be a significant positive relationship self-efficacy with creativity of secondary school students in Himachal Pradesh” has been accepted. The results also indicated that the self-efficacy is positively related to creativity in case of secondary school girls’ group and total group but there is a positive and non-significant relationship of self-efficacy with creativity in case of boys’ group.

25. Mathematical attitude is positively and significantly related to creativity. Therefore, the hypothesis, “There will be a significant positive relationship of mathematical attitude with creativity of secondary school students in Himachal Pradesh” has been accepted. The results also revealed that mathematical attitude is positively and significantly related to creativity both for boys and girls.

26. Anxiety is negatively and non-significantly related to creativity. So, the hypothesis, “There will be a negative relationship of
5.2 CONCLUSIONS

The following conclusions were drawn on the basis of the results of the study.

1. There is no significant gender difference in creativity of secondary school students, though the girls have tendency to be more creative than boys.

2. There is no significant difference in mean creativity scores of low and high anxious secondary school students, though less anxious ones tend to be more creative.

3. There is no significant difference in mean creativity scores of low and high self-efficacy secondary school students, though high self-efficacy students tend to be more favourable to creativity.

4. The secondary school students with more favourable mathematical attitude have significantly higher mean creativity score than those with less favourable mathematical attitude.

5. Though there is no significant gender difference in creativity of secondary school students, the girls have tendency to be more creative than boys. However, when there is an intervention of mathematical attitude, the boys group showed higher mean creativity scores than girls. Surprisingly, the girls group with less favourable mathematical attitude score high on mean creativity score than boys with less favourable mathematical attitude. Now, with this interaction of gender and mathematical attitude, when anxiety mediates in between, the difference of less favourable and more favourable attitude became true for secondary school boys both at high and low levels of anxiety. In case of girls, only low level of anxiety shows significant differences but at high level of anxiety, there exists a non-
significant difference but in reverse order.

6. Gender and mathematical attitude are dependent upon each other to explain creativity among secondary school students. Now with this interaction, when third variable self-efficacy interacts, the situation changes.
   a) In case of low self-efficacy group, the boys group with more favourable mathematical attitude have more mean creativity scores than boys with less favourable mathematical attitude but there is no such significant difference between less favourable mathematical attitude and more favourable mathematical attitude in case of girls’ group.
   b) However, in case of high self-efficacy group of secondary school students, the group both for boys and girls with more favourable mathematical attitude have higher score of mean creativity than less favourable mathematical attitude group. High self-efficacy boosted attitudinal differences for girls and vice versa to some extent for boys’ group.

7. Though gender and anxiety separately do not show any significant differences on mean creativity scores, but when there is an interaction of these two, they both depend upon each other to explain creativity. The girls’ with low anxiety group have high mean creativity scores than boys with low anxiety. However, the boys’ group with high anxiety surpasses girls with high anxiety on mean creativity scores. Now, when another psychological variable, self-efficacy, interferes between gender and anxiety, the situation changes.
   a) In case of low anxiety, the group of students with high self-efficacy has significantly higher level of creativity than their counterparts with low self-efficacy.
   b) In case of high anxiety level, boys with low self-efficacy have more score on mean creativity than their counterparts with high self-efficacy group. For girls’ high self-efficacy group
scores more than girls with low self-efficacy group.

8. Although there is no significant difference at anxiety level among secondary school students in their mean creativity scores, when mathematical attitude interacts with anxiety, more favourable mathematical attitude group scores significantly higher than less favourable mathematical attitude group but only in case of low anxiety. However, when self-efficacy intervenes between mathematical attitude and anxiety, there is a variation across situation.

a) In case of high anxiety group, the mean difference on mean creativity between less and more favourable mathematical attitude groups of students is not significant irrespective of the level of self-efficacy.

b) In case of low anxiety group, the mean difference on mean creativity between less and more favourable mathematical attitude group is not significant at low self-efficacy, but it is significant at high self-efficacy level.

9. Mathematical attitude is one of the major predictors of creativity among secondary school students. Self-efficacy came out to be a facilitator of creativity for girls’ group and not for boys’ group. Anxiety does not contribute to creativity of secondary school girls but acts as a facilitator for boys group.

5.3 EDUCATIONAL IMPLICATIONS

The present study was an effort to investigate self-efficacy, mathematical attitude and anxiety as correlates of creativity among secondary school students. The findings of the study have a number of significant recommendations that may be useful to teachers, teacher educators, parents, curriculum framework makers, educational planner and for school system as a whole. Following are some recommendations on the basis of the results of the study:

1. The result of this study indicated that there is a positive relationship between creativity and self-efficacy. As Bandura
had identified four specific sources of efficacy beliefs which are mastery experiences, vicarious experiences, verbal persuasion and arousal, verbal persuasions should be effectively used by parents and teachers for encouraging the learners to accomplish the tasks. Bandura pointed out that negative comment lowers down the efficacy expectations to greater extent than positive messages do on increasing efficacy. So, the educators should use positive verbal persuasions to bring about students’ success and must avoid negative comments. Mastery experience or past performance acts as one of the strongest predictors of achievement of an individual. Therefore, whenever an individual is feeling low about one’s own capability, he/she should be shown his/her prior achievements by the teachers and the parents. This will help the individual to regain his confidence. Ghosh (2007) pointed out that individual’s efficacy judgment can be increased through proper guidance and counseling and here, proficient modeling by parents, siblings and teachers can play an important role in fostering this important aspect. Self-efficacy beliefs are also affected by arousal or physiological state. Hence, teacher must provide comfortable and appropriate environment to the learners.

2. It is desirable for teachers and parents that they should constantly strengthen students’ self-efficacy and provide them with the space for the development of creativity. It has been reported in literature that there are some instructional strategies which teacher can use to increase students’ self-efficacy such as (a) reviewing lesson accomplishments from the previous day, posting the current lesson’s objectives prior to instruction, drawing attention to lesson objectives at the end of lesson (b) asking students to record each day on a calendar something new they learned that day or something at which they excelled (c) prompting students who perform poorly to
attribute their failure to lack of effort and encouraging them to try harder (d) drawing students’ attention to their growth and complimenting them on their specific skills (e) using student models early to demonstrate some aspects of a lesson to remind them that other students like themselves are mastering the material and therefore, they can master it also (Siegle and McCoach, 2007).

3. When students are trying new methods and approaches, teachers should provide them with guidance or assistance at the right time in order to trigger new ideas and achieve the expected goals. There is a need to reframe evaluation system also so that it will assess the creative aspect of cognitive skills. National Knowledge Commission (2005) recommended that in India, the pedagogy should be modified to impart creativity and global vision training. This commission also recommended that the system should move from examination based evaluation to more open assessment mechanisms. Memory, comprehension and creativity should be given equal importance in evaluation.

4. One of the major findings of the study is that there is a negative relationship between creativity and anxiety. It is important for teachers and school system to reduce the anxiety level of students by applying different techniques like: yoga, meditation, developing creative thinking. Passer et al. (2009) suggested that the possibility of implementing creative thinking techniques helps to lessen anxiety. This is important because creative thinking is a skill that produces the power of discovery and new thoughts and also helps to change negative feelings to positive and in turn, improves mental health when an unpleasant event occurs. Carlsson (2002) also found that creativity provides a defense mechanism to anxiety.

5. The results of the study revealed that out of selected variables, most powerful predicator of creativity in mathematics is
mathematical attitude and thus, it serves as the catalyst to execute mathematical problem solving or creative ability in mathematics. So, it the duty of the teachers to foster positive attitude towards mathematics which will increase the creativity of students in the same. Teachers should sympathetically interact with students to build confidence in the subject and thereby develop favourable attitude towards it. The curriculum planners must provide opportunities to develop positive attitude towards mathematics among students and should consider students’ interest when developing mathematical curricula. Some instructional strategies must also be made which will help to increase emotional disposition towards mathematics. Bonomo Cerda suggested that in developing mathematical attitude among the students, the teachers should encourage or provide the students for: self-study, activity and confidence in learning mathematics, having characteristics of being honest, hardworking, overcoming difficulty, disciplinal, and creative (cited by Marsigit, 2011).

6. As the mathematics syllabus now a days, has been divided into theory and practical work, school authorities and teachers should give opportunities to the learners for practicing unusual ways to solve problems so that their divergent thinking abilities can be developed and the practical work can be accomplished most effectively and innovatively. Projects, challenging questions and open-ended questions are some effective techniques to enhance divergent thinking. Teachers should adopt appropriate teaching methods and strategies that actively involve learners. It can be suggested that schools should provide a variety of mathematics resources like Mathematics Laboratory, Mathematics Library Corner, Mathematics Club, and Mathematics Park etc. to increase mathematical creativity. Dr. A.P.J. Abdul Kalam, the XI president of India said that the
curriculum and the education system of 21st century should emphasize on creativity, innovation, and entrepreneurship and management skills among students to make India happy, prosperous and strong.

7. Teacher education colleges must provide such curriculum and practical activities which help pupil teachers to inculcate the creative aspect in students which are the future citizen, scientists, economist, and leaders of our nation. Teacher educators must develop creativity in all teacher trainees so that they learn to foster it in the school students.

8. Mathematically creative children should be encouraged and motivated properly. All pupils can be creative if placed in a conducive environment (Sternberg, 2006). Cedillo and Santillan concluded that the teacher needs to frame classroom events according to the students’ way of reasoning instead of students following teachers’ ways of reasoning. Mathematical attitude and creativeness need to be promoted through posing and solving problems, argumentation, communication, and procedural skills (Cited by Marsigit, 2011).

5.4 SUGGESTIONS FOR FURTHER RESEARCH

1. The present study measured creativity in mathematical domain only and correlated it with selected psychological variables. Similar studies can be undertaken with other creativity domains viz. scientific, artistic, linguistic, performing arts etc.

2. The present investigation was undertaken on grade IX boys and girls of secondary school students. To validate the present findings of the study, a large sample at different age and grade levels like at primary level and secondary level may be drawn from all the districts of the state.

3. Path analysis studies may be undertaken to examine the direct and indirect effect between creativity, self-efficacy, mathematical attitude and anxiety.
4. Himachal Pradesh has large number of tribal population. So, the ethnographic studies may be undertaken to compare the creative behaviour of the tribal and non-tribal group of students.

5. Since human behaviour, especially creative thinking is a complex phenomenon to be understood by one, two or three socio-psychological independent variables a multitude of socio-psychological variables should be taken for both analytical and correlational studies to understand the phenomenon. Such kind of research should be further taken up across cultures to find out culture specific issues to facilitate nurturance of creative potential.

6. Other psychological variables like self-concept, technological creativity, critical thinking, emotional intelligence, achievement motivation can be added in research endeavor which may possibly correlate or predict creative giftedness vis-à-vis other gifted groups such as intellectually, academically and socially gifted students.

7. In the present study, creativity has been studied as a dependent variable; self-efficacy, mathematical attitude and anxiety as independent variables. Studies can be conducted by taking these variables in factorial designs to see effect of creativity in combination with other variables on self-efficacy, anxiety etc.

8. Mathematical attitude has been studied as a correlate of creativity. Attitude towards any other school subject like language, science, performing arts etc. can be studied which may facilitate creative potential to blossom.

9. The present study found that anxiety is negatively correlated to creativity. It has been reviewed in literature also that major studies found out that anxiety is negatively correlated with creativity. So there is a suggestion to conduct qualitative research for finding out the factors that contribute to anxiety
with the purpose of minimizing the incidences of its occurrence.

10. Bandura had found four sources of self-efficacy viz. mastery experience, vicarious experience, verbal persuasion and arousal or affective state. A study can be conducted to find out the relationship between these sources and creative ability in mathematics. Predictor of creativity out of these sources can be used at different stages of school education from primary to secondary level.

11. Experimental studies can be conducted to see the effect of mathematics laboratory in relation to some other socio-psychological variables on creativity.