CHAPTER - II
REVIEW OF RELATED LITERATURE

Review of research literature is an important and indispensable part for the execution of any research work. Best (1993) says, “A familiarity with the literature in a problem area helps the students to discover what is already known, what others have attempted to find out, what methods have been promising and disappointing and what problems remained to be solved.” In the present scenario, there is an expansion of knowledge. The reviews of literature help the researcher to avoid unnecessary duplication of work. It is an important step for execution of any research work before embarking on of a new research work.

Survey of the related literature for the present problem has been done from various resources like research articles published in journals, published books, M. Phil. /Doctoral dissertation, survey of educational research, online journals.

In the above context, it was appropriate to review the relevant facts regarding the variables under consideration. The review of literature has been grouped under sub categories.

2.1 Studies Related to Self-efficacy.
2.2 Studies Related to Mathematical Attitude.
2.3 Studies Related to Anxiety.
2.4 Studies Related to Creativity.
2.5 Studies Related to Inter Relationship of Variables.

2.1 STUDIES RELATED TO SELF-EFFICACY

Zinta (2006 a) in a study reported the effect of self-efficacy, test-anxiety and short-term intervention on problem solving. It was found that there existed no relationship between self-efficacy and performance.

Zinta (2006 b) investigated the impact of rural and urban
background on performance among high and low self-efficacious students. The results revealed that there was a non-significant difference in the performance of boys and girls with high and low self-efficacy within urban and rural settings. Furthermore, it was reported that there were highly significant differences between performances of males and females with high and low self-efficacy in rural and urban settings.

Guardia (1993) conducted his study to examine the validity of task specific and general measures of physical self-efficacy in a competitive sports setting and how these measures related to anxiety and actual running performance. Forty seven members of a running club and sixteen members of a university track teams completed measures assessing general and task specific self-efficacy, anxiety and training experience. They were asked to run three running events. Associations among these variables and running performance examined by correlation and regression analyses indicated that race finishing time was significantly related to a number of training variables, predicted performance and measures of self-efficacy; however, state and trait anxiety were not significantly related to pace of race. Results suggested that a task specific measure of self-efficacy was the better predictor of performance in a race than a general measure of self-efficacy.

Pajares and Miller (1994) examined the role of self-efficacy in mathematical problem-solving and found that mathematics self-efficacy was the best predictor of problem-solving out of the selected variables, namely, self-concept, perceived usefulness of mathematics, prior experience with mathematics and sex of the student.

Junge and Dretzke (1995) in their study on mathematical self-efficacy and gender differences in gifted/talented adolescents found that usually, boys had more perception of self-efficacy than girls.

Pajares (1996) conducted a study and reported that the gifted girls were found to surpass gifted boys in performance but did not
differ in self-efficacy. Moreover, gifted students reported higher mathematical self-efficacy and lower mathematical anxiety than regular education students.

Malpass et al. (1999) conducted a study to find out the effect of sex and self-efficacy on mathematics achievement and found that self-efficacy was positively related to achievement and males had more mathematics self-efficacy than females.

Katalin (2003) researched to examine relationships between VIth and VIIth grade students’ (N=651) mathematics self-efficacy, academic self-concept, and mathematics achievement, as well as the extent to which mathematics self-efficacy and academic self-concept predicted math achievement. Results indicated moderate correlations between mathematics self-efficacy, academic self-concept, and mathematics achievement. Prediction of math achievement by math self-efficacy and academic self-concept differed by grade ethnicity. For white students, math self-efficacy was a stronger predictor of mathematics achievement regardless of the grade level. For VIth grade Hispanic students, academic self-concept predicted math achievement while math self-efficacy was not a significant predictor. At both grade levels, Hispanic students solved fewer mathematics problems correctly than the white students.

Douglas (2005) tested Bandura’s (1977) theory of self-efficacy by utilizing the predictor variable of teacher age, gender, grade (s) instructed, years of teaching experience, level of education attained, number of students with an active IEP present in the classroom at the same time, and the areas of inclusion classes in five rapidly growing school districts located in the Monroe and Pike country area of Northeastern Pennsylvania. Teacher’s sense of Efficacy Scale (TSES) was used for the purpose. Multiple regression results demonstrated that area of certification predicted self-efficacy level. Those teachers with special education certification scored significantly higher on the TSES than those with only regular education certification.
Lloyd et al. (2005) investigated the sex differences in performance attribution, self-efficacy and achievement in mathematics and claimed that self-efficacy showed no significance difference between the sexes. Further, the study revealed that girls tended to be under-confident relative to their actual academic achievement whereas boys tended to be relatively over-confident.

Beghetto (2006) had examined correlates of creative self-efficacy (i.e., self-judgment of creative ability) in middle and secondary students (N= 1,322). Results indicated that students’ mastery- and performance- approach beliefs and teachers feedback on creativity ability were positively related to students’ creativity self-efficacy. Creativity self-efficacy was also linked to students’ reports of their teachers not listening to them and sometimes feeling that their teachers had given up on them. Students with higher levels of creativity self-efficacy were significantly more likely to hold more positive beliefs about their academic abilities in all subject areas and were significantly more likely to indicate that they planned to attend college than students with lower levels of creative self-efficacy. Finally, students with higher levels of creative self-efficacy were significantly more likely to report higher levels of participation in after-school academics and after-school group activities.

Victoria (2006) examined the relationship between academic self-efficacy and the first year’s grade point average of freshman level student. It explored the development of students’ perceived self-efficacy focusing on demographic variables such as parent and sibling, college attendance and graduation; in addition, students’ beliefs in their ability to persist through college until graduation were explored. The results indicated that there was a low positive correlation between self-efficacy and year’s grade point average. Further, a relationship between self-efficacy and 1st year’s grade point average existed for females but not for males. Lastly, for white students, a relationship existed between self-efficacy and Grade Point Average (GPA). No
significant relationship existed between those factors for non-white students.

Gosh (2007) conducted a study on academic self-efficacy and achievement in a group of siblings in primary schools. It was found that self-efficacy beliefs in the area of arithmetic and reading comprehension were significantly related with achievement in that area for both younger and older brother. There was also low but positive relationship between the two groups of siblings (younger and older) with respect to academic performance in reading comprehension as well. Thus, it could be concluded that older siblings’ characteristics like efficacy beliefs and academic performance influenced favourably younger siblings’ personal efficacy and performance.

Hui-Jen Yang et al. (2007) examined the impact of language and internet usage anxiety and self-efficacy on the intended uses of internet site, respectively. It was also studied that whether internet/language self-efficacy would mediate the effects of internet/language anxiety on the intention of the internet site. A valid sample of 368 undergraduates was tested in this study. The analysis mostly supported the model tested. The results displayed that the anxiety of language and internet use had significantly influenced self-efficacy on internet use and language respectively. Anxiety about language and internet use had also significantly influenced the intention to use the internet site individually. Furthermore, language self-efficacy had significantly influenced the intention to use internet site, but internet self-efficacy had not.

Marriner (2007) designed a study to analyze the components of Rezuelli’s enrichment trait, which was comprised of above average ability, creativity and for this study, self-efficacy, to gauge its possible use as a predictor of academic success. The analysis of the data illustrated that high school grade point average and self-efficacy scores were strongly correlated to first year grade point average both
as individual variables and when they were combined. Additionally, when self-efficacy measures were broken down into their separate components; it was revealed that the technical sub scores correlated more weakly. Achievement scores were not found as valuable a predictive measure as high school grade point average.

Boldaji (2008) found that the mathematics and physics students had higher self-efficacy beliefs when compared with students of other fields. It was also concluded that female students’ self-efficacy belief was more than that of the male students.

Hudson (2008) examined self-efficacy and the characteristics of resilience with respect to academic performance of college students under special criteria. The major findings were that the self-efficacy combined with parental involvement was found to be an important predictor of the academic performance of college students admitted through special criteria.

Vancouver et al. (2008) concluded that consistent with a multiple goal process conceptualization, self-efficacy was found to relate positively to directing resources towards a goal but negatively to the magnitude of resources allocated for accepted goals.

Phan (2010) in his study revealed that the students’ critical thinking can be foreseen by means of their self-efficacy. It was found that there was a close relationship between individuals’ self-efficacy and critical thinking.

Paul et al. (2014) in their exploratory study found the experiences of college students on the autism spectrum by examining disability identification and self-efficacy. Results indicated that nearly one-third of the students did not report themselves as disabled or having special need. Two-third of the population considered themselves to have a disability or special need. It was also found that identity and self-efficacy measures were not significantly associated with each other.

Shelangoski et al. (2014) in their study on self-efficacy in
intercollegiate athletes found that student-athletes had high levels of self-efficacy. Males possessed higher level of self-efficacy than females. It was also revealed that more playing experience did not predict higher levels of self-efficacy.

William (2014) examined gender differences in self-efficacy. The results indicated that gender differences in self-efficacy were significant with boys holding a lower sense of self-efficacy than girls coupled with lower performance. Boys’ self-efficacy scores were significantly correlated with performance but this relationship was lower than that of the girls.

Zan et al. (2014) aimed his study to explore the coping strategies and the effect of self-efficacy of Chinese undergraduate nursing students when they faced stress in clinical practice. Self-report questionnaire, perceived stress scale, coping behaviour inventory and generalized self-efficacy scale were used to collect the data. It was found that self-efficacy had a positive main effect in predicting the frequency of use of staying optimistic and problem-solving strategies. Self-efficacy also moderated the effects of stress (from assignments and workload) on problem-solving strategy.

2.2 STUDIES RELATED TO MATHEMATICAL ATTITUDE

Rosaly (1990) found that the attitude of high school students towards the learning of mathematics and their achievements in mathematics were highly correlated and that urban boys and girls had more positive attitude towards mathematics than rural boys and girls.

Gill (1994) indicated that middle school and high school girls had positive attitude towards school but negative attitudes towards mathematics. It focused on gendering the separation of boys and girls of Australian schools through the study of 7th, 8th and 10th graders in co-educational programs as well as girls only schools.

Reck (1994) examined and compared the mathematical attitudes of groups of elementary and junior high school black students by grade level, gender and degree of academic success. This
research found that students in the upper achieving group possessed the greatest potential for success in mathematics, but too often their self-concept and enjoyment were low and their anxiety was too high for them to reach their full potential. Males possessed significantly more positive attitude than females (cited in Parida, 2010).

Swetman (1995) showed that girls’ positive attitude towards mathematics declined as they grew older. Initially, girls had more positive attitude towards mathematics than boys did, but as they continued in school, girls’ attitudes became more negative. In order to improve girls’ performance in mathematics, teachers needed to facilitate positive attitude in girls towards mathematics.

Wangu and Thomas (1995) assessed the attitude of high school students towards the achievement in mathematics and revealed that there was a significant positive correlation between attitude and achievement in mathematics.

Patel (1997) in his study found that sex was a significant factor in developing the attitude towards the study of mathematics. It was also revealed that the boys had more positive attitude than girls. The urban area students were more positive towards mathematics than that of rural one.

Al-Furachi and Ali (2004) investigated the relationship between students’ attitude towards learning mathematics and math’s achievement with respect to gender in 10th grade students in Riyadh, Saudi Arabia. It was also examined if there was any difference between gender, attitude towards learning mathematics and mathematics achievement. Three instruments were used in the study to collect the data; a Math Achievement Test (MAT) consisting of items selected by the researcher from the 2000 Ohio Graduation Practice Test, an attitude questionnaire (ATM), which was developed by Taylor (1997) from the Aiken scale (1976), and students interviews developed by the researcher. In addition to descriptive statistics, by using Wilks’ Lambda test, the overall result indicated that there was no significant
difference between male and female students in the 10th grade in a combination of students' attitude towards learning and mathematics achievement where $F=0.044$, $p=0.957$. Also, by using the Pearson correlation and scatter plot, it was found that there was no significant correlation between the two dependent variables which were attitude towards learning mathematics and mathematics achievement. The main recommendations were for teachers to give more attention to students' attitude and mathematics achievement in their teaching and curriculum developers were strongly encouraged to consider students' interest when developing mathematics curricula.

XinMa and Jianymin (2004) conducted a study to determine the casual ordering between attitude towards mathematics and achievement in mathematics of secondary school students. The results showed that the achievement demonstrated casual predominance over attitude across the entire secondary school.

Jenkins (2006) conducted an action research on students of a VIth grade class in USA and found that most of the students had a negative attitude towards mathematics. It was also found that gifted children required to be given activities that involved mathematical interpretation and creative problem solving so that intrinsic interest in mathematics could be developed.

Thomas (2006) found that students using ILS (Integrated Learning System) for mathematics instruction under cooperative learning performed better on standardized tests and were more positive towards mathematics than those who worked on the same, but individually.

Saha (2007) conducted a study on gender, attitude towards mathematics, cognitive style and achievement in mathematics. It was found that all the three contributed to statistically significant difference in achievement in mathematics.

Farooq and Shah (2008) investigated “Students’ attitude towards mathematics” and concluded that the male and female
students of 10th grade of secondary school of Lahore had same type of attitude towards mathematics. It meant that gender differential had no impact on attitude of students towards mathematics in Pakistan.

Ravanann et al. (2008) found in their study that there was no significant difference in attitude of XI class students in Trichy district towards mathematics, owing to differences in their gender, region and medium of instruction. It was also found that there was a significant difference in attitude of XI class students towards mathematics owing to differences in their stream of study, types of school management and socio-economic status.

Kargar et al. (2010) investigated the relationship between mathematics anxiety, attitude towards mathematics and mathematical thinking among university students. The results indicated that a significantly high positive correlation existed between mathematical thinking and mathematical attitude. There was a negative moderate correlation between mathematical thinking and mathematics anxiety. There was also a negative correlation between mathematics anxiety and mathematics attitude. In conclusion, these findings indicated that level of mathematics anxiety was related to mathematical thinking and mathematics attitude.

Tahar et al. (2010) conducted a research to determine the criteria and sub-criteria that was considered important in measuring students' attitude towards mathematics. Factor analysis was carried out to identify the groups among criterion. The findings showed that there were five criterion that influenced students' attitude towards mathematics, namely, interest in mathematics, 6 sub-criteria for anxiety towards mathematics, 5 sub-criteria for self-efficacy, 3 sub-criteria for extrinsic motivation and 2 sub-criteria for students' self-concept. The analysis showed that total percentage of variation explained was 58.28% and with 0.88 Cronbach's Alpha reliability test.

Mohd and Mahmood (2011) investigated the effect of attitude towards problem solving in mathematics achievement. The findings
showed that there was a significant contribution of overall attitude in problem solving on mathematics achievement. On the other hand, the findings showed that there were significant relationships between gender, attitude towards problem solving and in mathematics achievement.

Chaudhary and Das (2012) in their study “Influence of arithmetical ability, attitude towards mathematics and study habit on the achievement in mathematics at the secondary stage” and found that attitude towards mathematics and achievement in mathematics were significantly related.

Mahanta and Islam (2012) studied the attitude of secondary school students towards mathematics and its effect upon mathematics achievement. They found that boys show more positive attitude towards mathematics than girls. Also, attitude of students and achievement were positively correlated.

Mahanta (2012) found that the students’ attitudes towards mathematics were positive. Many of the participants in the study believed that mathematics was an important subject which would help them in their future career.

Ralhan (2014) found that the attitude of students of 9th class towards geometry was favourable. There existed no significant difference between the attitude of boys and girls towards geometry. The study also revealed that the high, average and low achievers in geometry did not differ significantly on attitude scale.

2.3 STUDIES RELATED TO ANXIETY

Wigfield and Meece (1988) in their longitudinal investigation of children’s beliefs, attitude and values concerning mathematics provided the evidence for two components of mathematics anxiety: a negative affective reactions component and a cognitive component. The affective component of math anxiety was related more strongly and negatively than did the worry component to children’s ability, perceptions, performance perceptions, and mathematics performance.
Hembree (1990) in his study “The nature, effect, and relief of mathematics anxiety” revealed that students who had a high level of mathematics anxiety had lower levels of mathematics achievement. It also found that mathematics anxiety created constraints in mathematical tasks.

Lewinsohn et al. (1998) in their study “Gender differences in anxiety disorders and anxiety symptoms in adolescents” revealed that there was no gender difference in vulnerability to anxiety disorders. The results rather were that the female vulnerability to anxiety was associated with some type of genetic rather than purely environmentally determined gender difference.

Ashcraft (2002) arrived at the conclusion that there was a negative relationship between individuals’ hardiness scores and mathematics anxiety.

Croley (2004) explored the perception which VII grade mathematics anxious females had about the factors that caused and alleviated their mathematics anxiety. The qualitative case study consisted of a series of interviews of 25 seventh grade females whose score on the MARS-A survey indicated that they had mathematic anxiety. There were three in-depth semi-structured group interviews. The first interviews focused on the participants’ life history of math’s anxiety, the second interview focused on reconstructing the details of the participants’ experience with mathematics anxiety, and the third focused on encouraging the participants to reflect on the meaning of their experience and the ways their mathematics anxiety could be relieved. Participants reported that math’s began early and, for some, fluctuated over the years. They listed the most influential factors for both producing and reducing mathematics anxiety as (i) teachers, (ii) behaviour of classmates, (iii) class room atmosphere, (iv) mathematics curriculum and (v) parents and siblings.

Udo et al. (2004) in their study “Science anxiety and gender in taking general education science courses” and found that science
anxiety was a cohort consisting mostly of non-science majors taking general education science courses. Regression analysis showed that the leading predictors of science anxiety were: non science anxiety and gender.

Chapell et al. (2005) conducted a research on 5551 undergraduate and graduate students and found that there was significant difference of academic achievement among low, moderate and high level of test anxiety. It was concluded that students with low anxiety had higher academic achievement than students with moderate and high levels of test anxiety. Also, students with moderate test anxiety had more academic achievement than students with higher test anxiety.

Garry (2005) conducted a study on “The effect of mathematics anxiety on the course and career choice of high school” and found that girls experienced more level of mathematics anxiety than boys.

Kathleen (2007) explored nursing students’ mathematics anxiety, belief about mathematics and mathematics self-efficacy in relation to performances on a medication mathematics test. Results revealed that the participants experienced some mathematics anxiety and had positive beliefs about mathematics and mathematics self-efficacy. Qualitative responses indicated that participants worried about the consequences of failing the medication mathematics test and that practice helped to reduce this anxiety. In addition, participants acknowledged the importance of correct dosage calculations for nursing practice.

Roty (2008) examined the relationship between mathematics anxiety and emotional intelligence. A sample of 63 undergraduates enrolled in an evening and weekend bachelor degree program at a private Southeastern university completed assessments of emotional intelligence and mathematics anxiety. Mathematical anxiety was measured using the Attitudes Towards Mathematics Instrument (ATMI) developed by Tapia and Marsh. Emotional intelligence was
measured by Mayer, Salovey, Caruso, Emotional intelligence test (MSCEIT). Correlation analysis revealed that a significant positive relationship existed between total ATMI scores and total MSCEIT scores as well as between ATMI area scores and MSCEIT branch core pairing. The result suggested that students would benefit from having access to emotional Intelligence coaching. Experiments of the effect of emotional intelligence coaching on mathematics anxiety could be conducted.

Karimi and Venkatesan (2009) revealed that there existed a negative significant correlation between mathematics anxiety and mathematics performance. This study also found that females scored slightly higher than males on mathematics anxiety scale. But no significant difference was found for gender on mathematics performance.

Talib et al. (2010) determined the relationship between test anxiety and academic achievement. Results showed that there was a significant negative correlation between academic achievement and test anxiety among high school students.

Vitasari et al. (2010) in their study “The relationship between study anxiety and academic performance among engineering students” and found that there was a significant correlation between high end of anxiety and low academic performance.

Devine et al. (2012) found that no gender difference emerged for mathematics performance but mathematics anxiety and test anxiety were higher for girls than boys. Girls and boys showed a positive correlation between mathematics anxiety and test anxiety with mathematics performance, but the relationship was stronger for girls than for boys. Regression analysis revealed that mathematics anxiety was a significant predictor of performance for girls but not for boys.

2.4 STUDIES RELATED TO CREATIVITY

Wallach and Kogan (1965) in their study on 151 children, 10 majors’ of intelligence and creativity were found to have an average $r =
0.09 and found that creativity and intelligence are essentially unrelated.

Gowalker (1986) studied the scientific attitude, creativity and achievement of tribal students of Rajasthan. The sample consisted of 270 tribal and 270 non-tribal students of IX and X classes offering science as optional subject and living in tribal areas. Mehdi’s verbal and non-verbal test of creative thinking was used for measuring creativity. This test consists of fluency, flexibility, originality and elaboration components. Results reported that in verbal creativity, the non-tribals excelled the tribals in all components except flexibility and in non-verbal creativity, the performance of non-tribals was better in all components without any exception.

Xiaoxia Ai (1999) studied the relation between creativity and academic achievement, to see if this relation might be different for boys and girls. The two research questions were (a) What is the relation between different aspects of creativity and different subject areas of academic achievement? and (b) Are there any differences for boys girls in terms of the relation between different aspects of creativity and different subject areas of academic achievement? The students were from 68 schools, randomly selected from the Basque County, Spain. Among these 2,264 students, 38% were boys and 62% were girls. Three creativity batteries, the Torrance Tests of Creative Thinking (TTCT; Torrance and Ball, 1984), the Abedi-Schumacher Creativity Test (CT; ONeil, Abedi, and Spielberger, 1994), and the Villa and Auzmendi Creativity Test (VAT Auzmendi, Villa, and Abedi, 1996), were administered to the students. Teachers were also asked to rate students’ creativity. Academic achievement was operationalized by students’ self-report of their achievement in subject areas: Spanish, Basque, English, natural science, social science, and mathematics. By canonical correlation analysis, the following results were found: If operationalized by the teacher’s ratings, creativity was related to academic achievement for both boys and girls. For boys, flexibility was
the predominant factor that related to all 6 academic subject areas. For girls, elaboration related to 4 of the academic subject areas (Spanish, Basque, English, and social science), and fluency related to natural science and mathematics. If operationalized by the other 3 measures (TTCl, CT and VAT), however, creativity was barely related to academic achievement.

Gardunio (2001) investigated gender differences in self-efficacy, attitude toward mathematics and achievement of 48 gifted seventh and eighth grade students after participating in a two week course on probability and statistics that was taught with a mathematical problem-solving approach using heuristic strategies. A pre-test and post-test control group design was used. The result indicates that no statistical differences in achievement or self-efficacy were found in the group. Statistically significant differences in attitude towards mathematics were found favouring students in the whole-group instruction, competitive settings.

Fleith et al. (2002) in their study investigated the effects of a creativity training program, New Directions in Creativity, on students’ divergent thinking abilities and self-concept in monolingual and bilingual elementary classrooms. The sample consisted of 6 monolingual and 6 bilingual classrooms from a school in New England. The bilingual classrooms consisted of Brazilian students. Descriptive discriminant function analyses were used to investigate differences between treatment and control group with respect to divergent thinking abilities and self-concept. Qualitative procedures were used to analyze data from interviews with teachers and students who participated in the program. The findings indicated that the creativity program slightly improved the divergent thinking abilities of students in the treatment group. The results also indicated that the effect of the creativity program on the self-concept of students in the treatment group was small, and the control group students experienced a decline in self-concept between pretest and posttest.
Placement in monolingual or bilingual classrooms was not related to students’ divergent thinking abilities and self-concepts. Qualitative analyses generated 3 core categories that help explain how the creativity training program and the school environment influenced students’ divergent thinking abilities and self-concept: (a) the implementation of the creativity training program, (b) the degree of bilingualism of Brazilian students, and (c) cultural issues.

Banerjee (2003) found that grade-wise comparison of creativity showed students of class VII to be relatively higher in creativity than class VIII students. Cognitive style and self-concept revealed no difference due to grades. Gender-wise comparison revealed that boys had a higher self-concept than girls, but lower in overall creativity scores and more field dependent than girls. There was a significant correlation between creativity and cognitive style and creativity and self-concept. The factors discriminating between high, moderate and low creative were fluency, both verbal and non-verbal elaboration and originality.

Eisenberger and Shnock (2003) concluded on the basis of their study that rewards for novel performance increased intrinsic motivation and creativity, whereas rewards for conventional performance decreased intrinsic motivation and creativity. Creative motivational orientation, enhanced by rewards, strongly affected innovative performance.

Lee et al. (2003) revealed the relationship between Mathematical Creative Problem Solving Ability Test and Torrance Test of Creative Thinking and found that there was a correlation between the originality of general creativity and the three elements: fluency, flexibility, and total of mathematical creativity.

Hong and Yvette (2004) compared cognitive and motivational characteristics of high school students who were academically gifted in math, creatively talented in math, and non-gifted. Whereas no differences were found among the three groups in their beliefs about
ability, most of the other characteristics examined in the study distinguished the three groups. Academically gifted female students reported expanding more effort than did academically gifted male students. Creatively talented males put forth more effort than academically gifted males, and the creatively talented in general used more cognitive strategies than academically gifted. Overall, students who were either academically gifted or creatively talented in mathematics perceived that they were self-efficacious in general, used cognitive strategies, perceived their math self-efficacy to be high, and valued learning math more than their non-gifted age peers.

Mann (2005) found a relationship between mathematical experience (knowledge and skills) and creativity in mathematics as measured by the Creative Ability in Mathematics Test to be positive. It was found that positive attitude towards mathematics was linked to mathematics creativity, while negative attitude towards mathematics reduced mathematics creativity.

Tracy (2005) revealed that teachers and students had different perspective concerning creativity. Teachers defined creativity, in cognitive terms, most often as problem solving. Students defined creativity in affective terms and they were emotionally attached to their products. Most students had one dimensional views of creativity and they were generally not aware of the complexities of researched creativity construct. The teachers agreed that creativity could be taught in classroom, but many students contended that teaching creativity would cause loss of their personal voice in favour of standardized formats and instructionalised concepts of creativity. The data allowed for an understanding of a particular group of teachers’ and students’ perspective on creativity. Findings highlighted the complexities inherent in the construct and possibilities for misunderstanding in the classroom.

Yoon (2005) compared the performance of academically talented Asian American and Caucasian 4th and 6th grade students on
measures of creativity and intelligence. Additionally, this study will investigated if there were any gender differences in measures of creativity. Seventy one Asian American students and seventy five Caucasian students participated in the study. The mean age of Asian American students was 10.37 (S.D. =.49) and the mean age of Caucasian students was 9.89 (S.S. = 0.78). There were 77 females and 69 males that participated. The participants administered two instruments. The Standard Progressive Matrices (SPM) was used to measure intelligence. The Torrance Tests of creativity thinking (TTCT) form A was used to measure creativity. ANCOVA and Pearson’s Product Moments Correlations were used to analyze the results. Findings of the study indicated that there were no statistical or practical significant differences in the measures of intelligence and creativity for race or gender. Additionally, findings suggested that there were no statistical or practical significant differences in measures of intelligence and creativity among the Asian American subgroups.

Ahmed (2006) aimed his study was to develop and validate the Scientific Creativity Test for the Vth grade students to identify scientific creativity in those students. A related purpose was to investigate the gender differences in scientific creativity. The Scientific Creativity Test consisted of three subtests: Problems and Solutions, Grouping of flowers, and Design an Experiment. The General Linear Modeling (GLM) repeated measures two way analysis of variance indicated no overall significant differences between males and females. An interaction effect, however, was found. Females performed better than males in subtest II (grouping of flowers) and slightly better in sub test III (Design and Experiment). In the analysis using the independent samples, t- test indicated no significant difference between females and males in the scientific creativity test except in four items. These differences were in favour of females.

Christine (2007) investigated the similarities and differences in
general, artistic, and scientific creativity between engineering and music students as 2 groups, respectively representing scientific and artistic domains. One hundred music and one hundred and five engineering students from a large Northeastern university completed measures of general creativity, music creativity, engineering creativity, and a demographic questionnaire. Results indicated that musicians scored higher in general and artistic creativity, with no significant differences in scientific creativity. Participants had higher levels of creativity as compared with normative data from previous studies. Gender, age, and specialization within major yielded no significant differences. Implications for creativity measures were discussed, including cognitive risk to tolerance.

Jaiswal’s (2007) study showed that achievement motivation had significant impact on scientific creativity of grade students irrespective of their boards: U.P. Board, C.B.S.E. board and I.C.S.E. Board. It was also obvious that highly motivated students had more creativity in comparison to less motivated students. It was also observed that there was no difference in scientific creativity and achievement motivation of grade students of three different educational boards.

Jaussi et al. (2007) studied and examined creativity at work by considering a new construct, creative personal identity, in conjunction with creative self-efficacy and a problem-solving strategy. Result of a field study suggested that creative personal identity explained variance in creativity at work above and beyond creative self-efficacy, but that the two did not interact. Results also indicated support for the interaction of the self-concept and a problem-solving strategy. The positive relationship between creative personal identity and creativity at work was stronger when individuals applied non-work experiences in efforts to solve work-related problems.

Metzel (2007) examined the relationship between creativity and resilience within the context of surviving a natural disaster. The results supported the importance of creative thinking as a possible
important component in recovering emotionally after adversity. Further, it was found that flexibility had a close significant main effect in a general linear model taking into account both mediator (extroversion) and moderator (ethnicity). Two sub-categories of creative thinking, flexibility and originality, were found to be significant predictors of resilience for the African American population but not for the Caucasian population in the study.

Franky (2008) found that creativity was positively and significantly related with intelligence and cognitive style for the total sample of Navodaya Vidyalaya students though they did not correlate for the sub samples of Navodaya Vidyalaya students.

Kim (2008) wrote an article in which she stated that the underachievement of gifted students might be tied to their inherent and unrecognized creativity. Apparently, many gifted students were underachievers and up to 30% of high school dropouts might be highly gifted. Beginning with the belief that those gifted under achievers might be highly creative this article first views that creativity could be a gift a much like intelligence. It then reviewed the typical characteristics of gifted underachievers and the similar characteristics of creative under achievers. Finally, it reviewed the studies and theories that had shown that when placed in an environment that fastens their needs with motivation, mentors, understanding, freedom and responsibility, underachievers can become highly creative and intelligent.

Pany (2008) found that the making familiar strange (MFS) approach of synectics model of teaching was effective in enhancing the creative thinking ability of the learners. The MFS approach of synectics model of teaching did not prove to be effective in enhancing the achievement motivation of the learners. The MFS approach of synectics model of teaching did not put any significant impact upon the achievement of the learners in the subject general science.

Sarsani (2008) studied and explored the relation between
measures of creative potential and cognitive and motivational variables, including students’ interest, perceptions, and classroom experiences. Surveys were administered to 373 students (N=373), along with 2 questionnaires, namely, the Students Information Sheet (SIS) and the Teacher Encouragement Scale (TES). The students were divided in 3 groups as high creative (HC), low creative (LC) and average creative (AC) on the basis of composite score on the test of creative thinking. The high creative students liked science and mathematics subjects at school level whereas the rest of the groups (average creative and low creative) preferred Indian languages Telugu and Hindi. Surprisingly, all the three groups disliked social studies subjects. The top 5 occupations chosen were doctor, teacher lawyer, engineer, and police constable. On comparing the 3 groups, it was evident that each group had similar aspirations. A high percentage of students, including the high creative, were found to be addicted to school achievement. They perceived academic failures as a bad experience in the class and struggled for academic excellence, which was their only goal interest in life. The highly creative students had more favourable attitudes towards teachers’ encouragement than the other groups.

Silvia (2008) assessed the relationship between latent creativity and intelligence variables, and model method variance shared by the creativity tasks. Consistent with past research, the latent originality and fluency variables significantly predicted intelligence. The relative magnitude (around r = 0.20) was consistent with the past research.

Bournelli et al. (2009) revealed that creative children often had difficulty in forming their self-concept because parents might suppress their creative ideas. The purpose of the study was to investigate the relationship between motor creativity and self-concept. Factor analysis for the self-concept measures revealed a motor creativity with the self-concept factors. It seemed that perceived material acceptance had a significant role in explaining children’s
motor creativity.

Naderi et al. (2009) examined creativity, age and gender as predictors of academic achievement \((N=153, \text{ male}=105 \text{ and female}=48)\). A multiple regression analysis revealed creativity, age and gender as low predictors of academic achievement.

Mattoo (2011) studied “Vocational interest and academic achievement of secondary school students at different levels of creative thinking ability – A comparative study” and concluded that scientific interest was seen to go with high creative. The variable of gender seemed to contribute in scientific interest of the subjects. High creative were found to be higher in their academic achievement than low ones.

Siddiqi (2011) conducted a study “A comparative study of creativity among boys and girls of class VII” revealed that boys did not differ significantly in all the variables of verbal creativity, except the measure of originality from the girls.

Al-Srour and Al-Oweidi (2013) conducted a study to investigate the level of creativity among management employees, academic staff and artists and its relationship with gender, practical experience and age. The sample of the study consisted of 272 participants, 164 management employees, 18 academic staff and 90 artists. The findings of the study showed that the highest performance on the creativity test was for academic staff followed by artists and finally, employees. It was also revealed that there were significant statistical differences for the level of creativity on the total sample attributed to gender in the favour of females.

Cheung and Lau (2013) conducted a study in which the Wallach-Kogan Creativity Tests were translated into Chinese and later fully computerized for research in Hong Kong. The normative data of two Cohorts (1994 and 2002) of school children were employed to test the hypothesis that growth in creative thinking occurs in a society or culture during a period of education and curricular reforms that
emphasize creative thinking. Results of multivariate analysis of variance and subsequent univariate analysis supported the hypothesis. Moreover, some interesting gender differences in creativity growth were observed, underlining the fact that boys and girls should be treated differentially to obtain a desirable creativity growth for them.

Sayed and Mohamed (2013) attempted to explore gender differences in divergent thinking and the effect of gender-grade level interaction on divergent thinking. The sample consisted of 901 (367 boys and 534 girls), upto 6th grade, who were recruited from 7 co-educational schools in various rural and urban school districts in Southern Egypt. The students’ divergent thinking was assessed using the Test of Creative Thinking-Drawing Production (TCT-DP), a non-verbal measure of creative potential. The results of the study indicated no gender differences in divergent thinking, but the grade level effect was statistically significant, as was the interaction effect between gender and grade level (in 3 of TCT-DP subscales).

2.5 STUDIES RELATED TO INTER RELATIONSHIP OF VARIABLES

Arora (1976) found that anxiety appeared to be an essential prerequisite for optimum functioning of creative potential. Among women trainees, creativity was negatively related to anxiety and curvilinearly related to creativity in the case of males.

Gakhar (1984) ascertained that there was a significant negative relationship between creativity and test anxiety. It was also inferred that creative training in its interaction at low and average anxiety levels produced the best effect whereas high anxiety level seemed to degenerate the conducive effect when interacted with training method (without reinforcement) on creative responding. Average anxiety level seemed to best facilitate the training effect on the creative performance.

Kumar (1990) found out that there was a positive but moderate
relationship between attitude towards mathematics and mathematical creativity. The relationship of various dimensions of attitude towards mathematics, viz., enjoyment, motivation, importance and freedom from fear of mathematics with mathematical creativity were also found significant.

Carlson (2002) investigated the difference in anxiety level and defense mechanisms between differently creative people. Two extreme groups that scored either very high or very low on a test of the creative function were selected from a large cohort (N=60). Each group consisted of 12 male undergraduate students who took a test of defense mechanisms and completed anxiety inventories. The results showed that the high-creative group had more anxiety than the low-creative group. The high-creative group also used a greater number of different defense categories than the low-creative group. The number of defense categories was positively correlated with a fluency measure in the creativity test. These results were discussed in terms of variability in basal arousal, flexibility, and a creativity defensive style.

Gakher (2003) reported the abilities involved in problem solving task and mathematical creativity to be the function of divergent thinking, whereas anxiety was found to be insignificantly correlated with mathematical creativity.

Kabiri and Kiamanesh (2004) found that mathematics achievement and mathematics self-efficacy played the most important role in students’ mathematics achievement and math attitude. The direct and indirect effect of math attitude revealed that this variable passed its effect on math achievement through mediator variable such as self-efficacy and math anxiety.

Sam et al. (2005) in their study examined differences in computer anxiety, computer self-efficacy, attitude towards the internet and reported use of the internet for undergraduates with different demographic variables. It was found that undergraduates had a moderate computer anxiety, medium attitude towards the internet,
and high computer self-efficacy. There were no significant relationships between computer anxiety and attitude towards the internet with computer self-efficacy. However, a significant relationship between computer anxiety and attitude towards the internet was found.

Singh and Kaur (2005) found that creative students possessed higher level of achievement motivation and lesser anxiety levels than their low creative counterparts and socio-economic status was found to play a role in moderating the relationship of creativity with test anxiety.

Marie (2006) investigated the prevalence of test anxiety and locus of control orientation in three groups of middle school students: Achieving-gifted (AG), Underachieving-gifted (UAG), and Non-gifted (NG) students. Two instruments were used in the study: The Test Anxiety Inventory (TAI) and the Children’s Nowicki-Strickland Internal External Control Scale (CNSIE). Participants completed the TAI by indicating their level of agreement with 20 statements that measured test anxiety symptoms before, during and after testing sessions. Although none of the groups received extreme scores on either instrument, a 3x2 MANOVA indicated a significant difference between the groups by gender and achievement classification (AG, UAG, and NG). UAG students were more externally oriented than AG students. There was also a significant difference in the locus of control orientation between achieving gifted and non-gifted students; non gifted students were more externally controlled than achieving gifted students. In regards to under achievers, males were more externally controlled than females. Regarding test anxiety, females consistently reported interventions to reduce test anxiety than males. Findings suggested the need to assist students in developing the thought processes that give them a sense of control over the events in their life, in particular, their academic performance.

Annie (2007) inferred that the students of IX standard varied in
respect of their anxiety, economic values and social values. Secondly, the boys and girls belonging to over achieving, under achieving and normal achieving groups differed in their verbal creativity. Thirdly, anxiety was negatively correlated with verbal, non-verbal, total creativity for over achievers and under achievers. Fourthly, values had no influence on verbal, non-verbal and total creativity for over achievers and under achievers of IX standard.

Cubukcu’s (2008) study showed that self-efficacy and foreign language learning anxiety aspects were uncorrelated and gender played no important role in terms of the anxiety level and self-perception rating of junior teacher trainees.

Prabhu et al. (2008) conducted a study in a university setting and found support for the potential mediating role of intrinsic motivation between creativity/openness to experience. As it was found that Self-efficacy was closely related to creativity with intrinsic motivation completely mediating this relationship. Extrinsic motivation moderated the relationship between self-efficacy/creativity and perseverance/creativity and had a negative association with creativity.

Pimta et al. (2009) concluded that attitude towards mathematics, self-esteem and teachers’ teaching behaviour played a direct factor to influence mathematics problem-solving while indirect factors influencing mathematics problem-solving were motivation and self-efficacy.

Byron and Khacanchi (2010) in their study investigated the relationship of state and trait anxiety to performance on figural and verbal creative tasks and found a negative relationship between anxiety and creativity.

Kurbanoglu and Akin (2010) examined the relationships between chemistry laboratory anxiety, chemistry attitude and self-efficacy. The results revealed that chemistry laboratory anxiety was correlated negatively to chemistry attitudes and to self-efficacy. It was
also found that chemistry attitude was positively associated with self-efficacy. Self-efficacy predicted chemistry laboratory anxiety in a negative way. Also, self-efficacy had a direct and positive effect on chemistry attitudes which in turn affected chemistry laboratory anxiety. Finally, study also revealed that chemistry laboratory anxiety was explained negatively by chemistry attitudes.

Dhatrak and Wanjari (2011) concluded that a low correlation was found between scientific attitude and creativity. It was also found that scientific attitude and creativity were not necessarily related with sex.

Johny (2011) conducted a study to find out the correlation of attitude towards mathematics, gender and socio-economic status with mathematical creativity of secondary school students in Uganda. The selected components for attitude towards mathematics were confidence in mathematics, motivation in mathematics and anxiety in mathematics. The study revealed that the components of mathematical creativity like fluency, flexibility and originality were significantly different for high and low attitude mathematics students. The study also found that there was significant gender difference in mathematical creativity. Male students scored more on mathematical creativity than female students.

Shaabani et al. (2011) in their study revealed that the creativity and its component i.e. flexibility, fluency and elaboration (except for originality) as well as academic self-efficacy had a positive and significant relationship with critical thinking. Further, regression analysis showed that flexibility, fluency, elaboration and academic self-efficacy played a major role in predicting critical thinking.

Tabrizi et al. (2011) explored the relationship between creative thinking and anxiety and the results revealed no significance difference in anxiety level between girl and boy adolescents. Further, in their research, high correlation was found between creative thinking and anxiety.
Wu et al. (2011) in their study revealed that on the technological creativity for sports, athletes’ creativity and technological capacity had significant positive influence on self-efficacy.

Jha (2012) revealed in his study that there existed a significant difference among the mean scores of creativity of the high school students with different levels of intelligence. It was also found that there existed significant differences between the mean scores of creativity with different levels of anxiety. There existed no significant difference in creativity with respect to gender. It clarified that gender did not affect creativity. Also it was found that there existed a significant difference in creativity with different level of self-concept. Furthermore, it was found that there existed a positive and a very low correlation between self-concept and creativity. And also, there was a negative and very low correlation between anxiety and creativity.

### 2.6 OVERVIEW

Summarizing the review of related studies on the variable of self-efficacy, mathematical attitude, anxiety and creativity, it can be concluded that:

- Self-efficacy results indicated that girls had higher level of self-efficacy than boys (Boldaji, 2008 and William, 2014). However there was a study which revealed that boys had higher level of self-efficacy than girls (Shelangoski et al., 2014). Lloyd et al. (2005) claimed that self-efficacy showed no significant difference between sexes.

- Self-efficacy is studied in terms of gender, coping strategy, problem-solving strategy, performance, resilience, academic self-concept, critical thinking, mathematics achievement, academic performance, mathematical problem-solving, prior experience with mathematics, performance attribution, test anxiety, state anxiety, trait anxiety, anxiety (Pajares & Miller, 1994; Malpass et al., 1999; Katalin, 2003; Hudson, 2005; Lloyd
et al., 2005; Zinta, 2006 (a); Zinta, 2006 (b); Marriner, 2007; Boldaji, 2008; Phan, 2010 and Zan et al., 2014).

- Self-efficacy is studied in different domains viz., general self-efficacy (Malpass et al., 1999 and Zen et al., 2014), perceived self-efficacy (Victoria, 2006), mathematical self-efficacy (Katalin, 2003), internet language self-efficacy (Hu-Jen Yang, 2007), academic self-efficacy (Gosh, 2007), creative self-efficacy (Beghetto, 2006), physical self-efficacy (Guardia, 1993).

- From the perusal of the review it is found that researchers studied self-efficacy on different population: nursing students (Zan et al., 2014), intercollegiate athletes (Shelangoski et al. 2014), students studying mathematics, physics and other subjects (Boldaji, 2008), undergraduate students (Hu-Jen Yang 2007), group of siblings (Victoria, 2006 and Gosh 2007), middle, high and secondary school students (Beghetto, 2006 and Zinta, 2006 (a)), gifted and talented students (Junge & Dretzke; 1995 and Pajares, 1996).

- Self-efficacy has a positive effect in predicting problem-solving, critical thinking and is strongly correlated with performance (Pajares & Miller, 1994; Zinta, 2006 (b); Phan, 2010 and Zan et al. 2014).


- Attitude towards mathematics or mathematical attitude is
significantly related with achievement in mathematics (Chaudhary & Das 1995; Wangu & Thomas 1995 and Xi Ma & Jianymin 2004). It was also found that there was no significant correlation between attitude towards learning mathematics and mathematics achievement (Al-Furachi & Ali 2004).

- It is found that students’ attitude towards mathematics were positive (Patel, 1997; Mohd & Mahmood, 2011 and Ralhan, 2014). It is also reported that urban area students were more positive towards mathematics than that of rural one (Rosaly, 1990 and Patel, 1997). An action research work done by Jenksin (2006) on VIth grade student of U.S.A found negative attitude towards mathematics. In another study it is found that there is a significant difference in attitude towards mathematics and socio-economic status (Ravan et al. 2008).

- It is reported that gender has significant effect on mathematical attitude. Boys showed more positive attitude towards mathematics than girls (Reck, 1994; Patel, 1997 and Mathanta & Islam, 2012). But there is a study which reported that girls positive attitude towards mathematics decline as they grow older (Swetman, 1995).

There are some studies which reported that gender differential had no impact on attitude of students towards mathematics (Farooq & Shah, 2008; Ravan et al. 2008; Mohd & Mahmood, 2011 and Ralhan, 2014).

- The variables studied with anxiety are academic achievement (Chapell et al., 2005 and Talib et al., 2010) performance (Karimi & Venkatesan, 2009 and Devin et al., 2012) self-esteem (Croley, 2004), mathematics achievement (Hambree, 1990; Croley, 2004; Chapell et al., 2005; Kathleen, 2007 and Talib et al., 2010), emotional intelligence (Roty, 2008), hardiness score (Ashcraft, 2002).

- There is a significant negative correlation between academic
achievement and test anxiety (Hambree, 1990; Croley, 2004; Chapell et al., 2005; Karimi & Venkatesan, 2009 and Talib et al., 2010).

- Females mathematics anxiety score is higher than males (Garry, 2005 and Karimi & Venkatesan, 2009). But there is another study which revealed that there are no gender differences in vulnerability to anxiety disorders (Lewinsohn et al., 1998).

- Different types of creativity are studied viz., creative problem solving ability (Lee et al., 2003), creative ability in mathematics (Mann, 2005), scientific creativity (Ahmed, 2006; Christine, 2007 and Jaiwal, 2007), general artistic creativity (Christine 2007), Creative personal identity and creative self-efficacy (Jaussi et al., 2007), latent creativity (Silvia, 2008), technological creativity for sports and athlete creativity (Wu et al., 2011).

- Relationship with achievement motivation, resilience, creative self-efficacy, problem solving strategies, intelligence, intrinsic motivation, gender differences, academic achievement, anxiety, self-concept are seen in different domain of creativity (Xiaoxia Ai, 1999; Banerjee, 2003; Eisenberger & Shnock, 2003; Yoon, 2005; Ahmed, 2006; Jaissi et al. 2007; Jaiswal, 2007; Metzel, 2007; Sarsani, 2008; Naderi et al. 2009; Bournelli et al., 2009 and Jha, 2012).

- Gender wise comparison found that boys have lower creativity score than girls (Banerjee, 2003). But the study of Siddiqui, (2011) revealed that boys do not differ significantly in all the variables of verbal creativity, except the major of originality from the girls. However, there is no gender difference in case of creativity (Yoon, 2005; Ahmed, 2006; Christine, 2007 and Jha, 2012). Boys had more creativity score than girls (Johny, 2011).

- Creativity and intelligence are not related with each other (Wallach & Kogan, 1965 and Yoon, 2005). However, creativity is
positively and significantly related with intelligence (Franky, 2008 and Silvia, 2008).

- High creative have higher academic achievement than low ones (Mattoo, 2011).
- Creativity is low predictor of academic achievement (Xiaoxia Ai 1999 and Naderi, et al. 2009).
- Creative students possess lower anxiety level (Singh and Kaur, 2005). However, high creative group has more anxiety than low creative group (Carlson, 2002). It is also found that anxiety is the considered to be essential pre-requisite for optimum functioning of creative potential (Arora, 1976).
- There is a positive and moderate relationship between attitude towards mathematics and mathematical creativity (Kumar, 1990 and Johny, 2011). Low correlation was found between scientific attitude and creativity( Dhatrak & Wanjari, 2011)
- Self-efficacy is related to creativity (Prabhu et al., 2008), self-efficacy played important role in students’ mathematics achievement and mathematics attitude (Kabiri & Kiamanesh, 2004).

2.7 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 relations to self-efficacy, mathematical attitude and anxiety with creativity among secondary school students of Himachal Pradesh.