CHAPTER I

INTRODUCTION

“Creativity is often obvious in young children, but it may be harder to find in older children and adults because their creative potential has been suppressed by a society that encourages intellectual conformity.”


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 this 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) reported 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 reported by Marsigit (2011). Shaheen (2011) also reported 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’s (1991) findings 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.

1.1 CONCEPTUAL FRAMEWORK

1.1.1 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 is the core activity of any growing sector.

Roger (1959) expressed creative process as the emergence in action of a novel relational product growing out of uniqueness of the individual materials, events, people or circumstances of individual’s life; his openness to experience, an integral locus of evolution and the ability to toy with elements and concepts are associated with creativity.

According to Maslow (1968) creativity and self-actualization are one and the same. These two terms refers to the mental state characterized by freedom, atomism respectively, spontaneity and inner harmony which the individual experiences fully, vividly, selflessly and with full concentration and total absorption.

Creativity, sometimes, refers to creative potential, sometimes to creative production and sometimes to creative productivity. Creative
potential is the personal disposition of an individual that is describable in terms of collection of relatively enduring qualities that he possesses and that prepare him for creative thinking.

The term creative production does not necessarily mean tangible products. It refers to the process of productive thinking.

Creative productivity means quantity of output in the form of socially recognized product. In terms of basic sciences, it means another kind of quantity of output namely, number of responses of certain ideas, sentences or other products of generalized, psychological types.

Papalia and Olds (1993) defined that creativity is the ability to see things in a new way, to see problems that no one else may even realize to exist, and then come up with new, unique, and effective solutions to these problems. Standardized intelligence tests measure convergent thinking - the ability to come up with single correct answer. But creativity involves divergent thinking – the ability to come up with new and unusual answers (cited by Kaur, 2007).

Torrance (1969) saw creativity broadly as the process of sensing a problem, searching for possible solutions, drawing hypotheses, testing, evaluating and communicating the results to others. He added that the process includes original ideas, a different point of view, breaking out of the mould, recombining ideas or seeing new relationships along ideas (cited by Craft, 2001).

Wallach and Kogan (1965) viewed creativity as “individuals’ capacity or ability to generate cognitive associations in quality and uniqueness”.

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”.

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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:

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

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

c). 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.

Mackinnon (1963) identified three types of creativity (a) The product of creation as an expression of the inner states of the creator, e.g. his needs, perception, temper, evaluation etc. The art of poetry, painting, sculpturing and such other products find expression in the creative product of such creators, (b) The creator functions as a mediator between the externally defined needs and goals, the creator manipulates the environment and situations in such a way as to produce novel and unique product, e.g. scientific creativity, (c) Creativity which is not only an expression of the creator characterizing a very personal meeting the demands of the external problem e.g. the contributions of the inventors, sculptors, painters, designers,
architects and others to the society.

Zbigniew Pictrasinski (1969) describes three basic types of creativity (a) artistic, they create new aesthetic values (b) the scientific, the scientists discover unknown properties and laws in the realm of matter (c) technical, and they develop new and fruitful solutions to technical problems, in the form of complicated machinery or technological procedures. Self-directed learning, initiative, intuitive responses and emotional excitement facilitate the individual to become creative artistic, scientists, and inventors.

Amabile gave the three–component model of creativity and concluded that these three components increase creativity:

1) Expertise  
2) Creative skills  
3) Intrinsic motivation

Investment theory of Lumbart and Stenbergs 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 1.1: Person, Process, Product, Press](Source: Firestien (1993))
Rhodes (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.

**(i) Creativity as Person:**

Definitions in terms of ‘person’ refer to the person who is creative that is, in terms of physiology and temperament including attitudes, habits and values. Guilford (1963) defined that creativity is a combination of attitude factors and disposition that enables a person to use his importance in novel ways. Some personality-oriented psychologists conceive creativity in terms of the person. Considerations of the creative person typically fall into three general categories: (a) cognitive characteristics (b) personality and motivational qualities and (c) special events or, experiences during one’s development (Tardif and Sternberg, 1988).

- The cognitive characteristics can be grouped into three sets: the traits, abilities and processing styles that creative individuals use and possess (Tardif and Sternberg, 1988). (i) Traits that are associated with creative individuals include relatively high intelligence, originality, articulateness and verbal fluency, and a good imagination. (ii) Cognitive abilities include the ability to think metaphorically, flexibility and skill in making decisions, independence of judgement, coping well with novelty, logical thinking skills, internal visualization, the ability to escape perceptual sets and entrenchment in particular ways of
thinking, and finding order in chaos. (iii) the approach to problems (i.e. style) includes using wide categories and images, a preference for non-verbal communication, building new structures, questioning norms and assumptions in the domain, being alert to novelty and gaps in knowledge, and using existing knowledge as a base for new ideas.

- The most commonly mentioned personality or motivational characteristics are a willingness to confront hostility and take intellectual risks, being open to new experiences, curiosity and growth (Barron, 1988; Torrance, 1988), discipline and commitment to one’s work, high intrinsic motivation, being task-focused, a high degree of self-organization and competence in meeting optimal challenges (Hennessey and Amabile, 1988). Some additional characteristics mentioned less often include tolerance for ambiguity, a tendency to play with ideas, valuing originality and creativity (Walberg, 1988), unconventionality in behaviour, experiencing deep emotions, intuitiveness, seeking interesting situations and some degree of conflict between self-criticism and self-confidence (Barron, 1988).

- Environmental factors which stimulate home environment and provide diverse experiences.

(ii) Creativity as Product:

Creativity has also been defined in terms of products. These products should be novel, unique and useful. Product-oriented psychologists give primary importance to the product. If the product is considered creative, then the person who made it may be considered creative. The products of creativity can include behaviours, performances, ideas, things, and other kinds of output, through any channel or type of expression (Taylor, 1988). Parnes (1966) defined creative behaviour as that ‘which demonstrates both uniqueness and value in its product’. 
Creative products can be solutions to problems, responses to creativity tests, or explanations for phenomena. The products are novel - they are not imitations, nor are they mass-produced (Perkins, 1988, Taylor, 1988; Torrance, 1988).

Many researchers see creativity as the ability to bring something new into existence (Drevdahl, 1956; Dehaan and Havighurst, 1957; Maslow, 1959; May, 1959; Stein, 1960; Barron 1965; Johnson-Laird, 1993).

Stein (1963) has made product as the basic of his definition of creativity and defined creativity as that process which results in a novel work that is accepted as tenable or useful or satisfying by a group at some point of time. This definition emphasized both novelty and utility.

According to Isareli (1946), Drevdahl (1956) and Kavoli (1964) creativity is the capacity of the individual by which something new is produced, an idea or an object including a new form or arrangement of old element.

National Advisory Committee on Creative and Cultural Education (NACCCE, 1998) defined creativity as 'imaginative activity fashioned so as to produce outcomes that are both original and valuable (Jubert, 2001).

Creativity refers to skill in generating ideas and products that are relatively novel, high in quality, and appropriate to the task at hand (Sternberg, 2003).

(iii) Creativity as Process:

The orientation of process-oriented psychologists is towards understanding the process of thinking that leads to the emergence of creative products. If the creative process is understood, their efforts can be made to develop such thinking among children. Rogers (1954, 1959) defined the creative process "as the emergence in action of a novel relational product, growing out of the uniqueness of the individual on one hand, and the materials, events, people or
circumstances of his life on the other”. According to Ghiselin (1952), creativity is a process of change and development in the psychic life of an individual leading to invention.

Mackinnon (1962) argues that creativity is "a process extended in time and characterized by originality, adaptiveness and realization". A number of authors outline steps in creative thinking. For instance, Graham Wallas (1926) proposed four steps: preparation, incubation, illumination, and verification. Osborn (1948) proposed five stages which are similar to those of Wallas: orientation; preparation; analysis and ideation; incubation and evaluation. Rossman (1931) proposed seven steps in creative activity; need or difficulty is observed; the problem is formulated; available information is surveyed; solutions are formulated; solutions are critically examined; new ideas are formulated and the new ideas are tested.

The process approach to creativity is concerned with what actually happens in producing something, or what are processes involved in the creative act. A number of psychologists have proposed definitions of creativity which centre on the process of creativity. Among these are Torrance, Khatena, Mednick, Kubic and Koestler.

Torrance (1988), in his research based definitions described creative-thinking as the process of sensing difficulties, problems, gaps in information, missing elements, asking something new; making guesses and formulating hypotheses about these deficiencies; evaluating and testing these guesses and hypotheses; possibly revising and retesting them; and finally communicating the results.

Another process based definition of creativity is by Khetna and Torrance (1973), who has chosen to define originality rather than creativity. "Originality is the power of imagination to break away from perceptual set so as to restructure new ideas, thoughts and feelings into novel and meaningful associate bonds”.

Mednick (1964) had emphasized the importance of remote association in creativity. According to him creative thinking consists of
forming new combinations of associative elements, which combinations either meet specified requirements or are in some way useful. The more mutually remote the elements of the new combination, the more creative are the process or solution. Wallach and Kogan (1966) also agreed with Mednick and observed that creativity most appropriately refers to the ability to generate or produce.

(iv) Creative as Press (or Places)

In the context of environment it may be defined as environment or cultural influences that make a man creative. The process of manipulating the environment results in the production of new ideas, patterns or relationships through the interaction between persons and their environment. Creative places or environments include domains, fields and contexts.

Creative acts cannot be understood from a psychological perspective alone. The unit of analysis must be the individual as part of his or her cultural environment. According to the logic of part and whole structure, the primary focus must be on the cultural-historical context that makes the creative act possible and meaningful (Floistad, 1993). Particular social and historical contexts have been seen by some to be influential. Creativity can be viewed as an outcome of these (Csikszentmihalyi, 1988).

The definitions whether given in terms of person, product, or environment indicate that creativity includes four things: transformation, originality, adaptability and realization.

(v) Personality Characteristics of Creative Persons:

According to Eysenck (1993), the trait perspective was adopted by personality theorists. They made attempts to identify certain set of traits and their unique constellation through clinical and psychometric methods.

Taylor and Hollawd (1964) conducted a large number of empirical studies to determine the personality characteristics of highly
creative persons. Their results however have been contradictory depending upon the conceptualizations of creativity and personality formulated by different investigator and also depending upon the tools and methods employed and the samples studied by them. Nevertheless there has been a lot of evidence which suggests that creative persons are autonomous than others, more self-sufficient, more independent in judgement, more open to irrational in themselves, more dominant and self-assertive, complex, self-controlled and more introvert.

Creative persons possess personality traits like self-assertiveness, resourcefulness and adventurousness.

Roger (1954) defined that creativity is characterized by traits such as intuition and spontaneity with tendency to self-realization.

Van Zel St and Kerr (1954) found that creative persons are more imaginative, subjective, curious, impulsive, enthusiastic, original, confident, unconventional as well as less worrying, less inhibited and less contended than average people (Cited by Goyal, 1973). Drevdahl and Cattell (1958) found that creative scientists regardless of discipline were more dominant, had stronger motivation towards intellectual success, more withdrawn, self-sufficient, resourceful, introvert, strongly anxious. Aggarwal (1982) and Thandani (1983) found that creative persons possess high risk taking attitude. Gumeson (1964) indicates that the high creatives were more autonomous, dominant and aesthetical oriented. Amabile (1983) presented the intrinsic motivation hypothesis of creativity proposal that “The intrinsically motivated state is conducive to creativity, whereas the extrinsically motivated state is detrimental. The extrinsic constraints in the social environment could alter motivational state from intrinsic to extrinsic, and thus, undermine creative behaviour.

Traits such as unconventionality, high tolerance of ambiguity, willingness to take risks, determination and unwillingness to conform to accepted norms have all been identified as makes of creativity
(Sternberg, 1985, 1988a, 1988b; Sternberg and Lubart, 1995; Runco, 2004).

Creative children can be disruptive in class through asking too many questions, challenging accepted view and ways of doing things, and seeming to challenge the authority of the teacher (Torrance, 1981; Corpley, 1997; Ng and Smith, 2004).

Lubart (1994), Sternberg and Lubart (1991, 1995) have supported the importance of certain personality attributes for creative functioning. These attributes include willingness to overcome obstacles, willingness to take sensible risks, willingness to tolerate ambiguity and self-efficacy.

Strenberg and Lubart (1995) found that greater risk-taking propensity was associated with creativity for artwork but not for essays.

The intellectually talented, especially the creative adolescents, distinguished themselves in terms of exhibition of specific character as identified by Torrance (1975).

The salient characteristics of creative people are: adventurous, testing limits, attempting difficult tasks, asking questions about puzzling things, wants to know, courageous in convictions, curious, determined, emotionally aware, energetic, independent in judgment, independent in thinking, intuitive, never bored, persistent, preferring complex tasks, self-assertive, self-confident, self-sufficient, sense of humor, striving for distant goals, visionary, willing to take risk (Kaur, 2007).

Creativity may be applied in many areas of our life. It is not merely bound to art, dance or science. Its frame is very wide it is found in Agriculture, Athletics, Arts, Music, Poetry, Science, Mathematics Architecture, Engineering, Theatre, Marketing, Writing, Music, Technologies and so on.

Mathematics as an intellectual domain stands at or near the top of any hierarchical list of intellectual domains ordered according to
the extent to which creativity is evident in disciplinary activity or production. But it is ironic that for most students throughout the world, mathematics would almost certainly be among the set of school subjects least associated with creativity (Silver, 1997).

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).

Haylock (1987) has described problem solving ability as a creative ability in mathematics. Studies on the relationship between general and mathematical creativity were found to be positive, though there is no conclusive definition to creativity. However, it is suggested that
there are two approaches for identifying creative thinking in problem solving- the overcoming of fixation or the breaking of mental set, and determining the criteria for a product to be indicative of creative thinking such as flexibility, originality and appropriateness (Haylock, 1997).

1.1.2 Self-efficacy

Albert Bandura introduced the construct of self-efficacy almost three decades ago. Bandura (1986) defines perceived self-efficacy as people’s judgment of their capabilities to organize and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has but with the judgments of what one can do with whatever skills one possesses. Pajares (1996) defined self-efficacy in terms of individual’s perceived capacities to attain designated type of performance and to achieve specific results.

Schunk opined self-efficacy in the learning process as students’ judgment about their cognitive capabilities to accomplish a specific goal (Cited by Kaur (2008a)).

Fuller et al. (1982) defined self-efficacy as, “the individual’s perceived expectancy of obtaining valued outcomes through personal efforts”.

Barfield and Burlingame (1974) described efficacy as being derived from a personality that allows one to deal effectively with the world.

Stajkovic and Luthans (1998) defined self-efficacy as an individual’s conviction about his/her abilities to mobilize cognitive, motivational and behavioural faculties needed to successfully execute a specific task within a given context.

Bandura’s social cognitive theory (1986) postulates a triadic reciprocal interaction between an individual’s personal factors, environmental events and behaviour.
Cognitive, Affective and Biological Events are the domains of personality which form the basis of research in self-efficacy. Bandura (1977) proposed that efficacy expectations vary on three dimensions.

- **Level**: The number of tasks a person can do.
- **Strength**: How absolutely a person believes in an ability to perform each task.
- **Generality**: The extent to which the expectancy generalizes from one situation to the next.

Gupta (2013) quoted that behaviour can be predicted by predicting perceived self-efficacy (a person’s belief about the capabilities) over actual accomplishments, as self-efficacy determines what people will do with their knowledge and skills. Behaviour can sometimes differ widely from actual capabilities because of the
importance of perceived self-efficacy. For instance, talented individuals may suffer from extreme self-doubt, although they are quite capable of performing and exceeding the assigned task, while on the other hand, some individuals are extremely confident about what they can accomplish despite their credentials and limited skills. Bruce (2012) quoted that self-efficacy contributes to higher achievement, and higher achievement is interpreted by students as evidence that they have the ability to perform similar task in the future.

Bandura’s (1997) theory suggests efficacy beliefs are malleable, and he described four sources of information that contribute efficacy beliefs:

- **Mastery Experiences**: There are successes obtained from actual practice. It is the most important factor deciding a person’s self-efficacy. This can be explained as, ‘success raises self-efficacy, and failure lowers it’.

- **Vicarious Experiences**: It is also known as modelling. In this process people, compare themselves with other person, “If they can do it, I can do it as well”. Although vicarious experience or modelling is not as powerful as mastery experience source, it is a powerful influence when a person is particularly unsure of him/herself. When people see someone with similar ability succeeding at something, their self-efficacy increases and when they see such people failing, their self-efficacy will decrease.

- **Social Persuasions**: This is related to encouragement or discouragement. The positive persuasions increase the self-efficacy and the negative persuasions decrease the self-efficacy. It is easier to decrease someone’s self-efficacy than it is to increase it. Social/verbal persuasions are extrinsic motivation.

- **Affective State/Physiological Factors**: In unusual, stressful situations, people express nervousness, fear, nausea etc. These affective states influence efficacy and related behaviour. In general, a person with high self-efficacy will usually interpret
such physiological signs as normal and which will influence efficacy and related behaviour.

According to Bandura (1986), efficacy beliefs consist of two factors: efficacy expectancy and outcome expectancy. He distinguishes between the two components as: an outcome expectation refers to a person’s belief that a given behaviour will lead to a particular outcome. An efficacy expectation is the conviction that the person him/herself can successfully produce the behaviour required to generate the outcome.

Zinta (2006 b) in his study cited that self-efficacy expectancies predict behaviour in a varieties of contexts one such being in decision making, task performance and problem-solving task. He also quoted that Sanna, found that the people with high self-efficacy reported high solutions and experience in performing the task successfully as compared to students low in self-efficacy.

Researches indicated that self-efficacy predicts performance, contributes to higher achievement and is interpreted by students as evidence that they have the ability to perform similar tasks in the future. Hudson (2008) identified that self-efficacy, when combined with parental involvement act as an important predicator of the academic performance of college students. Stajkovic and Luthans (1998) concluded by identifying 114 studies using meta-analysis method that enhanced self-efficacy predicts successful performance of task. Usher and Pajares (2008) found that mastery experiences are the most powerful source of self-efficacy.

Self-efficacy is an influential variable in human behaviour and plays an important role in leading more productive and happy life. So, proper strategies and conditions must be provided for the learner which will enhance their self-efficacy.

1.1.3 Anxiety

People differ specifically in their predisposition to suffer anxiety. It is the subjective experience of the 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 & Ollendick, 2005; Engelhard, 2001). Sigmund Freud (1926, 1959) 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 existences of specific character of unpleasure, act of discharge and perception of these acts is called anxiety” (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.

American Psychiatric Association (1994) proposes that anxiety is the apprehension, tension or uneasiness that stems from the anticipation of danger, which may be internal or external.

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.

LeDoux (2000) described that anxiety is a normal response to situation that poses a threat to self-esteem or psychological well-being.

Anxiety is the 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.

May (1950) characterized anxiety as the comprehension cued off by a threat to some value which the individual holds essential to his existence as a personality.

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

Theories can give a better idea to grasp the concept of anxiety. Some theories of anxiety are:

1. **Existential Theory:** Soren Kierkgaurd (1844, 1957), in the early 1800, believed that anxiety is part of being human. Being free to choose, without knowing the correct choice, causes anxiety. Therefore, for existentialist, the antecedents of anxiety are, in a sense, very much existent in a world in which choice exists.
2. **Psychoanalytic Theory:** Sigmund Freud, in course of his work, presents two theories. His early theory proposed that anxiety came from blocked libido and his later theory proposed that anxiety is the signal from the ego and here, Freud bases anxiety process on avoidance of over stimulation.

3. **Learning Theory:** According to the learning theory anxiety acts as a drive to motivate performance; its reduction reinforces performance and the conditioned anxiety may interfere with and suppress performance. Anxiety was thought to be a learned or acquired drive that becomes a permanent part of an individual’s personality.

4. **Cognitive Interruption Theory:** George Mandler describes anxiety as a natural mental process serving normal roles in life. Cognitive interruption theory holds that anxiety disrupts other acts. Anxiety dominated activity becomes disorganized. The mark of anxiety is helplessness and disorganization.

5. **Cognitive Expectancy Theory:** These theories are also based on learning theories; they explained that anxiety comes not only from direct experience but also from observation of other’s experiences as models and from social communications (Cited by Edward, 1999).

Thus, from the above mentioned theories, we can conclude that anxiety interferes with and suppresses performance. Anxiety dominated activity becomes disorganized. It comes not only from direct experience but also from observation of other’s experiences as models and from social communications.

Webster (1956) defines anxiety as a painful uneasiness of mind concerning some impending or anticipated ill and anxiety reaction is a state of apprehension without an apparent object, in which attempts are made to discharge internally generated object, tension to reduce anxiety through increased bodily activity. The essential aspect of anxiety is that it brings on an internal or subjective condition. It
represents a danger or threat within the person himself rather solely an external danger.

Beck et al. (1974) believed that anxiety results from a misperception of danger or an unrealistic heightened expectation of harm.

Freud describes various kinds of anxieties, which differ by the conditions that produce them: reality anxiety (normal fear coming from real external threats), moral anxiety (comes from the interaction of the ego and super ego, producing guilt or shame), neurotic anxiety (focusing 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”).

Covington (1992) and Zeidner (1998) explained that trait anxiety is that when individual tends to be anxious in many situations; but some situations are especially anxiety-provoking. Then it is called state anxiety (Cited by Woolfolk, 2009).

1.1.4 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
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.

![Figure 1.4: Hannula's Classification of Attitude](#)

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 towards mathematics is important because there is a reciprocal relationship between attitude towards mathematics and achievement in mathematics (Akien, 1970, 1974, 1976).

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.

<table>
<thead>
<tr>
<th>Emotions</th>
<th>Attitude</th>
<th>Beliefs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mostly affective</td>
<td></td>
<td>Mostly cognitive</td>
</tr>
<tr>
<td>Least stable</td>
<td></td>
<td>Most stable</td>
</tr>
<tr>
<td>Most intense</td>
<td></td>
<td>Least intense</td>
</tr>
</tbody>
</table>

**Figure 1.5: McLeod’s (1992) Classification of Concepts of Affective Domain**

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

Hart (1989) found three components in the attitude: (i) emotional response, (ii) beliefs regarding the subjects, (iii) behavior related to subject. From this point of view, an individual’s attitude towards mathematics is defined in a more complex way by the emotions that he/she associates with mathematics, by the individual’s belief towards mathematics and by how he/she behaves.

Ma and Kishor (1997) found a small but positive significant relationship achievement and attitude towards mathematics through meta-analysis.

In some studies it is also found that general attitude towards mathematics, such as liking the subjects are associated with higher achievement (Anderson et al., 2006; Silver et al., 1996).

Hannula (2002) define attitude towards mathematics is 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).

1.2 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”

1.3 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”. 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. It is almost universally agreed that creativity is more developable than intelligence or other abilities. Hence the findings of the study will be useful in understanding of students’ creative aspect vis-à-vis other psychological variables for its optimal development at school stage.

1.4 OBJECTIVES OF THE STUDY

1. To study creativity of secondary school students of Himachal Pradesh in relation to self-efficacy.
2. To study creativity of secondary school students of Himachal Pradesh in relation to mathematical attitude.
3. To study creativity of secondary school students of Himachal Pradesh in relation to anxiety.
5. 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.
1.5 DELIMITATIONS OF THE STUDY

1. The study was delimited to Government Secondary Schools of Himachal Pradesh, affiliated to Himachal Pradesh Board of School Education, Dharmshala.
2. The study was delimited to secondary school students studying in class IX.
3. The study was confined to only three out of twelve districts of Himachal Pradesh, namely, Hamirpur, Solan and Chamba.
4. Correlation and regression analysis was applied to study the relationship and hence prediction of creativity.
5. Analytical approach was applied for the analysis of data by using ANOVA (3-way and t-ratio).

1.6 OPERATIONAL DEFINITIONS

1. 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).

2. 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).

3. 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).

4. **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 in terms of the development of mathematical problems in situational data (Balka, 1974).