DEVELOPING CREATIVITY IN STUDENTS OF SECONDARY LEVEL: PROBLEMS AND PROSPECTS

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DEDICATION

Dedicated to My Loving Parents whose Love and Support Transform my Dreams into Reality

ABSTRACT

Creativity plays a vital role in the holistic development of students. Creativity may provide opportunities to learners to develop their creative and critical thinking which would indirectly increase talents related to creativity development in students. On the basis of these facts, a survey type study of F.G. Model Schools of Islamabad was conducted to investigate the problems and prospects of creativity development in students of secondary level.

The objectives of study were (a) to obtain the views of secondary level science teachers and students on problems that blocked creativity development in students; (b) to obtain the views of secondary level science teachers and students on prospects that fostered creativity development in students; (c) to compare the views of secondary level science teachers and students and (d) to suggest various measures for the development of creativity in students.

In order to achieve the objectives of this study, a questionnaire having same items for teachers and students, was developed on five point Likert scale for secondary level science teachers and students. The population of this study consisted 162 secondary level science teachers and 1632 secondary level science students. The sample of this study comprised 288 respondents (240 IX grade science students and 48 secondary level science teachers) selected through stratified random sampling. Fourteen null hypotheses were developed and tested at 0.05 significance level by using statistical test of Chi Square. Four out of 14 hypotheses were accepted while 10 of them were rejected in the light of teachers' and students' views. On the basis of significance/insignificance of the hypotheses, findings, conclusions and recommendations were made.

The responses of teachers and students regarding the existence of creativity development practices were placed in two categories. The first category, designated as problems, included the responses which exceeded 50% in denial of the existence of such practices. This meant that when more than 50% of teachers or students denied that a particular

creativity development practice was not taking place in their institutions, then it was a serious problem.

The second category labeled as prospects pertained to less than 50% responses in denial of existence of creativity development practices surmising that such practices were not totally non-existent. There were some creativity development initiatives which could be used as a spring board to develop creativity into full-scale programs.

The following main problems of creativity development were identified by teachers' and students' views: students were not rewarded for their creative work, creativity measuring tools were not used in order to assess students' creative level; creative individuals were not invited to school to address students; duties related to students' service and welfare were not assigned to creative teachers; and students were not provided the opportunities to work with creative individuals.

The following main prospects of creativity development were identified by teachers' and students' views: students were encouraged to find out a number of ideas/solutions to problems; students were given individual projects that were based on problem-based learning; students were taken to Science Museums; and Science Exhibitions were organized at school.

Keeping in view the findings and conclusions of this study, the following recommendations were offered to develop creativity in students: (a) teacher may follow problem-based learning technique by having students solve one problem through two different methods; (b) including creativity development as one of the objectives in curriculum of secondary level science education; (c) provision may be made in the policy documents for rewarding creative students; (d) creativity measuring tools developed by J.P. Guilford etc may be used; (e) teacher educators and educational administrators may acquire adequate knowledge of creative thinking by organizing seminars, debates etc at schools; and (f) different organizations, for example, American Creativity Association (ACA), The Creative Education Foundation (UK), National Museum of Science and Technology (Pakistan), National History Museum Islamabad, Natural Center for Physics Islamabad etc. may be contacted in order to develop creativity in students.

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INTRODUCTION

1.1 Background of the Study

Traditional way of teaching is now out of date. Now-a-days teachers are supposed to provide freedom of thinking to students in solving the problems in their own ways. Teachers should act only as an initiator, facilitator, and helper whenever students solve or fails to solve the problems. To develop thinking in students teachers need to observer

- a student solving a problem
- a computer programmer debugging a computer program
- a child absorbed in a fairy tale
- an architect designing a skyscraper
- a business planning strategies for convincing customer
- a senior citizen planning to live on a fixed income.

Teachers will find all the above individuals 'lost in thoughts' to describe the process of thinking. Thinking skills approach to education increases the learner's ability to notice, understand and work more effectively with what goes on inside their own heads. It is true that when a person's deficiency needs (food, shelter, security etc) have been satisfied, (s)he requires a degree of creative activity to stay optimally healthy mentally, emotionally and physically. For creative activities human beings look around themselves and think about the day-to-day happenings. For this purpose

all which a school can do is to develop learner's ability to think. Schools can develop two types of thinking i.e. critical/convergent thinking and creative/divergent thinking in learners which are considered vital for creativity development.

- Critical thinking: to interpret or evaluate information and experiences with a set of reflective attitudes and abilities that guide thoughtful beliefs and actions.
- Creative thinking: to stimulate curiosity and promote divergent thinking i.e. make efforts to produce something new which does not exist in literature.

Both types of thinking are important for teachers to solve problems, because in practice both kinds of them operate together much of the time and are not really independent of each other.

Because of less creative work on creativity development related topics, traditional way of teaching is enjoying a dominant role in Pakistan education system. In fact, working on creativity development related topic, is one of the most important factors that can convince teachers, students, teachers educators, and concerned educational administrators to skip using traditional ways of teaching and adopt modern techniques of pedagogy. So there is a dire need to work on creativity development related topic in order to bring innovations in Pakistan education system. On the basis of this, the researcher decided to conduct this study.

1.2 Statement of the Problem

The main focus of the study was to identify the problems that blocked creativity development and prospects that facilitated it in secondary level science students of F.G. Model Schools of Islamabad.

1.3 Objectives of the Study

The following were the objectives of the study:

1. To obtain views of secondary level science teachers and 9th class science students on problems that blocked creativity development in science students.

2. To obtain views of secondary level science teachers and 9th class science students on prospects that fostered creativity development in science students.

3. To compare their views and arrive at conclusions.

4. To suggest various measures for the development of creativity in science students.

1.4 Hypotheses

In order to achieve the objectives of the study, the following null hypotheses were formulated:

1. There is no significant difference among the views of teachers and students regarding the encouragement of students to find out a number of ideas/solutions to problems.
2. There is no significant difference among the views of teachers and students about assigning students individual projects in order to develop creativity in them.
3. There is no significant difference among the views of teachers and students about rewarding students for showing creativity in their individual projects.
4. There is no significant difference among the views of teachers and students regarding taking students to Science Museums in order to develop creativity in them.
5. There is no significant difference among the views of teachers and students about organizing science exhibits at school for students' creativity development.
6. There is no significant difference among the views of teachers and students regarding using creativity measuring tools in order to assess student's creative level.

7. There is no significant difference among the views of teachers and students about inviting creative scientists/individuals to address students.

8. There is no significant difference among the views of teachers and students regarding the availability of counseling services to students' at school.

9. There is no significant difference among the views of teachers and students regarding assigning students' service and welfare related duties to creative teachers.

10. There is no significant difference among the views of teachers and students regarding the proposition that the contents of the textbooks of science subjects build up problem-based and project-based learning in students.

11. There is no significant difference among the views of teachers and students regarding the proposition that exercises in the textbooks of science subjects boost up divergent and convergent thinking in students.

12. There is no significant difference among the views of teachers and students about encouraging students to challenge teachers and authors of the books for developing their creativity.

13. There is no significant difference among the views of teachers and students regarding the provision of taking courses on creativity development to students.

14. There is no significant difference among the views of teachers and students regarding the provision of working with creative individuals to students.

1.5 Significance of the study

The significance of the study is evident due to the following reasons:

1. This study is likely to be helpful for teachers in adopting different techniques of creativity development in order to overcome the problems that block creativity development in secondary level students.

2. This study may be useful for Curriculum planners to develop creative activities for different level of students.

3. Administrators, teachers, and students may find this study suitable for bringing innovations in traditional ways of learning.

4. The results of this study may open up new avenues of research on creativity.

1.6 Delimitation of the Study

Due to limited time and resources:

1. 24 F.G. Model Schools of Islamabad.
2. Secondary level science teachers and 9th class science students of F.G. Model Schools of Islamabad.
3. Out of four psychological aspects of creativity i.e. (a) the creative product (b) the creative process (c) the creative person and (d) the creative environment. Only the creative environment of the schools was analyzed for the development of creativity.

1.7 Methodology

The research design of this study was a survey type. It was also a comparative study i.e. it compared the views of secondary level science teachers and 9th class science students of FG Model Schools of Islamabad.

1.7.1 Population

There were twenty four (24) FG Model Schools of Islamabad till July 27, 2009. All 9th class science students and secondary level science teachers of the above schools constituted the population of the study. The estimated numbers of 9th class science students and secondary level science teachers of FG Model Schools of Islamabad were 1632 and 162 respectively.

1.7.2 Sample

Sample of the study consisted of two hundred and forty (240) 9th class science students and forty eight (48) secondary level science teachers of FG Model Schools of Islamabad. These were selected through stratified random sampling technique. Thus the total number of respondents became two hundred and eighty eight (288).

1.7.3 Tool of the Study

A common questionnaire was developed for 9th class science students and secondary level science teachers of FG Model Schools of Islamabad. All the questions of the questionnaire were developed on Likert five-point scale.

1.7.4 Data Collection

For collection of data the researcher personally visited all the schools in order to administer the questionnaire among the respondents. Luckily the researcher received hundred percent completed questionnaires through constant contact with the respondents.

1.7.5 Data Analysis

Data collected through questionnaire was tabulated and analyzed by using Microsoft Excel 2007. Chi Square Test was used for the analysis of data in order to find out the significance/insignificance of the hypotheses.

CHAPTER 2

LITERATURE REVIEW

Early findings have shown that students use their thinking, imagination and experience to develop their learning; they strategically collaborate over tasks; contribute to the classroom curriculum and pedagogy; and evaluate their own learning practices and teachers' performance. (Jeffrey, 2001)

2.1 Thinking

Human beings need to look around themselves and think about the day-do-day happenings so that they are 'lost in thoughts'. The quality of our lives and learning depends upon the quality of our thinking. Thinking is a process of exercising the mind to make decisions. Fisher (2005) has written in his book that John Dewey says "All which the school can or need to do for pupils, so far as their minds are concerned, is to develop their ability to think".

Human is superior to all other creatures due to his/her thinking and learning power. A chicken can produce 24 types of sounds at its birth while new born human baby can utter only 2 to 3 sounds. Human being generates new sounds from these two or three and becomes able to make billion sounds while chicken remains with 24 inborn sounds and never generate others. Furthermore, the human baby has the power to rule over others by using his thinking skills. (Afridi, 2006, p. 6)

Allah narrates in surah Al-Mominoon Ayah 14, "I am the best creator". Here the word 'best' indicates that creation from nothing is Allah's work but human being

can be good or the better creators. To keep change permanent, Allah has left the chances for human to explore the creations of the best creator by creating the good and the better creations. Allah has more forcefully declared this claim in Ayah 8 of Al-Nahl, "(Allah has created) horses, mules, and donkeys for your riding and for your honor and (He) will create those (means of transportation) what you don't know". (Shafi, 1965)

One way to look at thinking is to separate thinking into two broad categories: Convergent and Divergent Thinking.

2.1.1 Creative/Divergent Thinking

It is a process of thinking in which an individual thinks in unusual way, in order to generate several possible solutions to a problem. He uses idea generation technique (such as brainstorming etc.) in which an idea is followed in several directions to lead to one or more new ideas, which in turn leads to still more ideas. In contrast to convergent thinking, (which aims at solving a specific problem) divergent thinking is creative, open-ended thinking aimed at generating fresh views and novel solutions. (http://www.encyclopedia2009.org/wiki/creativity)

Divergent thinking occurs when we start to generate many ideas or possible solutions to a stimulus. Some of the mistakes we make are because of our type of thinking i.e. we do convergent thinking whereas there is need of divergent thinking for the solution of the problem. See figure 2.1. (Woolfolk, 2004)

Creative thinking enables students to generate ideas, suggest ways of doing things and supply imagination in looking for alternative and innovative outcomes in order to create something new or original. It involves the shelves of flexibility, originality, fluency, elaboration, brainstorming, modification, imagery, associative thinking. Pupils develop these skills when they contribute to exploratory discussions

of problems, and seek solutions that are useful for them and others as well. The aim of creative thinking is to stimulate curiosity and promote creativity. (Beetlestone, 1998)

Sometimes it is just not a good idea to fit everything into the same old box. New ideas sometimes need completely new categories. Divergent thinking attempts to free learners from the old ways of doing things. In this approach learners are train to take things apart and look at them in new ways, mix things together that don't belong, stir up the brain. (Ormrod, 2000)

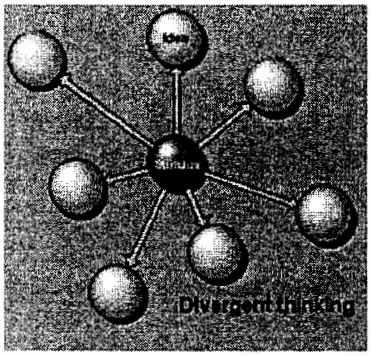

Fig. 2.1

Divergent Thinking ----> Thinking many possible answers

2.1.2 Critical/Convergent Thinking

Critical thinking is analytical, usually deductive, in which ideas are examined for their logical validity or in which a set of rules is followed. Convergent thinking, occurs when a person gathers facts evidence or experiences from a variety of sources to solve a problem. The result is one answer that hopefully is correct. In school we all have learned a large amount of knowledge that could be classed as factual. We have often been tested for the correct answers - so in many cases convergent thinking comes natural to us. For detail please see figure 2.2.

An example of convergent thinking would be solving a math problem such as 2+2= ___. (Woolfolk, 2004)

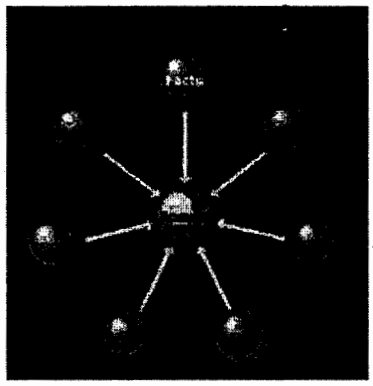

Fig. 2.2

Convergent Thinking --> Thinking only one answer

Critical thinking involves going past assumptions, highlighting them and then analyzing and debating alternatives. Critical thinking is important in that our individual thoughts and cultural views become our actions and policies. Toleration for ambiguity is key in critical thinking, as things tend not to be "black or white" but rather gray and murky. Honest scientists recognize that even their truths are provisional or tentative, meaning they are subject to modification or even outright falsification as more data are gathered. (Ormrod, 2000)

Convergent thinking is defined as the ability to use logical and evaluative thinking to critique and narrow ideas to ones best suited for given situations, or set criteria. We use this type of thinking when we make crucial and well-formed decisions after appraising an array of ideas, information, or alternatives. (Robert, 2008)

When we need new ideas to solve a problem, critical thinking is necessary to help determine the relevance and effectiveness of the idea. To build a rocket that flies

to the moon, one should not violate logic or the laws of physics. The evaluation of any proposal to solve a problem must involve good critical thinking. (Rowe, 2004)

2.1.3 Interlacing Divergent and Convergent Thinking

In creative production both thought processes are necessary as one first diverges ideas in numerous quantity and then narrows and refines the array through convergence. Specifically in creative problem solving, or in any complex problem solving activity for that matter, one needs to be able to weave in and out of divergent and convergent thought patterns in arriving at an appropriate conclusion specific for creative and innovative works. (Simonton, 2000)

Zhou (2003) narrates that convergent thinking and divergent thinking might sound complicated on the surface, and they can be when practiced, but as concepts they are fairly simple. Both styles of thought are employed in problem solving, and each may complement the other. In this study the researcher has identified the difference between convergent thinking and divergent thinking, and also how the two types may best complement each other. During instruction the following four steps should be implied.

Step 1

Understand convergent thinking. This is perhaps the more predominant style of thinking in contemporary technological society. In convergent thought, we locate a problem at the "center" of our focus and then gather peripheral resources to bear down on the problem. So then our resources "converge" on the problem. Often times with convergent thinking, there is a single best solution that is sought. An example of convergent thinking might involve taking a multiple choice test in which there is a single "correct" answer. The test-taker brings knowledge from outside of the problem

(perhaps learned in a course) and converges it all onto the problem in order to choose the correct answer.

Step 2

Understand divergent thinking. Divergent thinking involves some stimulus, which can take the form of a problem, and we can locate this at the center, as we did with convergent thinking above. However, the procedure is different. Rather than gathering information and converging it on the central problem, we branch off (diverge) and shoot for novel ideas, new perspectives and creativity. Instead of a single correct answer, there may be a whole host of possibilities. An example of using divergent thinking might involve taking an open-ended test that asks how many uses one can imagine for various (often mundane) objects. What can you do with a pencil?

Step 3

Combine convergent thinking with divergent thinking. Perhaps the most clear-cut way in which convergent thinking may be optimally combined with divergent thinking, is to engage students in divergent thinking in order to generate many novel ideas, and then to evaluate these ideas by using convergent thinking. The fecund imagination of divergent thinking is tempered by the selective critique of convergent thinking.

Step 4

Practice everyday application and relationships. It is probably wise to diversify your thought patterns to include both divergent and convergent thinking. Most of us are better at one than the other, but at least a little of each complements the other. This isn't just a matter of intellectual pursuits, but it can also come to bear on personal relationships. The old adage "opposites attract" might be especially

applicable here too, as a predominantly divergent thinker may admire the "logical" convergent thinker, who may in turn become infatuated with the "wild" divergent thinker.

The essence of thinking is creatively, not simply arriving at the right answer (Treffinger, D.J., Ripple, R.E. & Dacey, J.S. 1968). Yet typical school programs often focus on what the student does rather than what the student thinks (Davis, 1986).

2.2 Background of Creativity

Neither the Greeks nor the Romans used the word creativity for art, architecture, music, inventions, and discoveries. Christian assigned the word "creatio" for God's act of "creation from nothing". Polish poet Maciej Kazimierz Sarbiewski was the first one who actually applied the word "creativity" exclusively to poetry. During nineteenth and early twentieth century, leading mathematicians and scientists such as Hermann Von Helmholtz (1896) and Henri Poincare (1908) began to discuss publicly their creative process. However, the formal starting point for the scientific study of creativity was initiated by J.P. Guilford's 1950 address to the American Psychological Association, which helped popularize the topic and focused attention on the scientific approach to conceptualizing creativity. (http://www.en.wikipedia.org/wiki/Creativity)

Creativity is increasingly gaining recognition as a human characteristic that can and should be developed through education. It is viewed as important not only for personal development and fulfillment, but also for its contribution to economic growth. The recent report from the National Advisory Committee for Creative and Cultural Education (1999) made a number of detailed recommendations designed to

support the recognition and development of creativity within the formal and informal education system through curricular and co-curricular activities. (Parness, 1999)

So the curriculum should enable pupils to think creatively and critically, to solve problems and to make a difference for the better. It should give them the opportunity to become creative, innovative, enterprising and capable of leadership to equip them for their future lives as workers and citizens.

2.3 Definitions of Creativity

A survey of definitions of creativity highlights the following qualities:

i. "Creativity requires both divergent thinking and convergent thinking (Divergent Thinking - exploring solutions, Convergent Thinking - solving problems" (Guilford, 1978)

ii. "Playful display of old elements into new patterns". (Amabile, 1979)

iii. "The ability to get ideas". (Cropley A.J., 1992)

iv. "The process of generating something new that has worth". (Higgins, 1994)

v. "Creativity is the ability to produce work that is both novel (i.e. original, unexpected) and suitable (i.e., useful, adaptive concerning task constraints)". (Lubart, 1994).

vi. "The ability to produce something useful and novel". (Quigley, 1998)

vii. Harris (1998) provides one of the best descriptions of creativity:

An Ability: creativity is an ability to imagine or originate something new.

An Attitude: creativity is to accept change and innovation; an enthusiasm to play with ideas and possibilities; a flexibility of viewpoint; the habit of enjoying the good quality, while looking for ways to get better.

A Process: creativity is a process to advance ideas and solutions, by making gradual refinements to works.

viii. "The ability to generate new things or new knowledge". (Simonton, 2000)

ix. "Being imaginative and ingenious to get ideas, especially original, inventive and novel". (Woolfolk, 2004)

x. "Creativity refers to the skills and attitudes desirable for generating ideas and products that are (1) relatively novel, (2) high in quality, and (3) appropriate to the task at hand". (Sternberg, 2005).

xi. "It is re-arranging of what we know in order to unearth what we do not know". (Keller, 2006)

xii. "The ability to create or otherwise bring into existence something new, whether a new solution to a problem, a new method or device, or a new artistic object or form". http://www.britannica/topic/creativity

The above detail has exposed that there is no single accepted definition of creativity. The variety of definitions has created challenges in the detection and development of creativity. However, several experts on creativity generally agree on the five phases of the creative process, namely (a) Preparation phase -acquiring skills, sensing and dinning a problem; (b) Concentration phase -focusing intensely on the problem; (c) Incubation phase -withdrawing from the problem; (d) Illumination phase -the stage involving the emergence of an idea; and (e) Elaboration phase -testing out the idea (Guilford, 1975).

According to Torrance and Kneller (1990) academic creativity is a process of thinking about learning and producing information relevant to school subjects. Torrance narrates that content of school subjects encourages fluency, flexibility and novelty/originality in students. Fluency refers to the number of ideas generated, flexibility to the shifts in approaches, and novelty/originality ideas generation.

The cognitive approach to creativity seeks to understand the mental representations and processes underlying creative thought. Latelle, Denicolo & David (1992) proposed what they called the Geneplore model, according to which there are two main processing phases in creative thought: generative phase and an exploratory phase. In the generative phase, the individual constructs mental representations, which have properties promoting creative discoveries. In the exploratory phase, these properties are used to come up with creative ideas. A number of mental processes may enter into these phases of creative invention, including the processes of retrieval, association, synthesis, transformation, analogical transfer, and categorical reduction.

The most recent practitioner perspective has been taken by pragmatics who have taken a generative approach aimed purely at producing more and more ideas (Fisher, 1971, 1985, 1992; Florida, 1953; Gardner, 1961; Hardcover, 1974, 1986; Maravcsik, 1983; Rowe, 1998). This perspective has been of particular interest to the business and management schools.

2.4 Theories of Creativity

In order to achieve the objectives related to creativity, education theorists are debating different pedagogical theories. For example

2.4.1 The Walla's Theory of Creative Process

One of the earliest models of the creative process is attributed to Graham Walla. Walla (1926) has discussed brain's specific part in his theory. He says, "In schools where education is one-sided emphasizing knowledge and logic, students develop the left hemisphere of the brain but neglect the right one. For achievement beyond traditional school, a balance between the right and left hemispheres is needed. But many students leave school with the right side, the creative side, of the brain

undeveloped. He proposed that creative thinking proceeds through four phases. It detail can be seen in Figure 2.3.

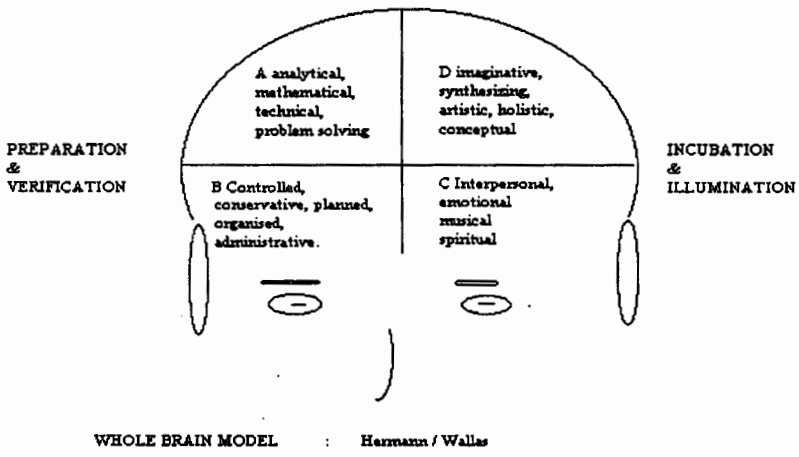

Fig: 2.3

Whole Brain Model

a) **Preparation** (definition of issue, observation, and study)

b) **Incubation** (laying the issue aside for a time)

c) **Illumination** (the moment when a new idea finally emerges)

d) **Verification** (checking it out)

Torrance (1988) asserts that Walla's theory is the basis for most of the creative thinking training programs available today. The inclusion of incubation followed by sudden illumination in this popular model may explain why so many people view creative thinking as a subconscious mental process that cannot be directed. (http://www.directedcreativity.com/pages/WPModels.html)

2.4.2 The Vary Approach Theory of Creativity

The second important theory to brain study is the vary approach theory of creativity or Howard Gardner's Multiple Intelligences where mind is divided into 9 specific parts. The most important in all these parts of mind is the visual intelligence. It detail can be seen in Figure 2.4.

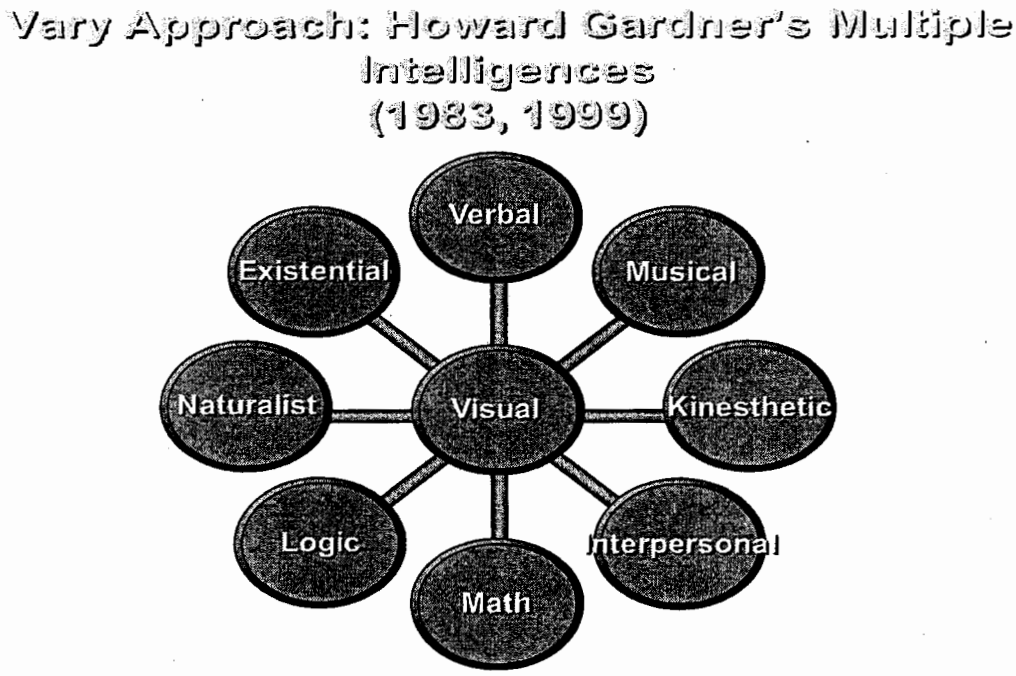

Fig: 2.4

Howard Gardner's Multiple Intelligence

(http://professorlamp.com/ed/TAG/7_Intelligences.html)

2.4.3 Barron's Psychic Creation Theory

Barron (1988) similarly places great emphasis on subconscious and chance processes in his four-phase, "psychic creation theory".

a) **Conception** (in a prepared mind)

b) **Gestation** (time, intricately coordinated)

c) **Parturition** (suffering to be born, emergence to light)

d) **Bringing up the baby** (further period of development)

The tone of Barron's theory supports the popular view of creativity as a mysterious process involving subconscious thoughts beyond the control of the creator. (http://www.directedcreativity.com/pages/WPModels.html)

2.4.4 The Chaos and Complexity Theory of Creativity

Chaos theory provides a useful framework within which notions of consciousness as an active agent in determining probable outcomes of events in the real world can be illuminated. If consciousness itself can affect the outcome of physical events, even on the micro scale, such minute changes will ultimately breed substantial mutations on the macro scale. Creativity is the only survival tool for an organization in an ever-changing business world. (Boden, 1990)

2.4.5 The Investment Theory of Creativity

The investment theory of creativity (Sternberg & Lubart, 1995) asserts that creative thinkers are like good investors: They buy low and sell high. The 1990s saw researchers seeing the need to account for the multidimensional nature of creativity. Lubart and Sternberg's (1995) investment theory argues that certain people will investigate unknown or unpopular ideas if they reflect potential value. These individuals will study and promote their new ideas even when others fail to support them. In fact, they have the confidence and determination to continue their investigation of new ideas until they gain more favor in the public arena. Then, they will move on to another unpopular idea. This is called a "buy low and sell high" (Sternberg et al, 2005).

2.4.6 Constructivism Theory of Creativity

Learners are active creators of their own knowledge by asking questions, exploring subject, and constantly assessing what and how they know. New knowledge must be reconciled with prior understanding; else false models (previous knowledge/paradigms) continue to prevail. Teaching is done through pupil-generated experiments, real-world problem solving, discussion, and debates. (Guilford, 1978)

2.4.7 Grace Theory of Creativity

Creativity is something of a mystery, drawing forth images of wonderful insights, imaginative efforts, illumination and intuitions that come from nowhere. It seems the work of magic. The idea of genius may add force to this notion since creative artists, musicians, etc. seemed to be endowed with superhuman potential. Creativity in this sense is seen as a divine gift. (Quigley, 1998)

2.4.8 Accident Theory of Creativity

Creativity rises by chance. Holders of this view like Keller (1982) offer various types of accidental discoveries such as those of immunization arising from an interruption in work, radioactivity from the wrong hypothesis, and the smallpox vaccination from observation.

2.4.9 Association Theory of Creativity

This theory approaches creative thinking as the formation of "associative elements into new combinations which either meet special requirements or are in some way useful" (Mednick, 1962).

It suggests applying procedures from one area to another. It underlies the justification for many divergent thinking techniques such as lateral thinking and brainstorming.

2.4.10 Cognitive Theory of Creativity

This theory discusses thinking and information processing, reasoning and understanding. According to this theory, a normal human being also has creative ability. (Hamilton et al, 2004)

2.4.11 Personality Theory of Creativity

An attempt is made in this theory to relate creativity to personality in a much more definitive way than has been done previously and to use the known correlates of personality to suggest a theory of creativity that would explain many of the phenomena

associated with this concept. According to this theory, creativity is a state of mind which can be learned. Some people seem to have a facility for it while others do not, but they can improve it with practice (Eysenck, 1978).

2.5 Types of Creativity

There are different types of creativity that result in the generation of ideas that are novel, surprising, and valuable. The most common types of creativity are:

2.5.1 Combinational Creativity

Combinational creativity involves unfamiliar combinations of familiar ideas (Taylor's Inventive type). (Boden, 1988)

2.5.2 Exploratory Creativity

Exploratory creativity involves the exploration of some structured conceptual space (style of thinking) available in some preexisting culture (a version of Taylor's Innovative type). (Maravcsik, 2008)

2.5.3 Transformational Creativity

Transformational creativity involves the alteration of one or more dimensions of the relevant conceptual space (Taylor's Emergentive type). (Ogawa, 1991)

2.5.4 Private Creativity

People develop their individual latent and personal interests. Someone uses his thoughts and inventiveness to solve problems, produce a product, or approach a dispute from a new perspective. For example, formulating a formula, taking a snap, writing a story etc. (Beetlestone, 1998)

2.5.5 Public Creativity

It guides the reader through a range of techniques and tips for generating creative ideas, as described by the "five I's" of the creative process: information, incubation, illumination, integration and illustration. It also refers to imaginative acts that are accepted by one's community and/or culture - for example solving a community difficulty or beautifying public rooms. (Ormrod, 2000)

2.5.6 Group Creativity

Creativity, or the generation of novel ideas, especially ones that are useful, is essential for our survival as a species. Therefore, it is not surprising that we celebrate and revere those who make creative contributions in such areas as science, technology, and commerce. It is true that many minds are better than one; groups often appear with a smaller number of possible solutions than individuals. (Parness, 1970)

2.5.7 Social Creativity

Creative expression which enables older adults to assume one of their most important creative roles as "keepers of the culture" It transmits knowledge they have

accumulated through life experiences to younger members of the family or society, such as through autobiography, indigenous foods, crafts, trade skills, songs, dances, stories. (Pehkonen, 1997)

2.6 Creativity in Various Contexts

Creativity has been studied from a variety of perspectives in numerous contexts. The following are some of the areas in which creativity is seen as being important.

2.6.1 Creativity in Diverse Cultures

Creativity is a scientific concept which is mostly rooted within a diverse culture. Jullien in 'Process and Creation, 1989' is inviting people to look at that concept from a Chinese cultural point of view. Keller, (2006) has reported creativity courses in a range of countries.

Some studies about creativity in organizations signify that heterogeneous work groups (in terms of race, age, tenure, education, and gender) perform better than homogeneous groups on producing creative outcomes because heterogeneity helps with generating "a greater variety of ideas, perspectives, and approaches to solving problems" (Passi et al., 1998, Reddy, 1979; Taylor, 1992). Ogawa, Lipwell, and Marvin (1996) examined the issue of ethnic diversity and found that ethnically diverse groups are more creative than homogeneous groups.

2.6.2 Creativity in Science and Technology

Creativity is also seen as being increasingly important in a variety of other professions. Architecture and industrial design are the fields most often associated with creativity, and more generally the fields of design and design research. These

fields explicitly value creativity, and have published many studies on creativity and creative problem solving. (Pehkonen, 1997)

Isaac Newton's law of gravity is popularly attributed to a creative leap he experienced when observing a falling apple. That's why, fields such as science and technology have experienced a more explicit relation to creativity. Simonton (1996) says that some of the major scientific advances of the 20th century have proved that creativity will be seen as increasingly important for doctors and engineers in years to come. Accounting will also be called creative accounting in the years to come. Amabilehas (2007) suggested that ever ethic will also get benefit from application of creative thinking. Creativity is seen by economist such as Romer (2002) as an important element in the recombination of elements to produce new technologies and products and, consequently, economic growth. In his book written in 2002 'The Rise of the Creative Class', he has popularized the 3 T's of economic development: Technology, Talent, and Tolerance.

The association between the science and creativity has given rise to much debate. But it is recognized that science the most affected field of creativity. Viewing creativity as solely or mainly the province of the science is injustice to creativity because it will delimit creativity development in other areas, such as arts and crafts etc.

2.7 Derivative: The Rote Learner

Zhou (2003) states, "An individual who recognizes materials through recitation without understanding is called rote learner". Such type of learning is considered one of the most dangerous problematic factors in the development of creativity in students. Traditional assessment encourages rote learning by rewarding good greats to those students who show fluency and accuracy in tests.

2.8 Characteristics of Creative Individuals

Creative individuals welcome and even seek out problems, consider them as opportunities and challenges to improve things. They work very hard and continue their work with a level of persistence which is rarely matched by others. They often possess playful attitude which help them deal with ideas with an abandonment and imagination. They reject standard formats for problem solving. They take multiple perspectives on a problem. They use trial and error method in their experimentation. They have self-confidence and trust in their own judgment. They refuse to be puzzled by problems. Creative individuals do not like a biased view or prejudice. They have unique divergent thinking. They look for various solutions even after a single solution has been found. They cultivate a proper attitude toward errors (finding errors interesting and windows into thinking). (Bowkett, 2007)

2.9 Characteristics of Derivative Individuals

Uncreative or derivative individual has the following attitudes:

i. Oh no, a problem!

Many people avoid or deny problems until it's too late, largely because these people have never learned the appropriate emotional, psychological and practical responses. They react to the problem; consequently the problem becomes bigger than itself. (Quigley, 1998)

ii. That's Childish

In our effort to appear always mature and sophisticated, we often ridicule the creative, playful attitudes that marked our younger years. Remember that sometimes people laugh when something is actually funny, but often they laugh when they lack the imagination to understand the situation. (Reddy, 2003)

iii. What Will People Think?

Derivative feels strong social pressure to conform and to be ordinary and not creative. Almost every famous contributor to the betterment of civilization was ridiculed and sometimes ever jailed. Think about Galileo and look what happened to Jesus. Quotation: "Progress is made only by those who are strong enough to endure being laughed at". Solutions are often new ideas, and new ideas, being strange, are usually greeted with laughter, contempt, or both. (Woolfolk, 2004)

iv. Prejudice

The older we get, the more preconceived ideas we have about things. Theses preconceptions often prevent derivates seeing beyond what they already know or believe to be possible. These prejudices inhibit them from accepting change and progress. (Sternberg, 1996)

v. Learned Helplessness

This is a feeling of the derivative that he does not have the tools, knowledge, materials, ability to do things so he might not try. They are trained to rely on other people for almost every thing. They think narrowly and limit themselves. (Torrance, 1962)

In assessing personality characteristics as a means of measuring creative potential, Taylor (2003) wrote, "questions that ask the individual if he or she is creative, inventive, ingenious, or original may have a high degree of accuracy for prediction of future creative interests". The Khatenna-Torrance Creative Perception Inventory (Khatenna & Torrance, 1976) was developed to provide information on student attitudes and perceptions of their creativity. Khatenna and Torrance report that the inventory has been widely used for the identification of creative individuals in schools settings and in research. Feldhusen (1995) concluded that multiple means of

measurement (given below) are necessary for the assessment as creativity is a multidimensional construct.

i. Independence of judgment

ii. Self-confidence

iii. Attraction to complexity

iv. Aesthetic orientation

v. Openness to experience

vi. Risk taking

vii. Self-actualization

(Sternberg et al, 2005)

Balka (1994) outlined different criteria for describing creativity. These criteria were selected by a panel of distinguished educators. All the criteria have been identified as checking creative ability in school children. These include:

i. The ability to formulate hypotheses in a situation;

ii. The ability to determine patterns in a situation;

iii. The ability to break from stereotyped established mind sets;

iv. The ability to consider and evaluate unusual ideas; and

v. The ability to split general problems into specific sub-problems

Thus it is appropriated that students should at least be given the opportunity to examine a wide variety of problems. By providing divergent responses in unconventional questions and other problem-solving experiences can explore creativity to the fullest.

Davis (2007) considered creativity in students in terms of three major parameters: attitudes, abilities, and techniques (methods of preparing and manipulating information). Obviously, the study of the inter-relationships between

individual traits and creativity cannot tell the whole story. Creativity can be enriched through encouragement, autonomy, resources, pressures, and organizational impediments to creativity (Amabile, et al., 1996). Creativity is difficult to be developed if one is limited to rule-based applications without recognizing the essence of the problem to be solved.

2.10 Creativity Fostering Techniques

The following techniques may facilitate creativity in students:

2.10.1 Brainstorming

Process for generating creative ideas and solutions through intensive and freewheeling group discussion. Every participant is encouraged to think aloud and suggest as many ideas as possible, no matter seemingly how outlandish or bizarre. Analysis, discussion, or criticism of the aired ideas is allowed only when the brainstorming session is over and evaluation session begins. (Bartel, 2004)

2.10.2 Creative Climate

If teacher provides an environment where the following factors play dominated role, the creativity of the learners can be developed.

i. Student-Centered classroom

ii. Exposure to various learning strategies; allowing students to choose

iii. Three part Exam

One-third credit for the correct answer

One-third credit for finding MORE than one way to solve the problem

One-third credit for writing a paragraph on solutions

iv. Change in Emphasis from "What we know" to "How we come to know".

v. Nurturing of inquiring attitudes, habits of mind

vi. Going from known to unknown to generate new knowledge

vii. Becoming not an "all-knower" but an "Official learner"

(Balka, 1999)

Many organizations do not like to spend adequate funds for database subscriptions. Moreover, people have a tendency to look at critics of other's intellectual work as more intelligent than people who praise them (Amabile & Glazebrook, 1982; Sternberg, Hara, & Lubart, 1997). People also have the tendency to use criticism of other's ideas to impress others with their own abilities and intelligence (Sternberg & Lubart, 1997).

Organizational leaders who wish to enhance the creativity of their employees should avoid giving the wrong signals that the organization likes "always going the safe way as opposed to the adventurous and sometimes creative way" (Blumler, 1990). This requires organizational leaders avoid immediately ruling out an idea that may be unknown, untested, and/or unusual. One solution to this problem as argued by several researchers (e.g. Runco, Johnson, & Bear, 1993) is eliminating criticism and evaluation of ideas during the period of idea generation. These Researchers suggest various ways to do that including the widespread idea of conducting brainstorming meetings. Many teachers after having a student teacher, who has been particularly creative, cannot wait to have another one.

2.10.3 Creative Performance

A creative performance usually create the following factors:

i. Domain-Relevant Knowledge and Skills

ii. Cooperative contexts where students are to use contextual information

iii. Work that is authentic, complex, and worth doing

iv. Creative language and creative contexts

v. More than one way to solve a problem

vi. Interpersonal and small-group learning skills

(Balka, 1999)

2.10.4 Getting Benefits from Research Studies

Dr. Sylvie Labelle (1966) has done some fascinating research on how top teachers and administrator develop their creativity. Some of her findings were as under:

i. Creativity Begins At Home:

The majority of business leaders stated that personal factors played a greater role in acquiring creativity than organizational factors. Most of the executives asserted that creativity begins within the family and with schooling.

ii. Creativity Has Many Sources:

Dr. Labelle found that top teachers relied on many different sources of creativity, usually beginning with the inner self. For some it was being able to trust one's own intuition, knowing oneself, and being self reflective. For others it was seeking one's inner resources and knowing one's limits. Another business executive spoke of the interplay between happiness and creativity, each engendering the other.

iii. Creativity Can Be Developed:

Dr. Labelle found that creative teachers used many ways to develop their creativity. For example, they read widely; take courses on creativity development; work with mentor; learn from failures/experiments; have fun; are not afraid of fear; know their needs; observe the world; make decisions quickly; encourage others to be creative; are reflective; have an open mind; take risks; work hard; and build on successes.

Hong and Aqui (2004) studied the differences between academically gifted students who achieved high grades in school, and the creatively talented, those students with a high interest, active and accomplished in learning but not necessarily high achieving in school subjects. Hong and Aqui found significant differences in cognitive strategies used by the two groups with the creatively talented being more cognitively resourceful. This is not to say that students cannot be both academically gifted and creatively talented in school subjects. However, as they were examining differences, their study did not include students with strengths in both areas.

Hong and Aqui's (2004) division of talent into the academically gifted and creatively talented is important in the consideration of talent development. The academically gifted student may excel in the classroom by demonstrating high achievement which is valued in traditional educational settings. The academically gifted usually demonstrate their mastery of the utilitarian aspects of school subjects, but neither speed nor accuracy in the identification problems.

Current tests of number or numerical facility emphasize speed with stress imposed by severe time limits and accountability on the accuracy of the solutions (Romer, 2008). However, the next generation must be shown the "wellsprings of creativity, imagination, and an appreciation of the beauty of the subject" (Keller, 2006). In an analysis of cognitive ability theory and the supporting psychological tests and factor analysis, Romer, (2008) noted that despite six to seven decades of work, the relationships between the discrete abilities measured by psychometric tests and performance in calculation remains unclear.

Marvin (2006) found that, in general, most classroom teachers think there is a single correct answer and only one correct method to solve a problem. If taught that there is only one right answer or only one correct method, students' concept becomes

limited. Ogawa (1991) illustrates this point in a discussion with an elementary classroom teacher about a student who had arrived at the correct answer in an unexpected way.

Some researchers of creativity consider that there are five-steps in creative process:

i. Fact-finding

ii. Problem-finding

iii. Idea-finding

iv. Solution-finding; and

v. Acceptance-finding.

Many researchers believe that creativity can be taught by teaching (Simonton, 2000). Torrance (1974), in his widely used definition of creativity, concludes that creativity elements can be learned because creativity is the process of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements, disharmonies and so on; identifying the difficult, searching for the solutions making guesses or formulating hypotheses and possibly modifying and retesting them; and finally communicating the results. All factors that encourage the production of unique and useful problem solutions in the work place are creativity-enhancing factors.

According to Simonton (2000), creativity comes more from environmental factors than hereditary factors. Research has also shown that creative people do not like to work in a conventional way. In the classroom, White, (1968) has reported that creativity is displayed by students who think divergently.

2.10.5 Four Major Thinking Processes

To help students strengthen their ability to improve creativity, four major thinking processes are emphasized. They are:

i. Observing And Inferring: encouraging children to describe objects both orally and pictorially.

ii. Comparing: asking children to note likenesses and differences.

iii. Classifying: asking children to sort objects on the basis of one or more attributes.

iv. Sequencing: asking children to order elements in a set on the basis of one or more given characteristics. (Ma'moon, 2005)

2.10.6 Using Computer in the Classroom

Technology is used in the teaching and learning of school subjects for enriching and improving the teaching and learning conditions. Torrance (1990) defines creative learning as a natural healthy human process that occurs when people are curious and excited. Creative thinking and learning involve the ability to sense problems, fluency, flexibility, originality, and elaboration. With technology capabilities, students can visualize concepts which are difficult to comprehend without technology.

With the help of computers, the teacher can effectively address the challenge of organizing instruction for promoting creativity. Visual representation on a computer screen is more beneficial to the students' understanding compared to diagrams in books. There is no doubt that using a variety of technological tools, such as calculators, computers, and hands-on materials, under the guidance of a skillful teacher, creates a rich learning environment. Such an environment helps in exposing

and preparing students for diversified experiences. This is the exposure necessary for nurturing creativity. (Zhou, 2003)

2.10.7 Responsive Culture of Classroom/School

Students' creativity is also influenced by a responsive classroom culture. A deeply responsive classroom culture alleviates motivational struggles and promotes students' perceptions of self-determination. Differences such as children's ability and interests, their social interaction and personalities and even the weather, will combine to create the learning atmosphere of that class at that moment in time. Teachers should continuously adapt, change, add to and even abandon the prepared lesson plans as they assess the suitability of the work. (Robert, 2003)

For the students to feel creative in school subjects, they need to believe that they are good at them. The teaching strategy should develop positive and realistic self-concept among the students. Teachers should exert wonderful power over a student's creativity. A responsive classroom culture will facilitate students' adaptive learning processes. The learning environment should support the creativity processes of those who are undergoing motivational struggles as well as those who are deeply engaged in learning.

The phrase "fostering creativity" put greater stress on establishing a learning climate that offers students opportunities for cultivating their creative skills (e.g. problem solving). The facilitating element would involve introducing a variety of activities that represent a holistic perspective on the teaching and learning process (e.g. both individual and team work). Emphasis should be placed on creating authentic learning situations - students are thinking, feeling, and doing what practicing professionals do (Getzels & Jackson, 1962). The fundamental nature of

such authentic high-end learning creates an environment in which students apply relevant knowledge and skills to the solving of real problems (Grainger, 2005).

2.10.8 Constructivism

Black (1995) has created an educational paradigm based on the principles of constructivism. The model, called the Interpretation Construction (ICON) Design Model, reflects how cognitive psychology, technology and constructivism can be integrated into instructional activities. The main six steps in this approach are:

i. Observation: Students make observations of authentic artifacts anchored in authentic situations.

ii. Interpretation Construction: Students construct interpretations of observations and construct arguments for the validity of their interpretations.

iii. Contextualization: Students access background and contextual materials of various sorts to aid interpretation and argumentation.

iv. Cognitive Apprenticeship: Students serve as apprentices to teachers to master observation, interpretation and contextualization.

v. Multiple Interpretations: Students gain cognitive flexibility by being exposed to multiple interpretations.

vi. Multiple Manifestations: Students gain transferability by seeing multiple manifestations of the same interpretations.

2.10.9 Teaching Creativity through Testing

The test that requires the most divergent and creative thinking also encourage creativity in students. The last items require the most convergent thinking and least creative thinking. . Bowkett (2007) suggests the following steps while assembling a test for students.

i. Flexibility Of Test Items: Give more points for the least expected and most unusual correct answers to a question. Tell the class how you are scoring these items.

ii. Example Question: Common responses would get less credit than uncommon responses that seem equally feasible.

iii. Fluency Of Test Items: Ask questions that have more than one acceptable answer, and give credit based on the number of correct and tenable answers a student offers. Ask the student to rank the answers according to which answers are best, which are average, and which are less than average in quality.

iv. Draw The Opposite Test: Ask students to create a one-inch drawing next to each test word or concept that illustrates the opposite of the meaning of the selected word. This provides creative thinking practice because it requires both knowledge and imagination.

v. Write The Opposites Test: The students are asked to fill in the blank after each word by writing the opposite meaning of the word. In research, highly creative people have been found to intuitively come up with opposites faster and more frequently than average creative people.

vi. Essay Test: Essay tests can assess creative thinking or they can be directed at only memory and knowledge. Good questions can be posed to require imagination and problem solving that builds on knowledge acquired in the course and on thinking skills practiced in the course.

vii. Image/Word Matching: Include a group of small images on the test and ask students to match the word that best fits each image.

viii. Short Answer And Definition Test: Ask students to write short definitions of the terms. This is good for knowledge testing, but creativity is not being tested unless you ask for opposite definitions.

ix. Multiple Choices: This is time consuming to write an assortment of responses that look correct, with only one correct response per item. This can test knowledge well if the items and choices are well written. To make it a bit more creative, you can ask which the wrong answer is. It is easy to grade.

x. Matching Test: Matching probably encourages the least creative thinking of these test formats. The teacher supplies a second matching list of definitions, names, etc. that is based on how these things have been explained in the course.

xi. Take the Test Yourself: As a teacher, you will want to assemble appropriate items and take the test yourself before administering it to students. Fellow teachers who agree to read each other's tests can be very helpful in finding problems.

xii. Divergent Thinking: If your course consistently requires divergent thinking and imagination, it is quite valid to require this on the tests as well. I think many tests are unfair to highly creative students because most tests do not require creative and divergent thinking. Unfortunately, course content is often taught without asking for enough critical and creative thinking.

2.10.10 Avoiding Classroom Creativity Killers

Marvin Bartel (2008) has described ten classroom creativity killers. Their avoidance/discouragement during teaching and learning processes improves students' creativity in the classroom. These killers are as follows:

i. Encouraging Renting (Borrowing) Instead Of Owning Ideas:

Real work is based on the child's own experience, memory, observation, and/or imagination. Real work is not borrowed from other children or other persons.

ii. Assigning Grades Without Providing Informative Feedback:

Grades without rationale give no useful information that helps a person be creative. Sometimes grades punish instead of rewarding. If grading is used as punishment, it can motivate rebellion or passive resistance unless the student is unusually mature. When grading is needed, we can use an accumulation of positive points including credit for growth and improvement (longitudinal grading instead of normative grading). Normative grading assumes that there is a certain equal norm that everybody must achieve. It would be like forcing all children to be a certain height by a certain age.

iii. Giving A Lot Of Cliché Symbols Instead Of Original Experience:

Snoopy dogs, hearts, smiley faces, stick figures, formulas for drawing trees or animals, ovals for people, and so on, are all evidence that we are killing creative thinking in our class. If we see a lot of Cliché drawing, it tells us that we have not established a classroom culture of creative thinking and a joy of learning to learn.

What if we practice doing experiments in order to have fun making discoveries instead of teaching principles and color mixing as facts? Can more of our homework consist of idea books, journals, sketchbooks, question-lists, diaries, reflections, illustrated experiences, and so on that can be turned into future class projects?

iv. Teacher Demonstrates Instead Of Having Students Practice:

Tell us and we might remember a little while - if we listen. Show us and we will remember a bit longer - if we pay attention. Have us do it - we learn it. When we demonstrate, we still get quite a few questions about what we "taught". When we direct a practice session nearly everybody feels confident to do it again using their own ideas. A demonstration can cause the aborting of imagined ideas before they are born. We never see what a student might have imagined by providing the "right" way.

v. Teacher Shows An Example Instead Of Defining A Problem:

When not showing examples prior to work, we must provide a better problem definition, more chances to practice the technique, and be particularly alert to students who may be floundering at the beginning of a problem because they are not accustomed to doing their own thinking. Sometimes we have to repeat the practice a few times until everybody understands how to practice a new skill that can help them be creative.

When not showing an example, we must give students time for their subconscious mind to operate. This might mean that we discuss assignment issues and conduct practice sessions on one day and come back to the same problem on another day. Many students forget what is learned, so we should ask questions to let them know that it is good to remember what is learned so it can be used again next time.

Often, if students are not accustomed to listening carefully, they feel lost if we do not show them what it is supposed to look like. In these cases, we repeat the problem definition using different words, or we have them make some sketches of what they think might work. They are not used to the idea that they are to originate ideas from their own lives, experiences, and concerns. When we do not show them the answers, they may need help in learning how creative people develop ideas for their work. It can mean that we start thinking about things several weeks in advance. A future challenge can be presented long before the actual production so the subconscious mind can be focused on it. Creative people generally have several projects going on simultaneously at different stages of development. Creative minds, once unleashed, continue to work while we sleep.

While "image flooding" (showing many examples) may be inspirational, it can also be intimidating and very suggestive. It can be argued that "image flooding"

creates slicker work, but less creative thinking skills. It may win the scholastic awards, but it teaches us to go through life in other people's skins. We never learn the ecstasy of having original ideas.

vi. Teacher Praises Neatness More Than Expressive Original Work:

Neatness is over rated. Conformity (and even following the assignment too slavishly) may be a negative indicator when assessing work. We believe that product centered education makes very good slave training. What we want is student ownership. In any list of grading criteria, originality must have more importance than neatness. Neatness is style--not substance. As a style, neatness can get some credit, but other styles that are well executed without showing neatness need to get just as much credit.

vii. Teacher gives Freedom without Focus:

If we ask students to do whatever they want to do, they often avoid risk by doing something they already have learned in the past. The amount of creative thinking may be zero. When there are limits, there is a better chance of having a challenging task. Limits can encourage new and creative problem solving. The teacher's challenge is to make the limits seem compelling and interesting to the student. Good lessons ask questions, provide learning goals, reasonable objectives, and so on. As a teacher, our job is to make the hard stuff easy and to make the easy stuff hard. It is not to allow risk free lazy repetition.

As teachers, we also benefit from self-imposed limits that force us to try new approaches. If we have been routinely teaching something with a demonstration, it can be very creative for us to come up with a way for students to learn the same thing with hands-on experiences that we have them do as a warm-up or preliminary practice routine. If we have routinely been teaching by showing examples, it can be very

creative for us to come up with alternatives that use questions, experiments, preliminary sketches, and list making instead of showing visual answers (examples).

Students of nearly any age can learn to give themselves limits, but we have to cultivate the classroom culture where these expectations are expected. We want there to be student choices that require genuine thinking and decision making, but never choices to avoid innovation and problem solving.

A creative classroom culture expects focus and experimentation that requires modification to move beyond entrenched habits of thinking and working. We want students to learn to work this way on their own. Therefore, we think it is good to move from assigning this at first to a culture where it is expected without being specifically required. In class, the rubrics and critiques used can actively move students in the direction of self planning for creative thinking.

viii. Making Suggestions Instead Of Asking Open Questions

This makes students less self-reliant and more dependent. We teach them not to think for themselves. Would it not be better to bite our tongue - to pause long enough to phrase a question or two that helps students realize that what they think is important? We can often simplify the problem by asking them to solve a smaller problem that helps with the larger question.

ix. Teacher Gives an Answer Instead of Teaching Problem Solving Experimentation Methods

Some move things around until they look "right". Some know that they need to simplify. Some need to work at creating new kinds of order from chaos. Some want to point out the problems of the world. Others want to solve them. Some want to search for more perfect beauty. Still others use intentional accidents (often a series

of accidents). They find ideas in the accidents that are impossible to discover by force of will.

There are many experimental methods of working aesthetically. It is not our job to answer the students' questions. It is our calling to encourage the students to learn how to formulate questions that they find compelling. It is our job to make sure they learn to devise ways to test their ideas experimentally. In this sense we are teaching both science and art--truth and beauty.

x. Teacher Allows Students To Copy Other Artists Rather Than Learning To Read Their Minds:

We know that individuals look at and that they are influenced by the work of others (as well as everything else in their lives). How can we respond creatively to outstanding works done by other? How do we learn to stand on their shoulders rather than gather their crumbs? How can we use their Officialise to surpass them, or at least do for our time what they did for their time?

The answer is to think about the apprentice system of teaching and learning. Showing examples to students in order to develop their own concepts and generate ideas about creative effort is considered well and good. When not showing examples, we have to practice other ways to generate ideas.

In the tradition of the apprentice system, many assume that the apprentice learns by copying the techniques and looking at the master's finished products. Some of this happens. However, what may not be nearly as obvious is that particularly creative apprentices are also apprenticing the master's idea generation process. The creative apprentice copies the master's thinking methods, idea building sequences, questioning processes, warm-up routines, practice routines, habits of work, and so on.

Today, formal education has replaced the apprentice system. As teachers, we should start a new course by showing slides of great works of individuals in the area the students were expected to learn. Starting the course with warm ups convenes the learners master skill building and idea generation activities. As a result, they learn good practice methods to build confidence and make things easier to do. New students get warm-ups that are easy enough to avoid frustration and hard enough so they feel they are learning and becoming prepared and skilled enough to be creative. This is accompanied by questions to be answered with materials. The questions focus the thinking and the practice suggests ways to materialize answers to the questions.

Often students expect and ask to see examples. We should assure them that we will be studying great exemplars as we begin to understand and experience how it feels to materialize work ourselves. We explain that when we look at great work, we see a reflection of another time and/or culture. We do not see work that needs to be done today by us and in our situation.

By showing exemplars of great work after some student creative experience, we want the students to see validation of their own inventions and yet be inspired to come back again and again knowing that there are more ways to think, to question, and develop the same themes. First impressions are important and unforgettable. Creative work is more likely to come from learning how to learn from the minds of others while applying similar thinking to local and personal experiences.

By showing exemplars of great work, we hope students will respond by moving beyond the exemplars by "stealing" thinking processes to make their own work---never copying or borrowing the look or style of the work. The thinking processes are taken (copied) to strengthen and express their own discoveries and experiences more fully. Learning to use models creatively means learning to search

for the hidden motivations under and behind them. We have to learn to see the masterwork in ways that inspire and activate our minds. Copying the work kills creativity because it does not include this thinking and speculation process. Because copying replicates answers, it is a shortcut that eliminates questions. It teaches dependency--not creativity.

(www.marvinbartel-2001to2008)

2.10.11 Teaching Creativity and Teaching for Creativity

The NACCCE (National Advisory committee on Creative and Cultural Education) report (1999) made a distinction between teaching creativity and teaching for creativity in its characterization of creative teaching. The former is defined as 'using imaginative approaches to make learning more interesting and effective' (ibid. p. 89). The latter is defined as forms of teaching that are intended to develop young peoples own creative thinking or behavior. (Lubart, 1994)

2.10.12 Teaching Creativity through Problem Solving

Most of the time, there are many correct approaches leading to solution of a given problem. In order to achieve this, rich thinking skills are required. With the skills, students can understand ideas better, discover relationships between ideas and solve problems that involve the ideas. Students see the school teacher as the organizer and presenter of information providing examples for the students to duplicate. Teachers should help the students to see school subjects with new eyes. The essential role of a teacher is to guide the students to identify learning as investigation and interaction to construct knowledge. (Keller, 2006)

Jeffrey (2001) suggest that problem solving technique has the following four important features so it should be encouraged in teaching learning processes:

i. Problem solving develops general cognitive skills.

ii. Problem solving fosters creativity.

iii. Problem solving is a part of application process.

iv. Problem solving motivates pupils to learn.

To prepare students for life in today's highly technical society, their mathematical and science knowledge as well as creativity must include and go beyond knowledge of the simple skills into capability to solve more complex problems. In problem-based learning curriculum students place more emphasis on meaning rather than on rote learning. They are more confident and self-directed in their acquisition of skills. They use a more in-depth approach to learning and employ a hypothetico-deductive mode of reasoning which works backward from the starting hypothesis (Lipwell, 1979).

The effort to help students develop passion should also involve the promotion of confidence, persistence and risk taking. Where appropriate, allow students to define their own problems and conduct a self-assessment of their efforts and outcomes, rather than always having work both defined and evaluated by teachers. It is too often that students' curiosity, motivation and creativity are stifled by the educational environment. A deeper understanding of how and why this happens and how to correct it is needed.

Problem-based and project-based learning programs have shown significant promise to increase divergent and convergent thinking. These methods are crucial for engaging students in learning activities and increasing their motivation as well. A deeper review of some of the more well-regarded problem-based learning programs on creativity will be keys to understanding how to best implement this method in the classroom environment. (Keller, 2006)

2.11 Characteristics of Creativity-Encouraging Institution

Fryer & Collings (1991) have concluded that five major characteristics of a creativity-encouraging institution are:

i. Collectivism—Trust is expected to be enhanced by the management of the organization that allows individuals to contribute to the decision-making processes that affect the creativity of the institution/organization.

ii. Reward System—Rewarding staff members and students develops a competition among worker and outcome. Fryer & Collings stress that defining the reward method in a specific way tells employees what is wanted from them. The reward system that suggests to the employee that creative contributions lead to being paid more sends a strong message about the preferences of the organization.

iii. Information Availability—Making all necessary data for a problem solving process develops creativity. It is a common complaint by students and teachers that the management holds some information secret and keeps employees in the dark. Another common complaint is that organizations are sometimes not willing to spend adequate funds for database subscriptions.

iv. Moderate Time Pressure—Providing sufficient time for creative work and problem solving enrich creativity and originality in students. Time pressure is important for the development of creativity but it needs to be moderate.

v. Flexibility—Flexibility is an important provision for an organization that lives by creativity. According to Fryer & Collings, flexibility is establishing few regulations that work to prevent big mistakes during creative processes. Many

organizations suffer from having too many conventions that contribute to hot employees and restricting their ability to challenge problems.

2.12 Characteristics of Creativity-Encouraging Organization

An organization, in order to enhance creativity, should set up a system where every member in the organization has the chance to communicate an original idea to people who have the authority to put these ideas into practice. Such creativity-encouraging systems should also include ways to give employees the opportunity to receive feedback. Feedback in this case is, according to Getzels & Jackson (1962), "knowledge of the actual outcome of the work activities". It is important that this feedback is rapid, accurate, and continuous.

Feedback can be a very important tool of enhancing creativity if it can effectively promote members of the organization to be always involved in different processes of creativity (Fryer & Collings, 1991). Many reasons can affect the process of communication of creative ideas to people in charge.

Establishing a system that encourages organization members to adopt new ideas without the fear of rejection and embarrassment seems crucial for enhancing creativity within an organization. To achieve that, a smooth transition between the steps of the collective decision making framework, as explained by Hong and Aqui (2004), should be supported. According to these authors, collective decisions go through five steps: (a) stimulation, (b) initiation, (c) legitimation, (d) decision, and (e) action. Novel ideas and problem solutions should be allowed to go through all these steps without many barriers.

Some researchers suggest that network of interpersonal contact is a significant factor in enhancing creativity. Sternberg & Getzels (1996) explain that because new ideas are risky, employees have the need to share their ideas with members of the organization whom they trust, often seeking encouragement and enforcement of the validity of the idea. Amabile (1984) conclude, "Innovative ideas are not usually discussed among people who have weak ties within the organization because their vagueness toward one another is greater". Organizations can contest this factor by organizing social events that help to enhance interpersonal relationships among employees. Amabile and Amabilehas (1984) further suggest bringing managers and employees together regularly in problem solving sessions is also useful.

A related factor is the importance of (and the dwindling of) face-to-face communication among an organization's decision makers and between the decision makers and (other) creative employees, including friendships (Barron, 1984; Clegg, 1990). Organizations increasingly depend on mediated communication channels to communicate new ideas.

Some studies propose that integrating playfulness and humor in the place of work may encourage creativity (Cowley, 1998; Grainger, 1987; Jeffrey, 1994). Latelle and Marvin (1962) examined "playful attitude". This attitude was found 89 percent in creative students' answers, and 32 percent in intelligent students' answers. In another test, called "Picture Drawings," Latelle and Marvin found humor in 53.8 percent of highly creative students, and in only 17.8 percent of highly intelligent students. They conclude, "The high creative tend to be more fanciful and humorous. Indeed, some of their pictures seem to be rather obscure fantasies or elaborate pictorial puns, apparently intended as much for their own enjoyment as anyone else's".

Creative work requires applying and balancing three abilities that can all be developed (Sternberg 1985; Sternberg & Lubart, 1995; Sternberg & Williams, 1996).

i. Synthetic ability: It is the ability to generate novel and interesting ideas. Often the person we call creative is a particularly good synthetic thinker who makes connections between things that other people do not recognize spontaneously.

ii. Analytic ability: It is typically considered to be critical thinking ability. A person with this skill analyzes and evaluates ideas. Everyone, even the most creative person you know, has better and worse ideas. Without well-developed analytic ability, the creative thinker is as likely to pursue bad ideas as to pursue good ones. The creative individual uses analytic ability to work out the implications of a creative idea and to test it.

iii. Practical ability: It is the ability to translate theory into practice and abstract ideas into practical accomplishments. An implication of the investment theory of creativity is that good ideas do not sell themselves. The creative person uses practical ability to convince other people that an idea is worthy. For example, every organization has a set of ideas that dictate how things, or at least some things, should be cloned. To propose a new procedure you must sell it by convincing others that it is better than the old one. Practical ability is also used to recognize ideas that have a potential audience.

2.13 Twenty-Four Tips for Developing Creativity in Students

The majority of teachers want to encourage creativity in their students, but they are not sure how to do so. Marvin Bartle (2004) claims that teachers can apply the following Twenty-Four Tips for Developing Creativity of their students.

i. Model Creativity

The most powerful way to develop creativity in your students is to be a role model. Children develop creativity not when you tell them to, but when you show them.

ii. Build Self-Efficacy

All students have the capacity to be creators and to experience the joy associated with making something new, but first we must give them a strong base for creativity.

iii. Question Assumptions

Everyone has to learn which assumptions are worth questioning and which battles are worth fighting. Sometimes it's better to leave the inconsequential assumptions alone so that you have an audience when you find something worth the effort. Make questioning a part of the daily classroom exchange. It is more important for students to learn what questions to ask-and how to ask them-than to learn the answers.

iv. Define and Redefine Problems

Promote creative performance by encouraging your students to define and redefine problems and projects. Encourage creative thinking by having students choose their own topics for papers or presentations, choose their own ways of solving problems, and sometimes choose again if they discover that their selection was a mistake.

v. Encourage Idea Generation

Once the problem is defined or redefined, it is time for students to generate ideas and solutions. The environment for generating ideas must be relatively free of criticism. The students may acknowledge that some ideas are better or worse, but teacher must not be harsh or critical.

vi. Cross-Fertilize Ideas

Stimulate creativity by helping students to think across subjects and disciplines. The traditional school environment often has separate classrooms and classmates for different subjects and seems to influence students into thinking that learning occurs in discrete boxes-the math box, the social studies box, and the science box. But creative ideas and insights often result from integrating material across subject areas, not from memorizing and reciting material. Teaching students to cross-fertilize draws on their skills, interests, and abilities, regardless of the subject.

vii. Allow Time for Creative Thinking

Ours is a society in a hurry. We eat fast food, we rush from one place to another, and we value quickness. Most creative insights, however, do not happen in a rush (Gruber, 1986). We need time to understand a problem and to toss it around. If we are asked to think creatively, we need time to do it well. If we stuff questions into our tests or give students more homework than they can complete, then we are not allowing them time to think creatively.

viii. Instruct and Assess Creatively

If we want to encourage creativity, we need to include at least some opportunities for creative thought in assignments and tests.

ix. Reward Creative Ideas and Products

Reward creative efforts. For example, assign a project and remind students that you are looking for them to demonstrate their knowledge, analytical and writing skills, and creativity. Let them know that creativity does not depend on your agreement with what they write, only that they express ideas that represent a synthesis between existing ideas and their own thoughts. You need to care only that the ideas are creative from the students' perspectives, not necessarily creative with regard to the state of the art. Students may generate an idea that someone else has already had.

x. Encourage Sensible Risks

Creative people take risks and defy the mass by buying low and selling high. Defying the crowd means risking the crowd's wrath. But there are sensible-and less sensible-reasons to defy the crowd. Creative people take sensible risks and produce ideas that others ultimately admire and respect as trend setting. In taking these risks, creative people sometimes make mistakes, fail, and fall flat on their faces.

xi. Tolerate Ambiguity

A creative idea tends to come in bits and pieces and develops over time. But the period in which the idea is developing tends to be uncomfortable. Without time or the ability to tolerate ambiguity, you may jump to a less than optimal solution. Tolerating ambiguity is uncomfortable. When a student has almost the right topic for a paper or almost the right science project, it's tempting to accept the near miss. To help students become creative, encourage them to accept and extend the period in which their ideas do not quite converge. Ultimately, they may come up with better ideas.

xii. Allow Mistakes

When your students make mistakes, ask them to analyze and talk about these mistakes. Often, mistakes or weak ideas contain the germ of correct answers or good ideas. In Japan, teachers spend entire class periods asking children to evaluate the mistakes in their mathematical thinking. For the teacher who wants to make a difference, exploring mistakes can be learning and growing opportunity.

xiii. Identify and overcome Obstacles

Describe obstacles that you, friends, and famous people have faced while trying to be creative; otherwise your students may think that obstacles confront only them. Include stories about people who weren't supportive, bad grades for unwelcome ideas, and cool receptions to your ideas. To help your students deal with obstacles, remind them of the many creative people whose ideas were initially shunned and help them develop an inner sense of awe of the creative act. You can suggest that they reduce their concern over what others think, but it is tough for students to lessen their dependence on their peers.

xiv. Teach Self-Responsibility

Part of teaching students to be creative is teaching them to take responsibility for both success and failure. Teaching students how to take responsibility means teaching students to (1) understand their creative process, (2) criticize themselves, and (3) take pride in their best creative work. Unfortunately, many teachers and parents look for-or allow students to look for-an outside enemy responsible for failures.

xv. Promote Self-Regulation

Sour students must take control of the process. After forming initial creative products and awakening the joy of creating in students, strategies should be planned for self-regulation.

xvi. Delay pleasure

Students must learn rewards are not always immediate and that there are benefits to delaying gratification. Many people believe that they should reward children immediately for good performance, and that children should expect rewards. This style of teaching and parenting emphasizes the here and now and often comes at the expense of what is best in the long term. The short-term focus of most school assignments does little to teach children the value of delaying gratification.

xvii. Encourage Creative Collaboration

Collaboration can spur creativity. Encourage students to collaborate with creative people because we all learn by example. Students benefit from seeing the techniques, strategies, and approaches that others use in the creative process. Also, students absorb the enthusiasm and joy many creative people exude as they go about the business of making something new. Finding practical ways to encourage creative performance in groups of students is essential because you cannot work with students one-on-one all of the time.

xviii. Imagine Other Viewpoints

An essential aspect of working with other people and getting the most out of mutual creative activity is to imagine ourselves in other people's shoes. We broaden our perspective by learning to see the world from a unusual point of view, and that experience enhances our creative thinking and contributions. Encourage your students to see the importance of understanding, respecting, and responding to other people's points of view. Many bright and potentially creative children never achieve success because they do not develop practical intelligence (Sternberg 1985, 1997; Sternberg et al., in press). They may do well in school and on tests, but they never learn how to get along with others or to observe things and themselves as others see them.

xix. Recognize Person-Environmental Fit

By building a constant appreciation of the importance of person-environment fit, you prepare your students for choosing environments that are conducive to their creative success. Encourage your students to examine environments to help them learn to select and match environments with their skills.

xx. Find Excitement

Less creative people often pick a career for the money or prestige and dislike their career. These people do not do work that makes a difference in their field. Helping students find what they really love to do is often hard and annoying work. Yet, sharing the frustration with them now is better than leaving them later to face it alone. To help students expose their true interests, ask them to display a special talent or ability for the class.

xxi. Seek Stimulating Environments

To encourage students to develop skills in selecting environments that enhance creativity, choose some environments for the class to explore and help your students connect the environments with the experiences, creative growth, and accomplishment. Show students that creativity is easier with environmental stimulation.

Plan a field trip to a nearby museum, historical building, town hall, or other location with interesting displays and ask your students to generate and examine creative ideas for reports. Read excerpts from a book about a creative pioneer in the discipline being studied or the fieldtrip destination you have targeted-a great paleontologist if the focus is on space travel. Get students involved in role-playing.

xxii. Play to Strengths

Show students how to play to their strengths. Describe your strengths to your students and ask them to declare their strengths. Any teacher can help students play to

their strengths. All you need is flexibility in assignments and a willingness to help unwilling students determine the nature of their interests and strengths.

xxiii. Grow Creatively

Once we have a major creative idea, it is easy to spend the rest of our career following up on it. Being creative means stepping outside the boxes that we-and others-have created for ourselves.

xxiv. Proselytize for Creativity

Make the difference by telling your colleagues, associates, administrators, principal, school board members, and everyone else how important it is to develop creativity in students. Use examples of creative student work, particularly from students who are not gifted in traditional academic abilities, to demonstrate the difference it makes to teach for creativity. Describe how every student can be reached with patience and a few techniques for developing creativity.

If you spread the word about the importance of teaching for creativity in schools, homes, and communities, this approach to teaching will become more common and benefit teachers and students everywhere. Small changes in the way questions are asked, assignments are worded, and tests are crafted can make big differences in the lives of students. These are the ideas anyone can use to start teaching creativity. (Bartel, 2004)

2.14 Measurement of Creativity

To assess efforts to develop creative potential, a means of identification and measurement is needed. There have been several instruments developed to measure creativity (Balka, 1974; Evans, 1964; Getzels & Jackson, 1962; Haylock, 1984; Jensen, 1973; Singh, 1988). Balka (1974) defined creativity as the score obtained on his instrument. His instrument was developed based on responses to his Creative

Ability in school subjects Survey distributed to a randomly selected group of 100 subject specialists, 100 educators, and 100 secondary school teachers. The overall response rate to the survey was 81.3%. The resulting criteria to measure creative potential were the following:

i. Ability to formulate hypotheses concerning cause and effect;

ii. Ability to determine patterns in school situations;

iii. Ability to break from established mind sets to obtain solutions;

iv. Ability to consider and evaluate unusual ideas, to think through the possible consequences for a situation;

v. Ability to sense what is missing from a given situation and to ask questions that will enable one to fill in the missing information;

vi. Ability to split general problems into specific sub problems

(Balka, 1974)

Kohler (1997) claimed that the inadequate success of students is due to lack of creative approaches in teaching and learning. Evans (1964) identified three aspects that elicit creative thinking. These are fluency, flexibility and originality. These parameters are used for assessing general creativity in Torrance's (1966) general divergent production tests. The Torrance Tests of Creative Thinking (TTCT) (Torrance, 1974) have frequently been utilized to assess children's creative thinking. Fluency refers to the number of ideas generated, flexibility to the shifts in approaches, and novelty to the originality of the ideas generated. The three components can be adapted and applied in the domain of creativity. The fluency score is the total number of relevant responses made; the flexibility score is the number of different methods or categories of ideas, while the originality score is based on the number of unusual, unique or infrequent ideas. Students' responses to creativity problems can be assigned

by fluency and originality scores (Prouse, 1967). Fluency may be awarded by counting the number of acceptable responses made. Duplicate responses are to be eliminated. The originality score is obtained by giving weight for correct responses within a range of percentage by students giving the same response (Prouse, 1967). For example, a weight of one (1) is assigned to a common response given by 25 percent to 50 percent of the students.

Teachers can provide valuable knowledge and advice to their students that will promote enduring creativity in their lives. For instance, creative people must be willing to overcome resistance to their ideas and plans. Sternberg (2003) relates that "I have often wondered why so many people start off their careers doing creative work and then vanish from the radar screen. I think I know at least one reason why: Sooner or later, they decide that being creative is not worth the resistance and punishment". Teachers can train students to face and overcome obstacles by relating personal narratives on when they encountered people who were not encouraging and reacted negatively to their best ideas. Instructors should have students read materials (e.g. articles and instructor lectures) that will enhance their awareness of issues associated with the creative process. Students should learn that obstacles can appear in different forms such as external issues (e.g. fearing the opinions of others) or reflect internal battles with performance anxieties. Teachers can use vigorous group discussions that mentally equip students to handle adversity during their creative projects (Sternberg, 2003).

The social-personality and social-cognitive approaches have focused on three major sources of creativity: personality variables, motivational variables and socio-cultural environment. Carl Rogers and Abraham Maslow emphasize self actualization connected with self-acceptance and a supportive environment. Researchers have

identified numerous creative individuals who had weak people skills and struggled to cope with their daily routines. The 1950s-1970s saw psychologists striving to develop a test to measure creative potential similar to the modern IQ tests. Various personality tests were utilized to measure creativity but they tended to reveal information on social achievement. Creativity research during this era did affirm that creativity was related to individuals having a strong work ethic, dedicated to completing tasks, being motivated and have a good working knowledge of their job. Yet, the researchers were not able to develop a personality test that could effectively identify exceptional talent in children or identify particular personality traits that were characteristic of creative people (Sawyer, 2006).

It is necessary to address the impliciticos of measuring creativity for the educational process because the mesurement and evaluation of creativity form part of the development of creativity and innovation.

2.15 Suggestions in the Measurement of Creativity

Clegg (2004) says that there are some implication/indirect suggestions that should be kept in mind while measuring creativity of learners. These are:

i. There is no consensual definition of creativity;

ii. Understanding creativity is a complex process;

iii. Obtaining original and appropriate results is time consuming;

iv. Self-realization is quite difficult and needs patience; and

v. Measuring creativity is, in itself, a challenge.

Talf, Mackinon, Marin (1978) says that for fifty years the great theorists of creativity focused on measuring creativity, at last they decided that measuring creativity is based on four (4) categories:

i. Attitudinal aspects (divergent production, fluency, flexibility, etc.)

ii. Creative personality (the behavior of biographical subjects)

iii. Projective tests

iv. Performance Tests: Tests of artistic abilities, Tests of psychometric creative performance and production.

2.16 Creativity and Cognition

During the 1970s, cognitive psychologists began to emerge with new approaches for examining creativity. Researchers focused on studying mental processes instead of the creative personalities. Cognitive studies led to undermining the idealists theory that stressed once a creative concept was produced, it is not essential to implement the idea. In contrast, action theory advocates the execution of ideas as being a key part of the creative process. Therefore, creativity happens over time and while the individual is working on using their ideas in a project (e.g. artwork). The creative process has four primary stages: preparation, incubation, insight, and verification (Simonton, 2006).

Creativity involves generation of new ideas. A person may come to a new realization. We do not know when a creative event will happen. There are many myths that grow up around great inventions. The significance of inventions is not realized until much later. People tend to dramatize the story. Most creative acts are rather mundane. Invention is 99% perspiration and 1% inspiration. (Edison, 2007)

The cognitive ability to produce novel and valuable ideas is the first step in innovative processes (Torrance, 1988). Students who use content in creative ways learn the content well. They also learn strategies for identifying problems, making decisions, and finding solutions both in and out of school (Davis, 1994). 21st century schools should foster creativity, judgments, the ability to think, and the power of expression (Cowley and Amabile, 1991).

2.17 Creativity and Innovation

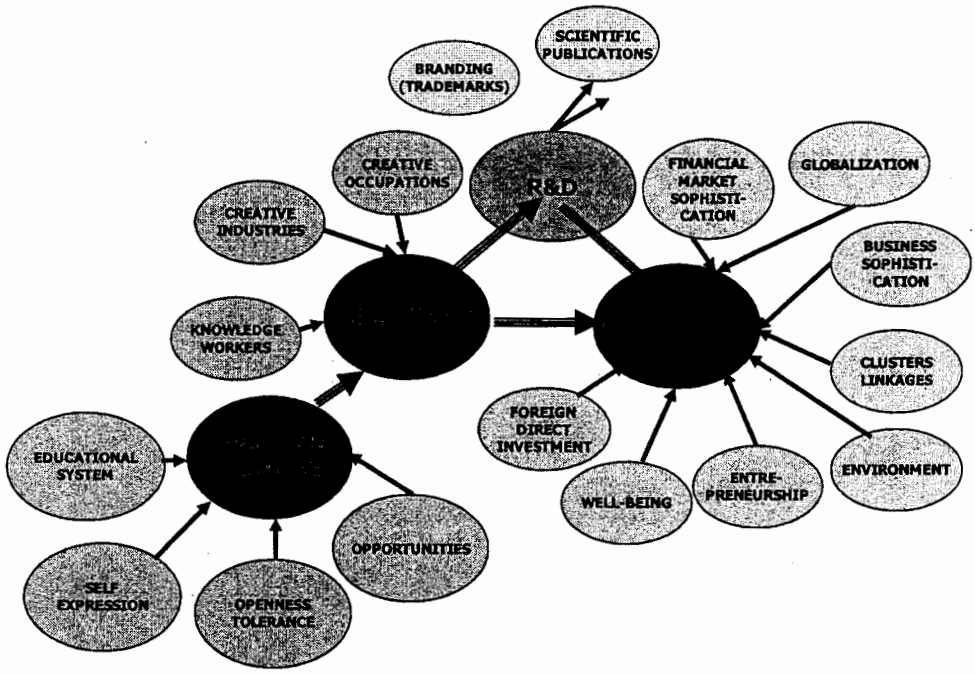

Fig. 2.3: The nature of innovation [Ogawa, 1991]

Creativity is typically used to refer to the act of producing new ideas, approaches or actions, while innovation is the process of both generating and applying such creative ideas in some specific context. The human being needs to innovate and be creative in order to live and progress.

For example, Amabile and Mednick et al. (1996) suggest that innovation begins with creative ideas i.e. creativity by individuals and teams is a starting point for innovation; the first is a necessary but not sufficient condition for the second.

In the context of an organization, therefore, the term innovation is often used to refer to the entire process by which an organization generates creative new ideas and converts them into novel, useful and viable commercial products, services, and business practices, while the term creativity is reserved to apply specifically to the

generation of novel ideas by individuals or groups, as a necessary step within the innovation process.

(http://en.wikipedia.org/wiki/Creativity)

2.18 Suggestions for Bringing Innovations

Marvin and Khatenna (1975) suggest that following are the requirements to bring innovations:

i. Innovation requires a risk-analysis and discipline;

ii. Schools need to be at an acceptable level before the freedom to innovate;

iii. Test things out – not just pilot;

iv. Learn from trying things out on behalf of the profession;

v. Careful planning;

vi. Close monitoring and evaluation; and

vii. Processes to capture knowledge.

2.19 Principles of Teacher-Led Innovations

Maravcsik and Ogawa (1991) say that the following are the basic principles or rules to be applied in classroom innovative processes:

i. Strong moral purpose

ii. Oriented towards learning

iii. Clarity of purpose and goals

iv. Builds on and develops professional knowledge

v. Integral to the professional life and work of teachers

vi. Context-based developing teachers' knowledge and skills ("New" professionals)

vii. Networked learning to build professional knowledge (innovation, creativity, quality)

2.20 Teachers and Innovations

Teachers are implementers of policy reforms and initiatives determined beyond the classroom. They are in need of tighter standards and greater accountability as a result they can play a significant role in providing solutions to the problems facing education. Moreover, Teachers are the masters of their own fate as the profession has to get it into teacher's mind that it is his own job to solve the problems of the education system.

(http://www.Sir Michael Barber. The Risk Takers, Guardian Education)

Kohler (1997) claimed that the inadequate success of students is might be due to lack of creative approaches in teaching and learning. Parness (1964) identified three aspects that elicit creative thinking. These are fluency, flexibility and originality. These parameters are used for assessing general creativity in Torrance's (1966) general divergent production tests. The Torrance Tests of Creative Thinking (TTCT) (Torrance, 1974) have frequently been utilized to assess children's creative thinking.

Creativity, as a teaching objective and a very sensitive and fragile phenomenon, should not be forcefully imposed upon teachers and students applying one pedagogical method or another. The teaching process should be flexible, allowing quick changes depending on the progress of students. In such a way the independent thinking and creativity of students could be stimulated in any teaching environment. (Rowe, 2004)

There is a degree of mystery associated with creativity that challenges educators to continue investigating how individuals translate their imaginations and ideas into innovative projects. Unfortunately, educators have often been influenced by pragmatic approaches that place a strong emphasis on practice with a lower priority on theory. Edward De Bono's work on lateral thinking has been a commercial success

by promoting two types of creativity strategies: Positive-Minus-Interesting (PMI) and thinking hats. Von Oech's focus is to encourage people to adopt a variety of roles: explorer, artist, judge and warrior. Practical approaches have a certain appeal due to their simplicity but they often lack scientific testing and validity (Sternberg et al, 2005).

2.21 Prospects of Creativity Development

Creative people can avail the following opportunities and so many other benefits all over the world.

2.21.1 Job Opportunities

Creative individual can truly get the title of a global person in the global village. Creative person can find his routes in each and every walk of life e.g. he can be the best teacher, educator, manager, entrepreneur, novelist, artist, columnist, economist, politician, or a chief executive officer. In such jobs there will be great opportunities for him to develop his critical and creative skills. Today many people are selected not for their pleasant personalities (it's hard to be perceived as pleasant when someone may have to fire 30% employees of an organization), learning and memory skills (computers or sub-ordinates are considered the best sources to remember the details), but for their creative vision to run the institution globally. (Quigley, 1998)

2.21.2 Benefits of Creativity

Creativity is viewed in organizational communication and management studies as one of the most desired qualities of organizations' members (Runco & Simonton, 1984; White & Treffinger, 1997). That is because creativity helps in coping with daily problems and stresses (Torrance, 1963; VanGundy, 1987). Highly creative people are

significantly better than highly intelligent people in terms of the achievement quality and quantity (Getzels & Jackson, 1962; Torrance, 1960). Furthermore, creativity, according to "chaos theory" and "complexity theory," is the only survival tool for an organization in an ever-changing business world (Eisenhardt & Brown, 1998; Johnson, 1995; Wah, 1998). Creativity is not only recommended for better organizations, but also preferred for employees. Hackman and Oldham (1980), utilizing the Job Descriptive Survey, found that employees have a stronger preference for a creative job over a well-paying job.

Cohen, Gene D. (2000), states the following benefits of creativity:

i. Creativity strengthens morale

ii. Creativity improves physical health

iii. Creativity enriches relationships

iv. Creativity enables the leaving of a legacy

(Cohen, Gene, 2000)

Taylor (1975, pp. 306-308) has described the following five level of creativity that can be used to identify contributions in science, art, problem solving, negotiation, and other subject areas.

i. Expressive: Spontaneity, where originality and quality of the product are unimportant (as in children's drawings).

ii. Technical: Involves skill and a new level of proficiency (for example, Stradavari's violin).

iii. Inventive: Ingenuity with materials, providing combinations to solve old problems in new ways (examples: Edison's light and Bell's telephone).

iv. Innovative: Basic principles are understood so that modification through alternative approaches is possible (examples: Jung and Adler elaborate on Freud).

v. Emergent: Involves the most abstract ideational principles or assumptions underlying a body of art or science. In rare instance there is an emergence of an entirely new principle or assumption (Examples: the work of Einstein, Freud, and Picasso).

2.21.3 The New Classification of People

Sternberg (1996) has classified people into four different classes on the basis of their creativity level. These are:

i) Creative Class

Scientist, Engineer, Architect, Educationists, Artist, Designer, Sportsmen, Actors come under this category.

ii) Creative Professionals

Manager, Businessman, Economist, legal/healthcare practitioners, technican, and sales officers come under this cateory.

iii) Working Class

Construction, extraction, installation, maintenance, repair, production, transportation, and materials moving occupations are under this class

iv) Service Class

Food production and service, personal care, low-end sales, office and administration support, community and social service, protective service occupations are related to this class.

2.21.4 Attitudes of Creative Class

Creative people get to do more enjoyable work and they contribute more by adding creative value. They also get paid better. The service economy is the support infrastructure of the creative age. Creative people are self-centered, and self-absorbing. They and the ordinary workers think differently, read different

newspapers, watch different shows, have different life styles, and vote for different parties. As a consequence, USA, and most countries with strong economy, is becoming a divided nation. The world is also becoming a divided world. The Three T's for Growth Technology, Talent, Tolerance is developing in creative class. (Toynbee, 2005)

2.21.5 Life Style of Creative People

Sternberg states that creative people tend to:

i. Have Front-loaded career (career first, live later)

ii. Have Life like Argentine Tango – the Slower the Better

iii. Create Purposeful creation in harmony with one's inner self

iv. Strive for innovation and creative refinement of products

v. Encourage organizations to be creative

vi. Provide incentives for regions to be creative

vii. Share local knowledge

viii. Have high degree of human interaction

ix. Adapt local conditions

2.21.6 The Rise of the Creative Class

Human creativity is the ultimate economic resource. The ability to come up with new ideas and better ways of doing things is ultimately what raises productivity and thus living standards. The number of people doing creative work has increased vastly over the past century and especially over the past two decades, now accounting for about one third of the work force. This is happening all over the world. (Zhou, 2003)

2.21.7 Mobility of the Creative Class

Richard Florida (2006) says, "The real threat to American security is not terrorism, it's that creative and talented people may stop wanting to come (to USA)." Likewise, the real threat to Taiwan security is not China or the Mainlanders; it's that creative and talented people (and businesses) may want to go elsewhere.

2.21.8 Latest Products of Creative Class

The following are the products/innovations of creativity that facilitate creativity in students in teaching/learning processes.

i. The virtual institutions are spreading

ii. Digital learning resources are created

iii. Students are leading their own learning

iv. Timetables are being made flexible

v. Students are working from home or elsewhere

(www.amazan.com.creativity_class_structure)

2.21.9 Creativity and Microsoft Software Developers

Microsoft follows the following criteria to encourage creativity

i. Hires smart people who think

ii. Expects employees to fail

iii. Keeps repercussions small when people make mistakes

iv. Creates them to use mentality

v. Sustains the company's start-up mentality

vi. Makes the office feel like home

(http://www.microsoft.com/presspass/exec/billg/bio.mspx)

2.22 Policy Provisions about Creativity Development

Educational Policy encourages creativity development in students by using the following wording.

i. The department of education and skills and qualifications and curriculum Authority have indicated the necessity of incorporating creativity into all curriculum subjects (nep, 1998-2010, p. 12)

2.23 Research Studies on Creativity

The study of creativity has a long history. However, serious research into creativity, certainly from a western perspective, only really took place from the middle of the 20th century. Many believe the trigger to be Guildford (1950) who in his APA Presidential Address challenged psychologists to pay attention to what he found to be a neglected but extremely important attribute in human behaviour, namely creativity. The focus at the time was from a psychological and behavioural point of view. As knowledge and experience developed, other frameworks for research into creativity started to emerge.

Prior to Guildford's plea, the earliest accounts of creativity were based on divine intervention. The creative person was seen as an empty vessel that a divine being would fill with inspiration. The individual would then pour out the inspired ideas. These mystical approaches dominated the study of creativity for many thousands of years and still have a major influence today.

The cognitive approach to creativity seeks to understand the mental representations and processes underlying creative thought. Finke, Ward & Smith (1992) proposed what they called the Geneplore model, according to which there are two main processing phases in creative thought: generative phase and an exploratory phase. In the generative phase, the individual constructs mental representations, which

have properties promoting creative discoveries. In the exploratory phase, these properties are used to come up with creative ideas. A number of mental processes may enter into these phases of creative invention, including the processes of retrieval, association, synthesis, transformation, analogical transfer, and categorical reduction.

The most recent practitioner perspective has been taken by pragmatics who have taken a generative approach aimed purely at producing more and more ideas (De Bono, 1971, 1985, 1992; Osborn, 1953; Gordon, 1961; Adams, 1974, 1986; Von Oech, 1983; Michalko, 1998). This perspective has been of particular interest to the business and management schools.

Dr. Labelle (1966) found that creative teachers used many ways to develop students' and their own creativity. For example, they take courses on creativity development; work with mentor; learn from failures/experiments; observe the world; encourage others to be creative; take risks; work hard; and build on successes.

Hong and Aqui (2004) studied the differences between academically gifted students who achieved high grades in school, and the creatively talented, students with high interest, active participation in learning activities but not necessarily high achievers in school subjects. Hong and Aqui found significant differences in cognitive strategies used by the two groups with the creatively talented being more cognitively resourceful. This is not to say that students cannot be both academically gifted and creatively talented in school subjects. However, as they were examining differences, their study did not include students with strengths in both areas.

Current tests of number or numerical facility emphasize speed with stress imposed by severe time limits and accountability on the accuracy of the solutions (Romer, 2008). However, the next generation must be shown the "wellsprings of creativity, imagination, and an appreciation of the beauty of the subject" (Keller,

2006). In an analysis of cognitive ability theory and the supporting psychological tests and factor analysis, Romer, (2008) noted that despite six to seven decades of work, the relationships between the discrete abilities measured by psychometric tests and performance in calculation remains unclear.

Marvin (2006) found that, in general, most classroom teachers think that there is a single correct answer and only one correct method to solve a problem. If learners are told that there is only one right answer or only one correct method, their concept will become limited. Ogawa (1991) illustrates this point in a discussion with an elementary classroom teacher about a student who had arrived at the correct answer in an unexpected way.

Researchers who have worked on creativity related issues, consider that Problem-finding and solution-finding are necessary for creativity development.

Many researchers believe that creativity can be taught by teaching (Simonton, 2000). Torrance (1974), in his widely used definition of creativity, concludes that creativity elements can be learned because creativity is the process of becoming sensitive to problems, identifying the difficulties, searching for the solutions, making guesses or formulating hypotheses, and finally communicating the results. All factors that encourage the production of unique and useful problem solutions are creativity-enhancing factors.

According to Simonton (2000), creativity comes more from environmental factors than hereditary factors. Research has also shown that creative people do not like to work in a conventional way. In the classroom, White, (1968) has reported that creativity is displayed by students who think divergently.

Some studies propose that integrating playfulness and humor in the place of work may encourage creativity (Barrett, 1998; Bowman, 1987; Freud, 1950; Getzels

& Jackson, 1962; Glynn & Webster, 1992; Mattimore, 1994; Schachtel, 1959; Schafer, 1969). Getzels and Jackson (1962) examined "playful attitude". This attitude was found in 89 percent of creative students' answers, and in 32 percent of intelligent students' answers. In another test, called "Picture Drawings," Getzels and Jackson found humor in 53.8 percent of highly creative students, and in only 17.8 percent of highly intelligent students. They conclude, "The high creative tend to be more fanciful and humorous. Indeed, some of their pictures seem to be rather obscure fantasies or elaborate pictorial puns, apparently intended as much for their own enjoyment as anyone else's".

Some studies about creativity in organizations signify that heterogeneous work groups (in terms of race, age, tenure, education, and gender) perform better than homogeneous groups on producing creative outcomes because heterogeneity helps with generating "a greater variety of ideas, perspectives, and approaches to solving problems" (Chatman et al., 1998; Hoffman, 1979; Nemeth, 1992). McLeod, Lobel, and Cox (1996) examined the issue of ethnic diversity and found that ethnically diverse groups are more creative than homogeneous groups. Dr. Muga (2004) has examined teacher-trainees in relation to their values, personality adjustment, and achievement motivation.

CHAPTER 3

RESEARCH METHODOLOGY

This chapter deals with the method of resources used in the present study under following headings:

3.1 Design of the Study

The Design of the Study was a survey (Descriptive) type. The research was quantitative in nature. It was also a comparative study i.e. researcher has compared the views about problems that hindered creativity and prospects that facilitated creativity development in students of secondary level among students and teachers of F.G. Model Schools of Islamabad

3.2 Sampling Design

As the population of this study consisted different strata i.e. F.G. Model Schools for Boys, F.G. Model Schools for Girls, secondary level male teachers, secondary level female teachers, male secondary level science students, and female secondary level science students, therefore, the researcher used stratified random sampling for the selection of the sample for this study. Thus all strata got due and equal importance. Furthermore, respondents from each stratum were selected on the basis of lottery technique so all respondents had equal chances of winning to be included in the sample. Random sampling is considered one of the best techniques for sample selection because it is unbiased one.

3.3 Population

There were twenty four (24) F.G. Model Schools of Islamabad till July 27, 2009. All 9th class science students and secondary level science teachers of 24 F.G. Model Schools of Islamabad constituted the population of the study. Their detail is given in table 3.1.

Table 3.1: Population of the study

S#	Category	Number of Individuals in the population
1	Total number of Boys of 9th Class Science Students of F.G. Model Schools of Islamabad	872
2	Total number of Girls of 9th Class Science Students of F.G. Model Schools of Islamabad	760
3	Total number of Male Secondary Level Teachers of F.G. Model Schools Islamabad	95
4	Total number of Female Secondary Level Teachers serving in F.G. Model Schools Islamabad	67
	Total number of individuals in the population	1794

3.4 Sample

Out of 1632 9th class science students and 172 secondary level teachers of F.G. Model Schools of Islamabad, 240 students and 48 teachers were selected as ultimate sample for this study. Detail of the sample can be seen in table 3.2.

Table 3.2: The Sample of the Study

S#	Category	Number of Respondents
1	Number of Boys of 9th Class Science Students of F.G. Model Schools of Islamabad	130
2	Number of Girls of 9th Class Science Students of F.G. Model Schools of Islamabad	110
3	Number of Male Secondary Level Teachers serving in F.G. Model Schools Islamabad	26
4	Number of Female Secondary Level Teachers serving in F.G. Model Schools Islamabad	22
	Total number of respondents	288

3.5 Tool of the Study

A common questionnaire consisting of 21 items to be responded on 5-point Likert Scale was used in order to find out the opinions of 9th class science students and secondary level teachers. Items selected in the tool were selected from the literature reviewed in chapter 2 of this thesis work.

3.6 Pre-testing of the questionnaire

A small sample of 48 (forty eight) individuals consisting of 40 (forty) 9th class science students and 8 (eight) secondary level teachers were selected by using stratified random sampling technique. For pre-testing the common questionnaire was distributed among the respondents. Respondents were requested to give their suggestions freely for the improvement of the tool. They were also repeatedly reminded to amend the questions, in format and language to make the common questionnaire more simple and understandable. The detail of the respondents selected for the conduction of pre-testing is given in table 3.3.

Table 3.3: Sub Sample for Pilot Testing

S#	Category	Number of Respondents
1	Number of Boys of 9th Class Science Students of F.G. Model Schools of Islamabad	20
2	Number of Girls of 9th Class Science Students of F.G. Model Schools of Islamabad	20
3	Number of Male Secondary Level Teachers serving in F.G. Model Schools Islamabad	4
4	Number of Female Secondary Level Teachers serving in F.G. Model Schools Islamabad	4
	Total number of respondents	48

3.7 Collection of Data

For collection of data, the researcher personally visited all the schools and distributed the questionnaire among the students and teachers included in the sample. The researcher made frequent visits of the sampled schools in order to collect the filled questionnaires from the students and teachers. Luckily the researcher received hundred percent questionnaires as a result of constant contact with the respondents.

3.8 Analysis of Data

Data collected on each item of the questionnaire was categorized into frequencies especially for students and teachers and analyzed by using statistical technique of Chi Square in order to test the study hypotheses. The level of significance used to test the hypothesis was 0.05.

The reasons behind using Chi Square technique were as under:

Chi Square (χ^2)

Test-statistic to be used to test independence of attributes i.e. observed frequencies are not greater that expected frequencies is Chi Square. Chi Square Test identifies whether the observed frequencies differed significantly from the expected frequencies.

Chi-square (χ^2) is a non-parametric test; it means that it is not used to make inferences about specific population parameters. Instead, it is used to make inferences about expected frequencies (Goodness of Fit Test), or relationships (Test of Independence) in the population. So Chi Square distribution is helpful in testing several hypotheses. One of the most important is "test of independence or association of attributes".

Chi Square values are always from zero to infinity. If $\chi^2 = 0$, the observed and expected frequencies agree exactly; but when $\chi^2 > 0$, they do not agree exactly. The larger the value of χ^2, the greater is the discrepancy between the observed and expected frequencies.

After computing the obtained value of Chi-Square (χ^2), it is compared with the critical value of Chi-Square which is also called tabulated value of Chi Square. With this test, the expected frequency reflects the null hypothesis.

Null Hypothesis (H_o)

The attributes under consideration are independent or there is no association between the given attributes i.e. observed frequencies are not greater than expected frequencies.

Null Hypothesis (H_a)

The attributes under consideration have some association or there is some association between the given attributes i.e. observed frequencies are greater than expected frequencies (one-tailed test only).

Critical/Tabulated Value of Chi-Square

Fixed Value of Chi Square at which attributes reflect the null hypothesis. When the value of Chi Square becomes greater than critical value the null hypothesis is rejected i.e. observed frequencies becomes greater that expected frequencies.

Significance of Chi-Square

The following points depict Chi-Square importance/significance:

A. Chi-Square vs. Parametric Tests

Unlike parametric tests, such as t-test or analysis of variance, chi-square has the following qualities:

i) Frequencies ii) Scaling iii) Distribution iv) Degrees of freedom

B. Chi-Square (χ^2) Goodness-of-Fit Test

This test is used when a researcher wants to test a theory that certain proportions of the population will fall into one category or another. It is a method for testing observed frequencies to see if they fit expected frequencies.

Formula for this test:

Different formulae are used for finding out the value of Chi Square (χ^2). One of these formulae is derived by Garrett (1997). Its detail is as follows:

$\chi^2 = \sum (f_o - f_e)^2 / f_e$ (Garrett, 1997, 253)

Degree of freedom = df = (r – 1) (c – 1)

Where

χ = Chi;

r= No. of rows;

c= No. of columns;

f_o = Observed frequencies;

f_e = Expected frequencies.

After computing the obtained value of Chi-Square (χ^2), it is compared with the critical value of Chi-Square which is also called tabulated value of Chi Square. Thus with this test, the null hypothesis at given/selected level of significance (α) is tested.

Steps

The following steps were followed for finding out the value of Chi Square:

Step 1: State the hypotheses

Step 2: Determine critical value of Chi-Square (χ^2)

Step 3: Prepare the data, and compute χ^2

Step 4: Conclude the result

CHAPTER 4

DATA COLLECTION AND DATA ANALYSIS

This chapter deals with the significance/insignificance of the hypotheses that were developed on the bases of a set of fourteen (14) factors of creativity development (detail of factors can be seen in Appendix A). These fourteen factors (events) were observed to occur with observed and expected frequencies. In order to get teachers' and students' options separately, two separate tables i.e. Table (a) and (b) were drawn. Chi Square value was calculated in order to check the divergence of observed frequencies from expected frequencies on equal probability at 0.05 level of significance.

In practice, expected frequencies are computed on the basis of a hypothesis H_o. If under this hypothesis, the computed value of Chi Square (χ^2), given by equation $\chi^2 = \sum (f_o - f_e)^2 / f_e$, is greater than critical value then the observed frequencies differ significantly from the expected frequencies. Thus H_o will be rejected at the corresponding level of significance; otherwise, it will be accepted (or at least won't be rejected). This procedure is called the Chi-Square Test of hypothesis or significance.

The detailed procedure is cleared from the tables given below, where Table (a) and (b) show the frequencies of the options being provided by secondary level science teachers and students about the factors availability for students' creativity development in the school environment.

Hypothesis 1

There is no significant difference among the views of teachers and students regarding the encouragement of students to find out a number of ideas/solutions to problems.

Table 4.1 (a)

Responses Of Teachers Regarding The Encouragement Of Students To Find Out A Number Of Ideas/Solutions To Problems

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	10	9.6	0.4	0.16	0.02
Agree	16	9.6	6.4	40.96	4.27
Undecided	4	9.6	-5.6	31.36	3.27
Disagree	10	9.6	0.4	0.16	0.02
Strongly disagree	8	9.6	-1.6	2.56	0.27
$\sum (f_o-f_e)^2/f_e=$					**7.83**

df=4 **χ^2 at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 7.83 for Teachers was less than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was accepted and it was concluded that there was no real difference among the views of teachers regarding the encouragement of students to find out a number of ideas/solutions to problems.

Table 4.1 (b)

Responses Of Students Regarding The Encouragement Of Students To Find Out A Number Of Ideas/Solutions To Problems

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	62	48	14	196	4.08
Agree	47	48	-1	1	0.02
Undecided	33	48	-15	225	4.69
Disagree	48	48	0	0	0.00
Strongly disagree	50	48	2	4	0.08
$\Sigma\chi^2=\Sigma (f_o-f_e)^2/f_e=$					**8.88**

df=4 χ^2 **at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 8.88 for students was less than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was accepted and it was concluded that there was no real difference among the views of students regarding the encouragement of students to find out a number of ideas/solutions to problems.

Conclusion: There was strong evidence of the availability of this factor in the school environment. That's why, it was identified as a prospect of creativity development.

Hypothesis 2

There is no significant difference among the views of teachers and students about assigning students individual projects in order to develop creativity in them.

Table 4.2 (a)

Responses Of Teachers About Assigning Students Individual Projects In Order To Develop Creativity In Them

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	15	9.6	5.4	29.16	3.04
Agree	14	9.6	4.4	19.36	2.02
Undecided	7	9.6	-2.6	6.76	0.70
Disagree	7	9.6	-2.6	6.76	0.70
Strongly disagree	5	9.6	-4.6	21.16	2.20
$\sum\chi^2=\sum (f_o-f_e)^2/f_e=$					**8.67**

df=4 χ^2 **at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 8.67 for Teachers was less than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was accepted and it was concluded that there was no real difference among the views of students about assigning students individual projects in order to develop creativity in them. Teachers agreed with the availability of this factor in the school environment.

Table 4.2 (b)

Responses Of Students About Assigning Them Individual Projects In Order To Develop Creativity

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	60	48	12	144	3.00
Agree	50	48	2	4	0.08
Undecided	43	48	-5	25	0.52
Disagree	49	48	1	1	0.02
Strongly disagree	38	48	-10	100	2.08
$\sum\chi^2=\sum (f_o-f_e)^2/f_e=$					**5.71**

df=4 χ^2 **at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 5.71 for students was less than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was accepted and it was concluded from this that there was no real difference among the views of students about assigning students individual projects in order to develop creativity in them. Students agreed with the availability of this factor in the schools network.

Conclusion: Teachers and students showed clear evidence about the availability of this factor in the school environment. Therefore, it was identified as a prospect of creativity development in the light of respondents' views.

Hypothesis 3

There is no significant difference among the views of teachers and students about rewarding students for showing creativity in their individual projects.

Table 4.3(a)

Responses Of Teachers About Rewarding Students For Showing Creativity In Their Individual Projects

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	6	9.6	-3.6	12.96	1.35
Agree	8	9.6	-1.6	2.56	0.27
Undecided	3	9.6	-6.6	43.56	4.54
Disagree	19	9.6	9.4	88.36	9.20
Strongly disagree	12	9.6	2.4	5.76	0.60
$\sum (f_o-f_e)^2/f_e=$					**15.96**

df=4 **χ^2 at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi Square (χ^2) i.e. 15.96 was greater than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was rejected and it was concluded that there was a real difference among the views of teachers about rewarding students for showing creativity in their individual projects. Teachers showed unfavorable attitude toward the availability of this factor in the school environment.

Table 4.3(b)

Responses Of Students Regarding Their Encouragement To Do Things Differently

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	12	48	-36	1296	27.00
Agree	29	48	-19	361	7.52
Undecided	12	48	-36	1296	27.00
Disagree	87	48	39	1521	31.69
Strongly disagree	100	48	52	2704	56.33
$\sum\chi^2=\sum (f_o-f_e)^2/f_e=$					**149.54**

df=4 **χ^2 at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi Square (χ^2) i.e. 149.54 was greater than the tabulated value of Chi square ($\chi 2$) i.e. 9.48, so the null hypothesis was rejected and it was concluded that there was a real difference among the views of students about rewarding students for showing creativity in their individual projects. Students showed clear unfavorable attitude toward the availability of this factor in the school environment.

Conclusion: Both teachers and students showed unfavorable attitude towards the availability of this factor. Thus, it was identified as problem of creativity development.

Hypothesis 4

There is no significant difference among the views of teachers and students regarding taking students to Science Museums in order to develop creativity in them.

Table 4.4 (a)

Responses Of Teachers Regarding Taking Students To Science Museums In Order To Develop Creativity In Them

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	15	9.6	5.4	29.16	3.04
Agree	13	9.6	3.4	11.56	1.20
Undecided	4	9.6	-5.6	31.36	3.27
Disagree	9	9.6	-0.6	0.36	0.04
Strongly disagree	7	9.6	-2.6	6.76	0.70
$\sum\chi^2=\sum (f_o-f_e)^2/f_e=$					**8.25**

df=4 χ^2 **at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 8.25 for Teachers was less than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was accepted and it was concluded that there was no real difference among the views of teachers regarding taking students to Science Museums in order to develop creativity in them. The results indicate less significant trend of opinion towards agreement with the statement.

Table 4.4 (b)

Responses Of Students Regarding Their Visiting To Science Museums For Creativity Developmental Purposes

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	56	48	8	64	1.33
Agree	61	48	13	169	3.52
Undecided	34	48	-14	196	4.08
Disagree	45	48	-3	9	0.19
Strongly disagree	44	48	-4	16	0.33
$\Sigma\chi^2=\Sigma (f_o-f_e)^2/f_e=$					**9.46**

df=4 χ^2 **at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 9.46 for students was less than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was accepted and it was concluded that there was no real difference among the views of students regarding their visiting of science museums for creativity developmental purposes. The results indicate less significant trend of opinion towards agreement with the statement.

Conclusion: There was very clear evidence of favorable attitude towards the availability of this factor in the school environment. So, this was identified as the prospect of creativity development in accordance with respondents' views.

Hypothesis 5

There is no significant difference among the views of teachers and students about organizing science exhibits at school for students' creativity development.

Table 4.5 (a)

Responses Of Teachers About Organizing Science Exhibits At School For Students' Creativity Development

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	14	9.6	4.4	19.36	2.02
Agree	12	9.6	2.4	5.76	0.60
Undecided	5	9.6	-4.6	21.16	2.20
Disagree	9	9.6	-0.6	0.36	0.04
Strongly disagree	8	9.6	-1.6	2.56	0.27
$\sum (f_o-f_e)^2/f_e=$					**5.13**

df=4 **χ^2 at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 5.13 for Teachers was less than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was accepted and it was concluded that there was no real difference among the views of teachers about organizing science exhibits at school for students' creativity development. The results indicated a significant trend of favorable attitude of teachers toward the availability of this factor in the school environment.

Table 4.5 (b)

Responses Of Students About Organizing Science Exhibits At School For Their Creativity Development

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	55	48	7	49	1.02
Agree	62	48	14	196	4.08
Undecided	43	48	-5	25	0.52
Disagree	38	48	-10	100	2.08
Strongly disagree	42	48	-6	36	0.75
$\sum\chi^2=\sum (f_o-f_e)^2/f_e=$					**8.46**

df=4 χ^2 **at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 8.46 for students was less than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was accepted and it was concluded that there was no real difference among the views of students about organizing science exhibits at school for students' creativity development. Students favored the availability of this factor in the school environment.

Conclusion: There was clear evidence of favorable attitude towards the availability of this factor in the school environment. So, this was identified as a prospect of creativity development according to respondents' view points.

Hypothesis 6

There is no significant difference among the views of teachers and students regarding using creativity measuring tools in order to assess student's creative level.

Table 4.6 (a)

Responses Of Teachers Regarding Using Creativity Measuring Tools In Order To Assess Student's Creative Level

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	5	9.6	-4.6	21.16	2.20
Agree	2	9.6	-7.6	57.76	6.02
Undecided	12	9.6	2.4	5.76	0.60
Disagree	15	9.6	5.4	29.16	3.04
Strongly disagree	14	9.6	4.4	19.36	2.02
$\Sigma\chi^2=\Sigma (f_o-f_e)^2/f_e=$					**13.88**

df=4 χ^2 **at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 13.88 for Teachers was greater than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was rejected and it was concluded that there was a real difference among the views of students regarding using creativity measuring tools in order to assess student's creative level. The results indicate a significant trend of opinion about disfavoring the availability of this factor in the school environment.

Table 4.6 (b)

Responses Of Students Regarding Using Creativity Measuring Tools In Order To Assess Their Creative Level

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	12	48	-36	1296	27.00
Agree	30	48	-18	324	6.75
Undecided	12	48	-36	1296	27.00
Disagree	63	48	15	225	4.69
Strongly disagree	123	48	75	5625	117.19
$\sum\chi^2=\sum (f_o-f_e)^2/f_e=$					**182.63**

df=4 χ^2 **at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 182.63 for students was greater than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was rejected and it was concluded that there was a real difference among the views of students regarding using creativity measuring tools in order to assess student's creative level. The results indicate a significant trend of opinion towards strong disagreement with the availability of this factor in the school environment for students' creativity development.

Conclusion: There is clear evidence of unfavorable attitude towards the availability of this factor in the school environment. Therefore, this was identified as a problem of creativity development in the school environment.

Hypothesis 7

There is no significant difference among the views of teachers and students about inviting creative scientists/individuals to address students.

Table 4.7 (a)

Responses Of Teachers About Inviting Creative Scientists/Individuals To Address Students

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	6	9.6	-3.6	12.96	1.35
Agree	7	9.6	-2.6	6.76	0.70
Undecided	3	9.6	-6.6	43.56	4.54
Disagree	17	9.6	7.4	54.76	5.70
Strongly disagree	15	9.6	5.4	29.16	3.04
$\Sigma\chi^2=\Sigma (f_o-f_e)^2/f_e=$					**15.33**

df=4 χ^2 **at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 15.33 for secondary teachers was greater than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was rejected and it was concluded that there was a real difference among the views of teachers about inviting creative scientists/individuals to address students. The results indicated a significant disfavoring about the availability of this factor in the school environment.

Table 4.7 (b)

Responses Of Students About Inviting Creative Scientists/Individuals To Address Them

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	13	48	-35	1225	25.52
Agree	24	48	-24	576	12.00
Undecided	6	48	-42	1764	36.75
Disagree	85	48	37	1369	28.52
Strongly disagree	112	48	64	4096	85.33
$\sum\chi^2=\sum (f_o-f_e)^2/f_e=$					**188.13**

df=4 χ^2 **at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 188.13 for students was greater than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was rejected and it was concluded that there was a real difference among the views of students about inviting creative scientists/individuals to address students. The results indicate a significant trend of opinion towards strong disagreement with the availability of the factor in the school environment.

Conclusion: There is clear evidence of unfavorable attitude towards the the availability of the factor for students' creativity development. Therefore, it was identified as a problem in the way of creativity development.

Hypothesis 8

There is no significant difference among the views of teachers and students regarding the availability of counseling services to students' at school.

Table 4.8 (a)

Responses Of Teachers Regarding The Availability Of Counseling Services To Students' At School

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	4	9.6	-5.6	31.36	3.27
Agree	6	9.6	-3.6	12.96	1.35
Undecided	1	9.6	-8.6	73.96	7.70
Disagree	23	9.6	13.4	179.56	18.70
Strongly disagree	14	9.6	4.4	19.36	2.02
$\sum\chi^2=\sum (f_o-f_e)^2/f_e=$					**33.04**

df=4 χ^2 **at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 33.04 for Teachers was greater than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was rejected and it was concluded that there was a real difference among the views of students regarding the availability of counseling services to students' at school. The results indicated a significant trend of opinion towards disagreement with the availability of the factor in the school environment.

Table 4.8 (b)

Responses Of Students Regarding The Availability Of Counseling Services To Them At School

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	27	48	-21	441	9.19
Agree	19	48	-29	841	17.52
Undecided	14	48	-34	1156	24.08
Disagree	86	48	38	1444	30.08
Strongly disagree	94	48	46	2116	44.08
$\sum \chi^2=\sum (f_o-f_e)^2/f_e=$					**124.96**

df=4 **χ^2 at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 124.96 for students was greater than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was rejected and it was concluded that there was a real difference among the views of students regarding the availability of counseling services to students' at school. The results indicated a significant trend of opinion towards strong disagreement about the availability of the factor in the school environment.

Conclusion: There is clear evidence of unfavorable attitude towards the the availability of the factor. So, it is identified as a problem in the way of creativity development.

Hypothesis 9

There is no significant difference among the views of teachers and students regarding assigning students' service and welfare related duties to creative teachers.

Table 4.9 (a)

Responses Of Teachers Regarding Assigning Students' Service And Welfare Related Duties To Creative Teachers

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	5	9.6	-4.6	21.16	2.20
Agree	7	9.6	-2.6	6.76	0.70
Undecided	2	9.6	-7.6	57.76	6.02
Disagree	20	9.6	10.4	108.16	11.27
Strongly disagree	14	9.6	4.4	19.36	2.02
$\Sigma\chi^2=\Sigma(f_o-f_e)^2/f_e=$					**22.21**

df=4 χ^2 **at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 22.21 for Teachers was greater than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was rejected and it was concluded that there was a real difference among the views of students regarding assigning students' service and welfare related duties to creative teachers. The results indicate a significant trend of opinion towards disagreement with the statement.

Table 4.9 (b)

Responses Of Students Regarding Assigning Students' Service And Welfare Related Duties To Creative Teachers

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	27	48	-21	441	9.19
Agree	38	48	-10	100	2.08
Undecided	26	48	-22	484	10.08
Disagree	72	48	24	576	12.00
Strongly disagree	77	48	29	841	17.52
$\Sigma \chi^2=\Sigma (f_o-f_e)^2/f_e=$					**50.88**

df=4 χ^2 **at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 50.88 for students was greater than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was rejected and it was concluded that there was a real difference among the views of students regarding assigning students' service and welfare related duties to creative teachers. The results indicate a significant trend of opinion towards disagreement with the statement.

Conclusion: There is clear evidence of unfavorable attitude towards the availability of this factor in the school environment for students' creativity development.

Hypothesis 10

There is no significant difference among the views of teachers and students regarding the proposition that the contents of the textbooks of science subjects build up problem-based and project-based learning in students.

Table 4.10 (a)

Responses Of Teachers Regarding The Proposition That The Contents Of The Textbooks Of Science Subjects Build Up Problem-Based And Project-Based Learning In Students

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	8	9.6	-1.6	2.56	0.27
Agree	6	9.6	-3.6	12.96	1.35
Undecided	4	9.6	-5.6	31.36	3.27
Disagree	14	9.6	4.4	19.36	2.02
Strongly disagree	16	9.6	6.4	40.96	4.27
$\sum (f_o-f_e)^2/f_e=$					**11.17**

df=4 **χ^2 at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 11.17 for teachers was greater than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was rejected and it was concluded that there was a real difference among the views of teachers regarding the proposition that the contents of the textbooks of science subjects built up problem-based and project-based learning in students. Teachers did not favor the availability of this factor for students' creativity development.

Table 4.10 (b)

Responses Of Students Regarding The Proposition That The Contents Of The Textbooks Of Science Subjects Build Up Problem-Based And Project-Based Learning In Students

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	23	48	-25	625	13.02
Agree	38	48	-10	100	2.08
Undecided	26	48	-22	484	10.08
Disagree	76	48	28	784	16.33
Strongly disagree	77	48	29	841	17.52
$\sum\chi^2=\sum (f_o-f_e)^2/f_e=$					**59.04**

df=4 χ^2 **at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 59.04 for students was greater than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was rejected and it was concluded that there was a real difference among the views of students regarding the proposition that the contents of the textbooks of science subjects build up problem-based and project-based learning in students. Students did not favor the statement.

Conclusion: There is clear evidence of unfavorable attitude towards the proposition. So, it was identified as problem of creativity development.

Hypothesis 11

There is no significant difference among the views of teachers and students regarding the proposition that exercises in the textbooks of science subjects boost up divergent and convergent thinking in students.

Table 4.11 (a)

Responses Of Teachers Regarding The Proposition That Exercises In The Textbooks Of Science Subjects Boost Up Divergent And Convergent Thinking In Students

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	2	9.6	-7.6	57.76	6.02
Agree	4	9.6	-5.6	31.36	3.27
Undecided	6	9.6	-3.6	12.96	1.35
Disagree	16	9.6	6.4	40.96	4.27
Strongly disagree	20	9.6	10.4	108.16	11.27
$\Sigma\chi^2=\Sigma (f_o-f_e)^2/f_e=$					**26.17**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 26.17 for Teachers was greater than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was rejected and it was concluded that there was a real difference among the views of teachers regarding the proposition that exercises in the textbooks of science subjects boost up divergent and convergent thinking in students. The results indicated a significant trend of opinion towards strong disagreement with the statement.

Table 4.11 (b)

Responses Of Students Regarding The Proposition That Exercises In The Textbooks Of Science Subjects Boost Up Divergent And Convergent Thinking In Students

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	27	48	-21	441	9.19
Agree	33	48	-15	225	4.69
Undecided	13	48	-35	1225	25.52
Disagree	81	48	33	1089	22.69
Strongly disagree	86	48	38	1444	30.08
$\Sigma\chi^2=\Sigma (f_o-f_e)^2/f_e=$					**92.17**

df=4 χ^2 **at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 92.17 for students was greater than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was rejected and it was concluded that there was a real difference among the views of students regarding the proposition that exercises in the textbooks of science subjects boost up divergent and convergent thinking in students. The results indicated a significant trend of opinion towards strong disagreement with the statement.

Conclusion: There is clear evidence of unfavorable attitude towards the proposition. Thus, it was identified as a problem of creativity development in the school environment.

Hypothesis 12

There is no significant difference among the views of teachers and students about encouraging students to challenge teachers and authors of the books for developing their creativity.

Table 4.12 (a)

Responses Of Teachers About Encouraging Students To Challenge Teachers And Authors Of The Books For Developing Their Creativity

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	3	9.6	-6.6	43.56	4.54
Agree	5	9.6	-4.6	21.16	2.20
Undecided	2	9.6	-7.6	57.76	6.02
Disagree	22	9.6	12.4	153.76	16.02
Strongly disagree	16	9.6	6.4	40.96	4.27
$\Sigma\chi^2=\Sigma (f_o-f_e)^2/f_e=$					**33.04**

df=4 χ^2 **at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 33.04 for Teachers was greater than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was rejected and it was concluded that there was a real difference among the views of teachers about encouraging students to challenge teachers and authors of the books for developing their creativity. Teachers seem to disagree with the statement.

Table 4.12 (b)

Responses Of Students About Encouraging Students To Challenge Teachers And Authors Of The Books For Developing Their Creativity

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	30	48	-18	324	6.75
Agree	37	48	-11	121	2.52
Undecided	33	48	-15	225	4.69
Disagree	72	48	24	576	12.00
Strongly disagree	68	48	20	400	8.33
$\sum\chi^2=\sum (f_o-f_e)^2/f_e=$					**34.29**

df=4 χ^2 **at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 34.29 for students was greater than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was rejected and it was concluded that there was a real difference among the views of students about encouraging students to challenge teachers and authors of the books for developing their creativity. Teachers did not favor the availability of this factor in the school environment.

Conclusion: There is not a favorable attitude towards the availability of this factor. Therefore, it was identified as a problem in the way of creativity development.

Hypothesis 13

There is no significant difference among the views of teachers and students regarding the provision of taking courses on creativity development to students.

Table 4.13 (a)

Responses Of Teachers Regarding The Provision Of Taking Courses On Creativity Development To Students

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	5	9.6	-4.6	21.16	2.20
Agree	4	9.6	-5.6	31.36	3.27
Undecided	3	9.6	-6.6	43.56	4.54
Disagree	17	9.6	7.4	54.76	5.70
Strongly disagree	19	9.6	9.4	88.36	9.20
$\sum\chi^2=\sum (f_o-f_e)^2/f_e=$					**24.92**

df=4 χ^2 **at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 24.92 for Teachers was greater than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was rejected and it was concluded that there was a real difference among the views of teachers regarding the provision of taking courses on creativity development to students. The results indicate a significant trend of opinion towards strong disagreement with the statement.

Table 4.13 (b)

Responses Of Students Regarding The Provision Of Taking Courses On Creativity Development To Students

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	23	48	-25	625	13.02
Agree	15	48	-33	1089	22.69
Undecided	28	48	-20	400	8.33
Disagree	86	48	38	1444	30.08
Strongly disagree	88	48	40	1600	33.33
$\sum\chi^2=\sum (f_o-f_e)^2/f_e=$					**107.46**

df=4 χ^2 **at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 107.46 for students was greater than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was rejected and it was concluded that there was a real difference among the views of students regarding the provision of taking courses on creativity development to students. The results indicated a significant trend of opinion towards strong disagreement with the availability of the factor in the school environment.

Conclusion: There is clear evidence of unfavorable attitude towards the proposition. So, it was identified as a problem of creativity development in the school environment.

Hypothesis 14

There is no significant difference among the views of teachers and students regarding the provision of working with creative individuals to students.

Table 4.14 (a)

Responses Of Teachers Regarding The Provision Of Working With Creative Individuals To Students

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	1	9.6	-8.6	73.96	7.70
Agree	4	9.6	-5.6	31.36	3.27
Undecided	3	9.6	-6.6	43.56	4.54
Disagree	22	9.6	12.4	153.76	16.02
Strongly disagree	18	9.6	8.4	70.56	7.35
$\sum\chi^2=\sum (f_o-f_e)^2/f_e=$					**38.88**

df=4 χ^2 **at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 38.88 for Teachers was greater than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was rejected and it was concluded that there was a real difference among the views of teachers regarding the provision of working with creative individuals to students. The results indicate a significant trend of opinion about disfavoring the statement.

Table 4.14 (b)

Responses Of Students Regarding The Provision Of Working With Creative Individuals To Students

Options	f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
Strongly Agree	24	48	-24	576	12.00
Agree	47	48	-1	1	0.02
Undecided	5	48	-43	1849	38.52
Disagree	85	48	37	1369	28.52
Strongly disagree	79	48	31	961	20.02
$\sum\chi^2=\sum (f_o-f_e)^2/f_e=$					**99.08**

df=4 χ^2 **at 0.05 = 9.48**

Finding: Referring to the Table of Chi Square with Alpha = 0.05 and df=4, it was found in the above table that the calculated value of Chi square (χ^2) i.e. 99.08 for students was greater than the tabulated value of Chi Square (χ^2) i.e. 9.48, so the null hypothesis was rejected and it was concluded that there was a real difference among the views of students regarding the provision of working with creative individuals to students. The results indicate a significant trend of opinion towards disagreement with the statement.

Conclusion: There is clear evidence of unfavorable attitude towards the the availability of this factor in the school environment. So, this was identified as a problem of creativity development.

Table 4.15

Hierarchical Order of Problems and Prospects in accordance with teachers' views

(**Problem:** Where majority of the teachers showed disagreement about the availability of creativity developmental factor(s) in the school environment for students. **Prospects:** Where minority of the students showed disagreement about the availability of creativity developmental factor(s) in the school environment for students. To make prospects more visible ones, they are italicized).

Table No.	Category	Chi Square Value	No. of Agreed Respondents	% of Agreed Respondents	No. of Undecided Respondents	% of Undecided Respondents	No. of Disagreed Respondents	% of Disagreed Respondents
14a	Teacher	38.88	5	10	3	6	40	
12a	Teacher	33.04	8	17	2	4	38	
8a	Teacher	33.04	10	21	1	2	37	
11a	Teacher	26.17	6	13	6	13	36	
13a	Teacher	24.92	9	19	3	6	36	
9a	Teacher	22.21	12	25	2	4	34	
7a	Teacher	15.33	13	27	3	6	32	
3a	Teacher	15.96	14	29	3	6	31	
10a	Teacher	11.17	14	29	4	8	30	
6a	Teacher	13.88	7	15	12	25	29	
1a	**Teacher**	**7.83**	**26**	**54**	**4**	**8**	**18**	**38**
5a	**Teacher**	**5.13**	**26**	**54**	**5**	**10**	**17**	**35**
4a	**Teacher**	**8.25**	**18**	**38**	**4**	**8**	**16**	**33**
2a	**Teacher**	**8.67**	**29**	**60**	**7**	**15**	**12**	**25**

Table 4.16

Hierarchical Order of Problems and Prospects in accordance with Students' Views

(**Problem:** Where majority of the students showed disagreement about the availability of factor(s) in the school environment for students. **Prospects:** Where minority of the students showed disagreement about the availability of factor(s) in the school environment for students. Prospects are italicized in order to make them more visible).

Table No.	Category	Chi Square Value	No. of Agreed Respondents	% of Agreed Respondents	No. of Undecided Respondents	% of Undecided Respondents	No. of Disagreed Respondents	% of Disagreed Respondents
14b	Student	188.13	37	15	6	3	197	
12b	Student	149.54	41	17	12	5	187	
8b	Student	182.63	42	18	12	5	186	
11b	Student	124.96	46	19	14	6	180	
13b	Student	107.45	38	16	28	12	174	
9b	Student	92.17	60	25	13	5	167	
7b	Student	99.08	71	30	5	2	164	
3b	Student	59.04	61	25	26	11	153	
10b	Student	50.88	65	27	26	11	149	
6b	Student	34.24	67	28	33	14	140	
1b	**Student**	**8.88**	**109**	**45**	**33**	**14**	**98**	**41**
5b	**Student**	**9.46**	**117**	**49**	**34**	**14**	**89**	**37**
4b	**Student**	**5.71**	**110**	**46**	**43**	**18**	**87**	**36**
2b	**Student**	**8.46**	**117**	**49**	**43**	**18**	**80**	**33**

Discussion

This study has discussed 14 (fourteen) most important factors that develop creativity in students. In these factors, the first four have been discussed as the most important ones by Alan J. Rowe (2004) in his book "Creative Intelligence: Discovering the Innovative Potential in Ourselves and Others". The next three factors have been considered crucial for creativity development by Noor Asma's in her Ph.D thesis conducted in 2003 and published by: Discovery Publishing House, New Delhi.

Factors 8th and 9th have been taken from the Stephen Bowkett's book entitled "100 ideas for Teaching Creativity" written in 2007. Factors 10th to 12th have been taken from the book entitled "Hearts, Mind, Bottom Lines" written by Teresa Grainger (2005). Factors from 13th and 14th have been taken from miscellaneous books and other research journals. Wording has been changed to easier format for the convenience of respondents.

Some studies about creativity development in organizations have also signified these factors as these factors influence creativity development of homogeneous and heterogeneous groups. This study has concluded that heterogeneous work groups (in terms of race, age, tenure, education, and gender) perform better than homogeneous groups on producing creative outcomes because heterogeneity helps with generating "a greater variety of ideas, perspectives, and approaches to solving problems". These are also supported in the studies of Chatman et al., 1998; Hoffman, 1979; Nemeth, 1992. Also, McLeod, Lobel, and Cox (1996) examined the issue of ethnic diversity and found that ethnically diverse groups are more creative than homogeneous groups. Similarly, Dr. Muga (2004) has used some of these factors of creativity development in order to examine teacher-trainees in relation to their values, personality adjustment, and achievement motivation. Similarly

Ma'moon, 2005, asked children to order such type of factors in a set on the basis of one or more given characteristics in order to develop creativity in them.

This study uses approaches leading to solutions of a given problem. Factors existed in the school environment have been analyzed in order to identify problems and prospects of developing creativity in students at secondary school level. This study considers that with this approach students may understand ideas better, discover relationships between ideas and solve problems that involve the ideas, teachers can help students to see school subjects with new eyes. This study may teacher to guide the students to identify learning as investigation and interaction to construct knowledge.

This study may produce responsive classroom culture as students' creativity is also influenced by it. A deeply responsive classroom culture alleviates motivational struggles and promotes students' perceptions of self-determination. Differences such as children's ability and interests, their social interaction and personalities and even the weather, will combine to create the learning atmosphere in schools for students. Torrance and Goff (1990) have emphasized like these studies in their books.

Balka (1994) have said that students should at least be given the opportunity to examine a wide variety of problems. By providing divergent responses in unconventional questions and other problem-solving experiences creativity can be explored to the fullest.

CHAPTER 5

SUMMARY, FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

This study aimed at identifying the problems that hinder creativity development in students and prospects that facilitate creativity development in them. Identification of problems is considered one of the most important steps in the developmental processes. For example, physicians recommend necessary tests for patients in order to find out the symptoms of diseases, teachers organize parents' day to know about the good and bad habits being inculcated in their students. On the basis of this fact, the researcher conducted a survey type research for finding out the problems that block creativity development and prospects that facilitate creativity development in students

Keeping in view the objectives of the study i.e. (a) to obtain the views of secondary level science teachers and students on problems that blocked creativity development in students; (b) to obtain the views of secondary level science teachers and students on prospects that fostered creativity development in students; (c) to compare the views of secondary level science teachers and students and (d) to suggest various measures for the development of creativity in students, the researcher selected 24 F.G. Model Schools of Islamabad and all secondary level science teachers and students of these schools as population of the study. The sample of this study

consisted 288 respondents (240 9th class science students and 48 secondary science teachers of these schools). The sample of the study was selected through stratified random sampling technique.

As the study was a survey type so the researcher reviewed related literature, made constant visits of the schools, and discussed the factors responsible for creativity development with teachers and principals. Thus the researcher got relevant information for developing the research tool. As a result, a common questionnaire that consisted 14 (fourteen) items was developed for collecting data from the respondents. For pre-testing of the questionnaire, it was administered to a small sample of 48 (forty eight) respondents who were selected from the whole population and were not included in the sample. The researcher identified the following findings, conclusions and recommendations on the basis of data received through the research tool. After the conduction of pre-testing of the questionnaire, it was distributed among the respondents of the sample.

Chi Square technique was used for testing the significance/insignificance of the hypotheses at 0.05 significance level. Views of teachers and students about the hypotheses were compared in order to identify findings, draw conclusions, and suggest recommendations.

5.2 Findings

On the basis of data analysis the following findings were made.

1. Hypothesis no. 1 was accepted as there was no significant difference among the views of the students who were encouraged to find out a number of ideas/solutions to problems and those who did not enjoy this facility. Similarly, there was no significant difference among the views of teachers who responded that students were encouraged to find out a number of ideas/solutions to problems and those who did not

think so. As students and teachers had same views about the proposition so it was concluded that students were encouraged to find out a number of ideas/solutions to problems in order to develop their creativity. (Table 4.1 a and b)

2. Hypothesis no. 2 was accepted as there was no significant difference among the views of the students who were assigned individual projects for their creativity development and those who were not treated like this. Similarly, there was no significant difference among the views of teachers who responded that students were assigned individual projects for their creativity development and those who did not think so. As students and teachers had same views about the proposition so it was concluded that students were assigned individual projects for their creativity development. (Table 4.2 a and b)

3. Hypothesis no. 3 was rejected as there was a significant difference among the views of the students who were rewarded for showing creativity in their individual projects and those who did not have this opportunity. Similarly, there was a significant difference among the views of the teachers who responded that students were rewarded for showing creativity in their individual projects and those who did not think so. As students and teachers had same views about the proposition so it was concluded that students were not rewarded for showing creativity in their individual projects. (Table 4.3 a and b)

4. Hypothesis no. 4 was accepted as there was no significant difference among the views of the students who were taken to science museums and those who did not enjoy this opportunity. Similarly, there was no significant difference among the views of teachers who responded students were taken to science museums and those who did not think so. As students and teachers had same views about the proposition so it

was concluded that students were taken to science museums for their creativity development. (Table 4.4 a and b)

5. Hypothesis no. 5 was accepted as there was no significant difference among the views of the students who responded that science exhibits were organized at school for students' creativity development and those who did not think so. Similarly, there was no significant difference among the views of teachers who responded science exhibits were organized at school for students' creativity and those who did not think so. As students and teachers had same views about the proposition so it was concluded that science exhibits were organized at school for the development of students' creativity. (Table 4.5 a and b)

6. Hypothesis no. 6 was rejected as there was a significant difference among the views of the students who responded that creativity measuring tools were used in order to assess their creative level and those who did not think so. Similarly, there was a significant difference among the views of the teachers who responded that creativity measuring tools were used in order to assess students' creative level and those who did not think so. As students and teachers had same views about the proposition so it was concluded that creativity measuring tools were not used in order to assess students' creative level. (Table 4.6 a and b)

7. Hypothesis no. 7 was rejected as there was a significant difference among the views of the students who responded that creative scientists/individuals were invited to schools to address them about creativity related issues and those who did not think so. Similarly, there was a significant difference among the views of the teachers who responded that creative scientists/individuals were invited to schools to address students about creativity development and those who did not think so. As students and teachers had same views about the proposition so it was concluded that

creative scientists/individuals were not invited to schools to address students about creativity related issues. (Table 4.7 a and b)

8. Hypothesis no. 8 was rejected as there was a significant difference among the views of the students who responded that counseling services were available to them for their creativity development and those who did not think so. Similarly, there was a significant difference among the views of the teachers who responded that counseling services were available to students for their creativity development and those who did not think so. As students and teachers had same views about the proposition so it was concluded that counseling services were not available to students for their creativity development. (Table 4.8 a and b)

9. Hypothesis no. 9 was rejected as there was a significant difference among the views of the students who responded that creative teachers were assigned the duties related to students' service and welfare and those who did not think so. Similarly, there was a significant difference among the views of the teachers who responded that creative teachers were assigned the duties related to students' service and welfare and those who did not think so. As students and teachers had same views about the proposition so it was concluded that duties related to students' service and welfare were not assigned to creative teachers. (Table 4.9 a and b)

10. Hypothesis no. 10 was rejected as there was a significant difference among the views of the students who responded that the content of textbooks of science subjects developed problem-based and project-based learning in them and those who did not think so. Similarly, there was a significant difference among the views of the teachers who responded that the content of textbooks of science subjects developed problem-based and project-based learning in students and those who did not think so. As students and teachers had same views about the proposition so it was concluded

that the content of textbooks of science subjects did not build up problem-based and project-based learning in students. (Table 4.10 a and b)

11. Hypothesis no. 11 was rejected as there was a significant difference among the views of the students who responded that the exercises in the textbooks of science subjects develop divergent and convergent thinking in them and those who did not think so. Similarly, there was a significant difference among the views of the teachers who responded that the exercises in the textbooks of science subjects develop divergent and convergent thinking in students and those who did not think so. As students and teachers had same views about the proposition so it was concluded that the exercises in the textbooks of science subjects did not develop divergent and convergent thinking in students. (Table 4.11 a and b)

12. Hypothesis no. 12 was rejected as there was a significant difference among the views of the students who responded that they were encouraged to challenge teachers and authors of the textbooks and those who did not think so. Similarly, there was a significant difference among the views of the teachers who responded that students were encouraged to challenge teachers and authors of the textbooks and those who did not think so. As students and teachers had same views about the proposition so it was concluded that students were not encouraged to challenge teachers and authors of the textbooks in order to develop their creativity. (Table 4.12 a and b)

13. Hypothesis no. 13 was rejected as there was a significant difference among the views of the students who responded that they had the provision to take courses on creativity development and those who did not think so. Similarly, there was a significant difference among the views of the teachers who responded that students had the provision to take courses on creativity development and those who did not think so. As students and teachers had same views about the proposition so it was

concluded that students did not have the provision to take courses on creativity development. (Table 4.13 a and b)

14. Hypothesis no. 14 was rejected as there was a significant difference among the views of the students who responded that they had the provision to work with creative individuals and those who did not think so. Similarly, there was a significant difference among the views of the teachers who responded that students had the provision to work with creative individuals and those who did not think so. As students and teachers had same views about the proposition so it was concluded that students did not have the provision to work with creative individuals. (Table 4.14 a and b)

5.3 Conclusions

From the above findings, following conclusions were drawn:

Factors That Blocked Creativity Development

The following were identified as problems of creativity development in the light of secondary level science teachers' and students' point of view.

i. Students were not rewarded for showing creativity in individual projects.

ii. Creativity measuring tools were not used in order to assess your creative level.

iii. Creative scientists/individuals were not invited to school to address students.

iv. Counseling services were not provided to students at school.

v. Duties related to students' service and welfare were not assigned to creative teachers.

vi. The content of textbooks of science subjects did not develop problem-

based and project-based learning approaches in students.

vii. Exercises in the textbooks of science subjects did not develop divergent and convergent thinking.

viii. Students were not encouraged to challenge teachers and authors of the textbooks.

ix. Students did not have the provision to take courses on creativity development.

x. Students did not have the provision to work with creative individuals.

Factors That Fostered Creativity Development

The following were identified as prospects of creativity development in the light of secondary level science teachers' and students' point of view.

i. Students were encouraged to find out a number of ideas/solutions to problems.

ii. Students were given individuals projects for their creativity development.

iii. Students were taken to Science Museums in order to develop creativity in them.

iv. Science Exhibitions were organized at school for developing creativity in students.

5.4 Recommendations

In the light of findings, relevant literature studied and observations made by the researcher during this study, the following recommendations which may help in developing creativity are offered.

i. Teachers may ask students to

(a) give two different methods of solving one problem.

(b) find creative solutions instead of prosaic solutions.

(c) find a rough approximation of the problems that are unreasonably difficult to answer correctly.

(d) go to the library and find the information that they need.

(e) take term papers that require reading from multiple sources, making a creative synthesis of the information, and finding contradictions or inconsistencies in authoritative, published works.

(f) slove exercises that have an incorrect solution to a problem (e.g., computer program that contains at least one bug, electronic circuit that will not function properly).

(g) find the defect and suggest a correction.

(h) do laboratory experiments that allow students freedom to choose technique(s) and topics.

(i) enjoy arranging or composing music, not merely playing music.

(j) follow demonstration-cum-practice sessions i.e. first demonstrate his own creativity and then direct others to perform a practice session.

(k) enjoy thinking in solving the problems in their own ways.

(l) consider teachers as an initiator, facilitator, and helper whenever students solve or fails to solve the problems.

(m) avoid completely spoon feeding.

(n) cultivate a proper attitude toward errors and mistakes.

(o) make as many errors and mistakes as possible in the presence or absence of their teachers.

(p) take active control of their learning.

(q) express and support their ideas.

(r) make predictions and hypotheses and test them by conducting experiments.

(s) present their work to the classroom for debate.

(t) make their ideas overt, test them, compare them with those of other students and give scientific explanations.

(u) use models, representational symbols, and measurements in order to develop their creative skills.

ii. Education cards and scholarships that allow students to get free education at F.G. Model Schools of Islamabad may be awarded to creative students.

iii. High creative teachers may be given responsibilities in matters related to student service and social work.

iv. Students may be taken to research labs, industries, and biological gardens to have adequate information about creativity development.

v. Debates on Science and technology related issues such as "Atom Bomb Merits and Demerits", "Global Warming" etc may be organized.

vi. Exhibits, Buying and Selling festivals may be arranged at schools.

vii. Creativity measuring tools such as "Taylor's questions", "The Khatenna-Torrance Creative Perception Inventory" and "The Torrance Tests of Creative Thinking" may be used in order to assess students' creative level.

viii. Creative individuals may be invited to schools to address to students about creativity developmental work and issues.

ix. At Learning Resource Centers of F.G. Model Schools experts of creativity development may be appointed to guide teachers and students about creative work. These experts may help the administrators in assigning duties related to students' service and welfare to creative teachers.

x. High creative teachers may be given the responsibilities in matters related to students' service and welfare such as Organizing Parent-Teacher Association etc.

xi. The contents of Science Subjects may be enriched with creativity enhancing material such as "Biographies of Creative People", "Inventions that Changed the World" etc.

xii. Textbooks of Science Subjects may be equipped with such type of quizzes and tests which first items develop divergent thinking and the last items develop critical thinking in students. For example, a test that support the following sequence (a) essay questions, (b) short questions, (c) matching items, (d) MCQs.

xiii. Students may be encouraged to write articles about science and technology related issues.

xiv. Students may take advance courses on creativity development.

xv. Students may be provided opportunities to work with creative students, teachers, and individuals in order to observe creativity developing techniques.

xvi. Provision may be made in the policy documents for rewarding creative students in the F.G. Model Schools of Islamabad.

xvii. The following individuals and organizations can be contacted for the creativity development in students.

xviii. Teacher educators and concerned educational administrators may have adequate knowledge and better understanding of creative thinking. For this purpose, may organize activities for generating human resources.

xix. A variety of publications, training programs and consulting services may be provided to students to improve their creativity.

xx. Among many, one of the main objectives of secondary level education may be the development of creativity in students.

xii. Provision may be made for rewarding creative students in the F.G. Model Schools of Islamabad.

xiii. The following organizations may be contacted for the developing creativity in students of secondary level:

a. The Center for Creative Learning (CCL): CCL offers a variety of publications, training programs, information support, and consulting services on creativity, Creative Problem Solving, talent development, and learning styles.

b. Nina L. Greenwald, Faculty, Graduate Program of Critical and Creative Thinking University of Massachusetts Boston: Her publications include articles on teaching creative thinking and problem solving, cultural impediments to creativity development and problem-based learning (PBL).

c. American Creativity Association (ACA): American Creativity Association is a primary resource for learning and applying creativity, innovation, and problem-solving techniques.

d. The Creative Education Foundation: The Creative Education Foundation is a non-profit membership organization of leaders in the field of creativity theory and practice. Its mission is to serve as the center of applied imagination.

e. International Center for Studies in Creativity: A department of Buffalo State College in New York, ICSC offers workshops, undergraduate and graduate programs in creativity studies. The center also houses and extensive reference library of creativity literature knows as the Creative Studies Library.

f. National Museum of Science and Technology (Pakistan).

g. UET Science Museum Lahore (Pakistan).

h. Technology Upgradation and Skill Development Company Lahore.

i. Lokvirsa Museum Islamabad (Pakistan).

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Appendix A

QUESTIONNAIRE FOR STUDENTS OF F.G.

MODEL SCHOOLS OF ISLAMABAD

Name of Respondent: _____ Class: _____

Name of School: _____

Contact No. _____ Email: _____

Please Tick (✓) the most appropriate column

S.#	Statement	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
1	You are encouraged to find out a number of ideas/solutions to problems.					
2	You are given individuals projects for your creativity development.					
3	You are rewarded for showing creativity in your individual projects.					
4	You are taken to Science Museums.					
5	Science Exhibitions are organized at school.					
6	Creativity measuring tools are used in order to assess your creative level.					
7	Creative scientists/individuals are invited to school to address students.					
8	Counseling services are provided at school.					

S.#	Statement	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
9	Duties related to students' service and welfare are assigned to creative teachers.					
10	The contents of the textbooks of science subjects build up problem-based and project-based learning.					
11	Exercises in the textbooks of science subjects develop divergent and convergent thinking.					
12	You are encouraged to challenge teachers and authors of the textbooks.					
13	You have provision to take courses on creativity development.					
14	You have provision to work with creative individuals.					

Appendix B

QUESTIONNAIRE FOR STUDENTS OF F.G.

MODEL SCHOOLS OF ISLAMABAD

Name of Respondent: _____ Designation: _____

Name of School: _____

Contact No. _____ Email: _____

Please Tick (✓) the most appropriate column

S.#	Statement	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
1	Students are encouraged to find out a number of ideas/solutions to problems.					
2	Students are given individuals projects for their creativity development.					
3	Students are rewarded for their creative work.					
4	Students are taken to Science Museums.					
5	Science Exhibitions are organized at school for students' creativity development.					
6	Creativity measuring tools are used in order to assess students' creative level.					
7	Creative scientists/individuals are invited to school to address students.					

S.#	Statement	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
8	Counseling services are provided for students' creativity development at school.					
9	Duties related to students' service and welfare are assigned to creative teachers.					
10	The content of textbooks of science subjects develops problem-based and project-based learning approaches.					
11	Exercises in the textbooks of science subjects develop divergent and convergent thinking in students.					
12	Students are encouraged to challenge teachers and authors of the textbooks.					
13	Students have the provision to take courses on creativity development.					
14	Students have the provision to work with creative individuals.