

**Mathematical Creativity Among Students of 10<sup>th</sup> standard of Secondary School****Anil Sharma**Research Scholar  
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Jalandhar**Abstract:-**

*The focus of this paper is to review the mathematical creativity among secondary school students. With this study creativity and interest in mathematics of the students can be penetrated minutely. For this Investigator has taken a sample of 190 students of tenth standard. A test was constructed consisting of seven items of tenth class syllabi of Punjab School of Education Board. These items were based on routine mathematical problems of the students. The test was conducted on the students of two schools i.e. government school and private school of Batala city of Punjab. After analyzing the result, the investigator found that the students of government school have more creativity than the private school. However the male students of government school are more creative than private school.*

**Keywords:** Creative effectiveness, Secondary school students, boys and girls.

**Introduction**

**E**ducation is a continuous and life long process. It goes from womb to tomb as man keeps learning one thing or the other throughout his life span. Hence we can say that it is inseparable to Man and it is this very "term" which transforms man from a mere "two legged animal" into a human being. Since it is the most important invention of mankind, we cannot isolate it from society. Both Society and Education are complementary and interdependent on each other. The Latter is based on four pillars i.e. Learning to know, learning to do, Learning to live together and Learning to be. Education enables us to think logically and rationally, thus prepares us to differentiate between right and wrong. It is also helpful in developing all dimensions such as Intellectual, social, physical, emotional and spiritual etc. thus is very important for all round development of personality.

Education can formally be imparted in a formal set-up therefore the need of school emanates, wherein the dissemination of knowledge and information is possible to small children. The well-being of children depends on school and its educational programs the latter can be accomplished and realized with the help of best curriculum. Since curriculum is the backbone of school programme and

plays a vital role in drawing the best, therefore the child can be motivated for gaining new knowledge by the best and innovative methods adopted by the teacher.

Acc. to ( Leikin & Pitta-Pantazi,2013) Creativity in a society is a central component of modern technology. Different persons examined creativity in their own way. For this purpose Nilsson, Schindler, Bakker (2018) (see Gough, Oliver, & Thomas, 2013) conducted a configurative literature where they searched adequate keywords in the proceeding of ten years of PME Psychology of Mathematics Education and developed a categorization system for the analysis of the articles. There are many reasons where interest in creativity and its importance is created. To do something new, solving creativity is needed.

In this way (Kim, Roh, & Cho, 2016). Barak summarizes:

"It is evident that creative thinking skills, openness to change, flexibility, and the ability to cope with challenging tasks are essential for integration in today's society and workplace, whereas specific skills and knowledge are rapidly becoming obsolete and new fields are emerging every few years." (Barak, 2009, p. 345)

Mathematics is the prominent subject in school curriculum and it is called 'Queen of Sciences'. Students who are good in Mathematics also better in other subject. According to Kothari

Commission Report (1966), was “Science and Mathematics must be an integral part of school education in the first ten years to age 16+ till class 10<sup>th</sup>.”

Acc. to NCF 2005 mathematics is the most important subject and it is the right of every child to learn and become proficient in it .It also stressed that primary education acts as the base or foundation on which the platform of secondary education will rest. Therefore at primary level, the mathematical skills are developed in such a way that they act as base to learn the complex phenomena at the secondary level by relating the curriculum with real life situations.

NCF 2005 states that “When a farmer estimates the yield of a particular crop, he uses considerable skills in estimation, approximation and optimization.” Such types of techniques are useful at school level. At this stage Individual and group exploration of connections and patterns, visualization and generalization, and making and proving conjectures are important. It can be encouraged through the use of appropriate tools.

Before implementing all such plans, it is mandatory to realize the present situation i.e. the recent trends and practices carried out in present school situations. According to NCERT, 2006 Report, “School Mathematics takes place in a situation where: (1) Children learn to enjoy Mathematics, (2) Children learn important Mathematics, (3) Mathematics is a part of children’s life experience which they talk about, (4) Children pose and solve meaningful problems, (5) Children use abstractions to perceive relationships and structure, (6) Children understand the basic structure of Mathematics and (7) Teachers expect to engage every child in class.” Even though the status of Mathematics Education has been improved, the quality of it is not yet increased, which is the urgent need of school curriculum today.

When we go through the reports and research studies, the results show that the quality of Mathematics Education is not up to the International levels. There are many reasons behind the low achievement in Mathematics Education at school level in India. The students at every level of education feel that it is hard subject, which is created by great mathematician. They consider it as a difficult subject .The lack of interest in Mathematics

is due to the fear about the subject, the failure rate in exams, lack of activities, boredom in classrooms due to ineffective curriculum , no special provisions for the talented students in a classroom , scarcity of trained teachers, traditional evaluation system, etc.

Despite India being culturally rich, it is disheartening to know that we are not integrating its enriched cultural heritage in the curriculum while teaching in classroom .In reality no school is following the concept of cognitive styles of teaching even when we are lagging. When we are lagging in Mathematics Education in the achievement to the International standards, it is time to think over and implement such concepts embedded in our own culture ,which will bring out the desirable success towards Mathematical Education not only quantitatively also qualitatively. In this way when we use cognitive styles in mathematics then Mathematical creativity and problem solving ability should be increased. It will become beneficial to all students in secondary schools.

### **Creativity**

Creativity is a phenomenon where something new and valuable is formed. Creativity should be an idea a scientific theory, a musical composition or a joke or physical objects such as inventions, a literary work, or a painting. Creativity is derived from the Latin word *creo* “to create”. Its derivation suffixes also come from Latin. It is a dynamic property of the human mind that can be enhanced and should be valued. It can be either strengthened or deteriorated. Therefore, it is important to study creativity and determine its characteristics. Nature of mathematics provides a suitable platform for developing creativity.

Creativity in general or usually distinguished from innovation in particular where the stress is implementation. e.g. Teresa M. Amabile and Pratt(2016) defines creativity as production of novel and useful ideas and innovation as implementation of creative ideas .An innovation requires implementation ,either by being put into use of by being made available for use by other parties, firms, individuals or organization.

### **Mathematical Creativity**

Mathematical Creativity means to create something in Mathematics. Chamberlin and Moon



(2005) state that mathematical creativity is observed when one generates a nonstandard solution for a problem which may not be solved by using a standard method.

"The essence of mathematics is not just producing correct answers, but thinking Creatively. In this way, teachers should easily find the way to solve a problem, but provide such atmosphere to students which helps them to go beyond known truth and give opportunities for flow of thoughts. Also these teachers should help students to find mathematical knowledge and apply them in new problem in order to generate insightful solutions to the problem. Neumann (2007) emphasis on effective environments for fostering mathematical creativity.

Therefore, one of the important tasks of mathematics educators is to identify and develop mathematical creativity. According to some of definitions, a creative act in mathematics is consisting of: building a new fruitful mathematical concept; finding an unknown relation; and reorganizing the structure of a mathematical theory. Mathematical creativity is not only related to the novel work of mathematicians but also discovering something not already known by one even if the result is hitherto known to others.

Sriraman (2009) proposed that at the professional level mathematical creativity can be defined as the ability to produce original work that significantly extends the body of knowledge .The ability to open up avenues of new questions for other mathematicians.

#### **Studies related to mathematical creativity are as follows:**

Karimi (2000) examined the relationship between creativity, academic achievement and sex among secondary school students. The result showed that there was significant relationship among these variables. There was a relationship in level ( $p < \% 1$ ) between total creativity and academic achievement. There is significant difference in creativity among boys and girls. He found the boys are more creative than girls. Also the parent's education plays an important role in creativity.

Nori(2002) examined relationship between creativity and academic achievement on sex bases in Shiraz city. For this she has taken 306 high school

students (150 boys and 156 girls) in the research. For academic achievement she used Abedi questionnaire and CGPA. The result was analyzed by CGPA for academic achievement. She found that there was no significant relationship between creativity and academic achievement, but in sex difference the result was different. The results are favorable to girls than boys in academic achievement which shows ( $p < \% 1$ )

Prasad (2002) conducted the research of 540 students studying in VII class in the state of Himachal Pradesh and examined that there is a positive relationship between mathematical achievement and mathematical creativity which is at 0.01 levels. He found that student of public and traditional schools have significant difference in mathematical creativity.

Bharath Sriraman (2004) examined that mathematical creativity is the growth of mathematics. Acc. to him it is the unexplored area in mathematics. For this he conducted a qualitative study with the help of five mathematicians. These mathematicians say that it is the thought processes involved in Mathematics. He used Analytic theory to verify driven hypothesis. He adopted four-stage Gestalt model of preparation-incubation-illumination-verification. The common characteristics of mathematical creativity are social interaction, imagery, heuristics, intuition, and proof. Additionally, to interpret the characteristics of mathematical creativity, he used the contemporary models of creativity from psychology.

Sriraman (2004), examined the area which is most important in school mathematics growth i.e. mathematical creativity is neglected. To make mathematics more creative a qualitative study was conducted by five mathematicians. They used analytic method to analyze qualitative data .For creative mathematics they use four stages namely social interaction, imaginary heuristic, intuition and proof.

Eric Louis Mann (2005) studied the mathematical creativity on middle school students. He studied many factors are responsible for potentially created students of mathematics. When he measure mathematical creativity among students statistically significant predictors found in their performance. Mathematical achievement was the

most significant predictor of Performance, explaining. When he applied Mathematics Test (Balka,1974a) 23% of the variance in scores on the Creative Ability found while 65% variance remained unexplained. Attitude towards mathematics varies regarding sex. Dependent variables were not significant predictors between mathematical ability And creativity. While analysis of regression model independent variables are complicated. He applied Creative Ability in Mathematics Test (Balka, 1947a) and found relationship between mathematical experience (knowledge and skill) and creativity in mathematics.

Singh (2006) examined that creativity is directly proportional to academic achievement of students. Highly creative students have more achievement than low creative students. He also found that creativity was also related to academic achievement.

Sharma (2006) examined that mathematics should be coherent and well organized. He emphasized on practical method of teaching in mathematics.

Alam (2009) examined the academic achievement and creativity. He found positive Correlation between academic achievement and creativity are directly proportional to each other. When he studied regarding creativity between sex he found a significant difference at 0.01 level between boys and girls.

H Naderi (2010) studied the relationship between different aspects of creativity and academic achievement and secondly regarding gender difference in respect of creativity and academic achievement. For this he applied creativity test on (N= 153; male = 105 and female = 48). To select the participant he used cumulative grade point average (CGPA). To measure creativity he used Khatena Torrance Creative Perception inventory (KCTPI). Mathematical creativity is related to academic achievement in both male and female which indicated by Pearson Correlation analysis.

Richa Sharma (2011) examined that creativity is related to the home environment of the students. She conducted a test of 200 students of class 9<sup>th</sup> students from Chandigarh city of india. 100 students from government school while the other 100 from private school. Result of her study

shows that government school students have higher creativity as compared to the private school students. Moreover she revealed that girls are more creative than boys. The t-values also shows that the creative stimulation, cognitive environment dimensions, permissiveness dimensions of school environment also effects the creativity of school child rent. The environment of home also effect the creativity of children.

Van Harpen et al. (2013) He established relations between mathematical problem and their content knowledge. He claimed that mathematical problems are helpful in developing creative approaches to mathematics.

Y Nami (2014) examined creativity and academic achievement for this he conducted a test of 72 subjects and use questionnaire and Torrens. He analyzed both descriptive and inferential statics to get the results. The result shows that there was a positive relationship between creativity and achievement.

Bikner- Ahsbabs, Knipping & Presmeg (2015) examined that creativity is a broad field. He précised theoretical methods to measure the creativity. Their methods are purely based on assumptions. They emphasized the joint discussion to decode the mathematical creativity.

[Ann Kajander](#) and [Bharath Sriraman](#) (2018) Exploring Creativity: From the mathematics classroom to the mathematician's mind In this working group we sought to capture the essence of mathematical creativity as seen through the eyes of mathematicians and described by current research, and express it in ways that might also be applicable to learners of mathematics including, but not restricted to, students described as highly able. Our initial questions for consideration included: What is mathematical creativity? Does it differ from other kinds of creativity? How can we observe it in learners? Is creativity necessary for mathematics research? How can creativity be enhanced in classroom mathematics learning? Are some students more mathematically creative than others?

### **Statement of the Problem**

### **Mathematical Creativity among Students of 10<sup>th</sup> standard of Secondary School**



**Objectives Of The Study**

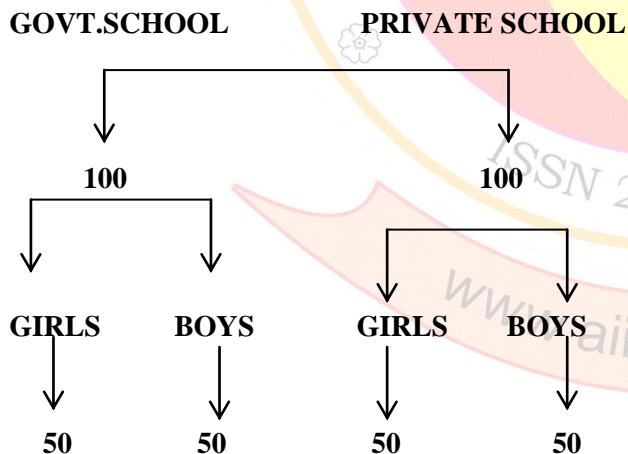
The objectives of the research study will be as mentioned below

1. To study the level of Mathematical creativity among students of Government school and Private school.
2. To compare the level of Mathematical creativity among girls and boys.

**Hypothesis of the study:**

1. **There is no significant difference of** Mathematical creativity among female students of government school and private school
2. **There is no significant difference of** Mathematical creativity among male students of government school and private school
3. **There is no significant difference of** Mathematical creativity among female students of private school and male students of govt. schools.

**Sample: Data for the research paper was collected from Government School and Private School .**



**Tools:**

The test of creative ability in Mathematics was designed on the 10<sup>th</sup> standard of Punjab School Education Board (PSEB) students of Batala Distt Gurdaspur Punjab. Seven items were constructed on the syllabus of 10<sup>th</sup> standard by the investigator.

**Statistical techniques Analysis of data:**

graph Mean Median S.D. and t-test

**Results and implications:**

**Table 1:** Showing Mathematical creativity among female students of government school and private schools.

Type of school	Mean	Median	SD	Variance	t-Test at 0.05 level
Govt. School Girls	21.68	24	7.18	51.55	0.5949
Pvt. School Girls	16.86	17	4.26	18.147	

1 Table No. 1 depicts that mean score of Govt. School Female is found to be 21.68 where as Private School Female is 16.86. SD of Govt. School Female is 7.18 where as Private School Female is 4.26. The t-test value of the sample is 0.5949 which is insignificant at 0.05 level. Hence the Hypothesis No. 1 i.e. ‘**There is no significant difference of** Mathematical creativity among female students of government school and private school’ is accepted.

**Table 2:** Mathematical creativity among male students of government school and private school

Type of school	Mean	Median	SD	Variance	t-Test at 0.05 level
Govt. School Male	24.97	25	1.77	3.132	2.97
Pvt. School Male	15.5	17	4.72	22.27	

2 Table No. 2 depicts that mean score of Govt. School Male is found to be 24.97 where as Private School Male is 15.5. SD of Govt. School male is 1.77 where as Private School Male is 4.72. The t-test value of the sample is 2.97 which are significant at 0.05 level. Hence the Hypothesis No 2 i.e. ‘**There is no significant difference of** Mathematical creativity among male students of government school and private school’ is rejected.

Table 3: Mathematical creativity among students of government school and private school.

Type of school	Mean	Median	SD	Variance	t-Test at 0.05 level
Government School	46.66	48	9.061	56.059	2.0161
Private School	32.36	32.5	9.0739	41.2759	

Table No. 3 depicts that mean score of Government School is found to be 46.66 where as Private School is 32.36 SD of Government School is 9.061 where as Private School is 9.073. The t-test value of the sample is 2.0161 which is significant at 0.05 level. Hence the Hypothesis No 3 i.e. **‘There is no significant difference** of Mathematical creativity among students of government school and students of Private school is rejected.

**Conclusion**

It can be concluded that Govt. School female and private female have no significant difference in mathematical creativity. Whereas Govt. School male and private school male have significant difference in mathematical creativity. This may be due to the fact of qualified staff and emphasis on practical knowledge in Govt. school. The mathematical creativity is more polished in Govt. School than Private School. Mathematical Creativity among male and female students of govt. and private school have no significant difference. Hence it could be concluded that mathematical creativity among female students of govt. and private school shows no significant difference where as a significant difference is found among the mathematical creativity of male students of govt. and private school. Similarly a significant difference is found in the mathematical creativity among male students of govt. school and female students of private schools. Similarly a significant difference is found in the mathematical creativity among students of govt. school and students of private school

**Implications:**

- 1 Further research could be carried on relationship of Mathematical Creativity with various teaching styles, personality and motivational theories.

- 2 Mathematical creativity is the area where more research is needed to be conducted to remove methodology problems of mathematics and phobia of Mathematics.
- 3 Different programming styles of mathematics could be researched upon to enhance the mathematical skills.

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