CHAPTER VII
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SUMMARY, CONCLUSIONS AND SUGGESTIONS FOR FURTHER RESEARCH

INTRODUCTION

Whether it is considered from the view point of its effect on society, or as one of the expressions of the human spirit, creativity stands out as an activity to be studied cherished and cultivated (Ariets, 1976) in one form or another; there is a world wide trend which shows great concern about creativity. Advanced countries are definitely interested in the study and development of creativity, as our third world countries, whose survival depends upon the creative vision and creative striving of the masses.

Scientific study of creativity is quite a recent phenomenon. Some investigators examine the personality make-up of the individuals who are high tested creativity while others specialized in test construction. Some concentrate on creativity and intelligence while others study the effectiveness of
Currently, there is a strong awareness that scientific, mathematical, technological and other types of creativity are as essential as the twin strains of musical and artistic creativity. As knowledge of mathematics is essential for understanding of various subjects and also indispensable for a wide variety of professions, as well as for each government of the world, therefore, the researcher considered appropriate to study the impact of intellective and non-intellective factors on the mathematical creativity of the elementary school children.

**Mathematical Creativity**

On the basis of Torrance (1962) definition of creativity, mathematical creativity may be defined as a process of sensing problem in the field of mathematics, searching for solution, making guesses and finally communicating the results. Its measurement is the score of Moghe (1987) Test for Testing Mathematical Creativity.
REVIEW OF RELATED STUDIES

Many studies have been conducted where positive and significant relationship between intelligence and creativity have been reported (e.g. Desai, 1987). However, Mehdi (1977) reported a negative correlation between creativity and intelligence for students coming from urban locality, while it was positive in the case of students coming from rural locality. On the other hand, Dutt (1977) reported that highly creativity need not be necessarily high intelligent. As there can be many possible explanation for such discrepancies in the results (e.g. this may be due to factors other than intelligence), therefore, there is need to explore this field further.

While taking the marks of the students in the annual examination as an index of their scholastic achievement, Desai (1987) reported a positive and significant relationship between creativity and scholastic achievement. On the other hand no relationship between creativity and achievement was found by Badrinath and Satyanarayan (1979).

Vohra (1975) revealed that about 75% of research studies have reported that creatives come from high socio-economic status. Parkash (2000) in his study on 400
students concluded that socio-economic status is significantly and positively correlated with mathematical creativity of the students at 0.01 level of significance. However, Raina (1986) found that socio-economic status of the students had no effect on their creativity.

Home factors are known to play a role in helping to identify the child at an early age of becoming a creative (Pringle, 1970). On the other hand Verma and Kumari (1984) concluded that scientific creativity is independent of the home environment.

Many studies (e.g. Arora, 1976) found that the female students were significantly superior to male students on verbal creativity, while equal number of studies have reported that male students scored higher than their counterpart on verbal creativity (Chauhan, 1986). Also no significant differences were found between the male and female students with respect to verbal creativity (Desai, 1987). Thus gender seems to play an important role. Therefore, it needs further research in the light of different environment in home and school.
Pandey and Rai (1988) reported that urban students have superior creative potential in comparison to rural students. Prakash (2000) revealed that mean difference in the mathematical creativity between urban and rural students is significant at 0.05 level and differences in favour of urban students. However, Gupta (1998) reported that rural students were more creative than urban students.

**STATEMENT OF THE PROBLEM**

"Intellecutive and Non-intellecutive Factors Associated with Mathematical Creativity at the Elementary School Stage".

**OBJECTIVES**

1. To find the relationship of intellecutive variables (i.e. intelligence, creativity and mathematical achievement) with the mathematical creativity of the children.

2. To find the relationship of non-intellecutive variables (i.e. socio-economic status, home environment and institutional
environment) with the mathematical creativity of the children.

3. To study the differences in the mathematical creativity of children due to high and low socio-economic status, sex-differences, urban-rural differences, school wise differences and differences due to home and institutional environment.

HYPOTHESES

1. There will be significant relationship between the intelligence and mathematical creativity of the children.

2. There will be significant relationship between the creativity and mathematical creativity of the children.

3. There will be significant relationship between the mathematical achievement and mathematical creativity of the children.

4. There will be significant relationship between the socio-economic status and mathematical creativity of the children.
5. There will be significant relationship between the home environment and mathematical creativity of the children.

6. There will be significant relationship between the institutional environment and mathematical creativity of the children.

7. There will be no significant difference in the mathematical creativity of children with high and low socio-economic status.

8. There will be no significant difference in the mathematical creativity of children with rich and poor in home environment.

9. There will be no significant difference in the mathematical creativity of children with rich and poor institutional environment.

10. There will be no significant difference in the mathematical creativity of girls and boys.
11. There will be no significant difference in the mathematical creativity of urban and rural children.

12. There will be no significant difference in the mathematical creativity of children studying in public and traditional schools.

METHODOLOGY

Method

To see the association of intellective and non-intellective variables with the mathematical creativity of student, Survey Method is employed.

Sample

Study is conducted on a random sample of 540 elementary school children studying in VIIth Class in Public schools and traditional schools in the state of Himachal Pradesh. While selecting the sample care is taken to include both boys and girls children from Public schools, traditional schools and also school situated in urban and rural areas.
Tools to be Used:

Following tools were used for data collection for the present study:

1. Test of Creative Thinking in Mathematics (Moghe, 1989).
2. Group Test of General Mental Ability (Tandon, 1971).
4. Achievement Test in Mathematics (Prakash, 2000).
5. Socio-Economic Status Scale (Kulshrestha, 1980).
7. Institutional Environment Scale.

DATA COLLECTION

Collection of data for the final study was undertaken on a sample of 558 boys and girls students was taken from Public and traditional schools situated in urban and rural areas of Himachal Pradesh state.

Before the collection of data schools were selected randomly and permission of head of the schools as well as co-operation of teachers teaching class VII were sought. Students were also made aware about the objective of collecting
the data and their doubts were cleared. They were made comfortable by telling that the results of study will be kept confidential and will be used for research purpose. All the tools namely – Test of Creative Thinking in Mathematics, Group Test of General Mental Ability, Creative Activity Check List, Achievement Test in Mathematics, Socio-economic status scale, Home environment inventory and Institutional environment scale were administered one after the other with some break. Data was completed in two sittings.

As 16 students did not respond to all the tests and 2 more students were deleted to make the sample size equal to 540. Thus final study and analysis of data was done on a sample of 540 children.

STATISTICAL TECHNIQUES USED
1. The technique of co-efficient of correlation is employed to study the degree of association of intellective and non-intellective variables with mathematical creativity.

2. To find the difference in the mathematical creativity due to sex-difference, rural-urban differences and also
differences due to type of schools, the technique of mean, SD and t-ratio is employed.

NEED AND IMPORTANCE OF THE STUDY

Upto 1970 only five studies were completed in the area of creativity. But despite difficulties there has been consistent growth of research about this complex and multifaceted phenomenon of creativity as the situation is gradually improving in India because by 1993 as many as 214 research studies have been completed. Therefore, this field needs further exploration.

In the present age, knowledge of mathematics has become essential in almost every field. Every government of the world has come to greatly rely on statistical data especially for economic planning and budgeting. Each government relies heavily on the creative and talented mathematicians as many vital decisions are taken on the basis of statistical data. From this study it will be helpful to get the awareness of mathematical creativity which in turn will help to examine the imaginative and productive application of this knowledge for improving the quality of life of our children.
Although some work has been done in the field of general creativity, but the area of subject creativity especially mathematical creativity has not been explored well. Researcher has come across with four studies as yet. Therefore, there is a great scope of research in this area.

Previous researchers have concentrated on the correlational technique of analysis by finding the relationship of general creativity with cognitive factors or personality traits. This study has taken into consideration in home environment and school environment. Findings could tell us clearly about the association of environment with mathematical creativity. Also technique of factor analysis and step up regression equations will give total and true picture regarding the inter-play of intellective and non-intellective variables with mathematical creativity of children.

Further most of the work done in the field of general creativity or mathematical creativity is the secondary stage and elementary stage is neglected till now.
Present study is conducted on the children of elementary stage as it is the foundation stage in the educational ladder of individual.

CONCLUSIONS
Based on the results of the present study following conclusions are drawn –

1. Variable of intelligence is significantly and positively correlated with the variable of mathematical creativity at 0.01 level of significance. In other words, a child having higher level of intelligence may possess high level of mathematical creativity and vice-versa.

Therefore, hypothesis 1 that, there will be significant relationship between the intelligence and mathematical creativity of the children is retained in the present study.

2. Independent variable of creativity and mathematical creativity are found to be insignificantly correlated with each other at 0.05 level. It means variable of creativity and mathematical creativity are independent of each other.
Thus, hypothesis 2 that there will be significant relationship between the creativity and mathematical creativity of the children is not accepted here.

3. Results of the present study clearly state that there is significant positive correlation between the variable of mathematical achievement and mathematical creativity at 0.01 level. Thus, mathematical achievement and mathematical creativity of the child go hand in hand with each other, in the same direction.

Therefore, hypothesis 3 that there will be significant relationship between the mathematical achievement and mathematical creativity of the children is retained in the present study.

4. Socio-economic status has positive and significant correlation with the dependent variable of mathematical creativity at 0.01 level. Thus, social status and economic position of the child influence his/her level of mathematical creativity.
Therefore, hypothesis 4 that, there will be significant relationship between the socio-economic status and mathematical creativity of the children is retained in the present study.

5. Variable of home environment is significant and positively correlated with the dependent variable of mathematical creativity at 0.01 level. It means home environment of the child affects his/her level of mathematical creativity upto maximum extent.

Thus, hypothesis 5 that, there will be significant relationship between the home environment and mathematical creativity of the children is retained.

6. Results of the present study state that there is significant and positive correlation between the variable of institutional environment and dependent variable of mathematical creativity at 0.01 level. It clearly means that open and democratic institutional environment helps the children in enhancing and developing their mathematical creativity along with other abilities.
Hence, hypothesis 6 that, there will be significant relationship between the institutional environment and mathematical creativity of the children is also retained in the present investigation.

7. From the results, it is observed that significant difference on the dependent variable of mathematical creativity is found due to the variable of socio-economic status. In other words high SES and low SES groups differ significantly with each other on the variable of mathematical creativity. Also it is observed that mean scores of mathematical creativity of high SES group is higher as compared to low SES group.

Thus, hypothesis 7 that, there will be no significant difference in the mathematical creativity of the children with high and low socio-economic status is not retained here.

8. It is revealed from the results of present study that mean difference on the dependent variable of mathematical creativity is found to be statistically significant at 0.01 level due to two levels (i.e. rich and poor) of home environment
and the group of children with rich home environment are at a higher level on mathematical creativity as compared to the children living in poor home environment.

Thus, hypothesis 8 that, there will be no significant difference in the mathematical creativity of the children with rich and poor home environment is not accepted.

9. Results of the present study state that significant difference on the dependent variable of mathematical creativity is found due to rich and poor institutional environment. Also mean scores of children with rich institutional environment is higher as compared to the group of children studying in poor institutional environment.

Therefore, hypothesis 9 that, there will be no significant difference in the mathematical creativity of the children with rich and poor institutional environment is not accepted in this study.

10. It is noticed from the results of present study that there is significant difference between boys and girls in their
mathematical creativity as t-value is found to be significant at 0.01 level. After comparing their mean scores on mathematical creativity test, it is noticed that mathematical creativity of boys is higher as compared to girls.

Hence, hypothesis 10 that, there will be no significant difference in the mathematical creativity of girls and boys is not retained.

11. From the results of present study, it is shown that there is significant difference in the mathematical creativity of urban and rural students on the dependent variable of mathematical creativity. The mean scores of urban children is higher as compared to their counter parts living in rural areas.

Therefore, hypothesis 11 that, there will be no significant difference in the mathematical creativity of urban and rural children is not retained here.

12. There exists significant difference in the mathematical creativity of children studying in public and traditional schools as is revealed by the results of the present study. Also mean score of public school children on the dependent
variable of mathematical creativity is higher as compared to the children studying in traditional schools.

Hence, hypothesis 12 that, there will be no significant difference in the mathematical creativity of the children studying in public and traditional schools is also not retained in the present investigation.
EDUCATIONAL IMPLICATIONS

After having reported the results of the present study in the preceding paragraph, some of the practical implications are pooled together here to consider their importance.

1. The research findings derived regarding the meaning, nature, significance and measurement of mathematical creativity talent naturally have practical implications for teachers. The study suggests that among the various variables under study, some have a direct bearing on the mathematical creativity. Therefore, there is need to identify the potential creative talents at each grade and at every stage of school education.

2. Teachers can help the children in identifying the creative talents in mathematical by performance of children on a tool used by the investigator. This test can be an indicator of growth potential and future guidance needs.

3. The mathematical creativity possessed by the children of urban areas is more as per the findings of the present study. It may be that urban area schools are equipped well with all
facilities and quality of teaching may also be good. This study indicates that if conducive facilities are provided to rural areas schools they may also score better as urban children.

4. As per the findings of present study, mathematical creativity of the public school children are higher as compared to the children of traditional schools. The significance influence of the above variable makes it clear that the facilities that are available and the conducive teaching learning atmosphere are the deciding factors in cultivating and promoting mathematical creativity.

5. The nurture of mathematical creativity is a concern of education. Once the creative students and their potentialities are identified the parents, the teachers, educationists and psychologists and all those individual who directly or indirectly are concerned with the children and nation can think of ways and means to encourage and foster the mathematical creativity.

6. There is need to tailor the educational system to suit the need and nature of creative children. There is need to bring
into academic education a wider range of divergent thinking, experiences and greater emphasis on student initiative and freedom in the institution.

7. The factor of home environment play significant role in enhancing the mathematical creativity of children as per the findings of the present study. Therefore, it is very essential to guide the patents and also the teachers to how to react and deal with the unusual questions of the children related to mathematical creativity. Also, the parents should be patiently guided to change their outlook towards their children’s future growth, development and adjustment. The parents should not fulfill their aspirations at the cost of the child’s creativity.

8. The results of the present study may form a subject of refresher courses, seminars and workshops organized for teachers, teaching mathematics to elementary school children.

9. After crystallizing the findings of the present study, the researcher has other educational implications for the consideration of educationists, mathematicians
psychologists, teachers, principals, curriculum framers and policy makers. As per the results, mathematical creativity among children of public schools is higher as compared to traditional schools. Thus, teachers and principals should develop certain micro-teaching skills and skills of organizing curricular activities such as brainstorm session, quiz competition, painting competition and competitions in mathematical games and also out of school or extended curricular activities such as science clubs, science fairs, science exhibitions and field studies in traditional school also for the promotion of mathematical creativity among the children.

10. In school, mathematics education should be developed and strengthened so as to develop in the child well-defined abilities and values such as the spirit of inquiry, creativity, objectivity, courage to question and innovate and also problem-solving abilities.

11. Mathematics Education Programme in the school should be so acquire designed to enable the child to acquire decision making skills and to discover the relationship of
mathematics with other subjects and many aspects of daily life.

12. Mathematics teachers should be well aware of not only the subject matter but of the innovations and new techniques. He should make maximum use of all the immediate resources like laboratory, manuals, reading materials available in schools. Finally his teaching should be activity based and child-centered so that children can be involved in all the activities.

13. Mathematical creativity among children of public school is higher as compared to children of traditional schools. The findings of the present study support that the better facilities available in a school facilitate the development of mathematical creativity. Therefore, teachers should provide informative and emotional experiences, wide reading facilities to the children along the stressing the need for adequate data before arriving at conclusions.

14. According to the result of present study, boys are higher in mathematical creativity than girls. The results states that if similar opportunities are provided to girls, they can also be
at higher level in mathematical creativity. In other words, girls should also be taken to fairs, parks, industries, they should also be allowed to mingle with various peers and intellectual groups, exposing them to the eminent scientists etc. in order to foster mathematical creativity among them.

15. Finding of the present investigation states that urban children hold high level of mathematical creativity than rural children. It may be urban schools are supported to be equipped well with all facilities and quality of teaching may also be good. This study indicates that if conducive facilities are providing to the rural children, they will also score as better as urban children.

16. As per the findings of present study rich home environment plays an important and significant role in promoting mathematical creativity among children. Therefore, parents must be conscious in answering to the various thought provoking questions of their children. They must provide free, open and congenial environment in the home, books, magazines and other material and play way activities to their children so that they can develop some good hobbies and
habits. Above factors will definitely be helpful to the children in the promotion of mathematical creativity.

SUGGESTIONS FOR FURTHER RESEARCH

Following suggestions are being made for further research in this area:

1. Instead of taking intellective and non-intellective variables, the effect of different creative-thinking instructional material on the mathematical creativity of students may be studied.

2. The study may be taken up in form of longitudinal study to see the enhancement of mathematical creativity of the students.

3. The study may be conducted by talking the sample from rural talented students e.g. Navodaya Vidyalaya as to compare the effect of school from the point of view of different instructional environment, curricula, policies, teaching strategies and learning styles.
4. Similar study may be conducted on the students of different streams and their results may be compared to see the effect of different curriculum on the dependent variable of mathematical creativity.

5. Instead of taking one class, different grades and age groups may be taken into consideration for comparing the effect of intellective and non-intellective variables on the mathematical creativity of the students.

6. The study may be conducted by using factorial design in order to study the main and interactive effects.

7. Study may be conducted by taking some other intellective and non-intellective variables.

8. A study of intellective and non-intellective variables in relation to scientific creativity of the students may be taken up.

9. Practically no work has been done on the pre-primary school student population. Therefore, study may be
conducted on pre-primary school students instead of students of elementary stage.

10. Instead of taking the total mathematical creativity scores as the dependent variable, separate scores of fluency, flexibility and originality can be taken up to see the effect of different intellective and non-intellective variables.

11. Replicative studies involving larger and different sample as also follow-up studies may be undertaken to establish the validity of the findings of the present investigation.