THE PSYCHO –PHILOSOPHY OF MATHEMATICAL CREATIVITY IN HIGHER EDUCATION

K.C.JAGADEESHA. M.Sc., M.Ed., M.Phil(Mat)., M.Phil(Edu)., PGDHE.
ASSISTANT PROFESSOR OF MATHEMATICS
Department of Mathematics.
IDSG Government College. Chikmagalur KARNATAKA , INDIA

ABSTRACT :

Now a days the main goals of any educational system should be fostering inner creativity in the individuals. Creativity is a dynamic property of the human mind that can be nurtured and enhanced and should be valued. It is also strengthened through activities. Therefore, it is important to know the meaning of creativity and its characteristics. The basic nature of mathematics provides a suitable platform for developing creativity. By studying exhaustively contemporary literature, this paper makes an effort to gain an insight into the nature of mathematical creativity by emphasising on learning environments to nurture and foster it, not only within school situations but also colleges, as the expression of mathematical creative behaviour changes from one level to another.

KEYWORDS**: **Creativity; Mathematics; Mathematical creativity ;

INTRODUCTION :

The meaning of the term 'Mathematical Creativity' ranges from philosophical to psychological, sociological to psychometric, and in general specific to generality. Many definitions we find for the term mathematical creativity, which is considered by many psychologists as a highly original and particularised capacity. According to many mathematicians and psychologists, formulation of hypothesis and testing hypothesis are most important abilities for problem solving of any individual at any stage. So, in assessing creativity in an individual, inquiring abilities are more important rather than intellectual abilities.

MATHEMATICAL CREATIVITY:

It is very difficult to explain the structure and nature mathematical creativity and its characteristics also defining mathematical creativity is a challenging task for any researcher. Since there is no specific conventional definition of mathematical creativity. Mathematical creativity is always considered as the important and exclusive cognitive domain of professional mathematicians (Sriraman , 2004). The French mathematician Henri Poincaré (1948, 1956) assumed that discovery in mathematics is combination of imagination and ideas and identified that there are a lot of these combinations but a few of them are useful.

In process of finding these useful combinations, a great number of combinations are constructed and then meaningful combinations are distinguished from meaningless ones. To develop mathematical creativity in students one must enable students to confidently engage in complex mathematical tasks…draw on knowledge from a wide variety of mathematical topics, sometimes approaching the same problem from different mathematical perspectives or representing the mathematics in different ways until they find methods that enable them to make progress.

DEFINITION OF MATHEMATICAL CREATIVITY:

Mathematical creativity ensures the growth of mathematics as a whole. Contemporary models of creativity from psychology were reviewed and used to interpret the characteristics of mathematical creativity .

According to Boden (2004); states that combining familiar ideas in unfamiliar manners can also be considered a creative work. Rather similar to these. According to Ervynck (1991;) asserts that creating useful mathematical concepts through combining previously known concepts or discovering unknown relations between mathematical facts can be considered as a creative act of doing mathematics. also, he emphasizes that creativity in mathematics plays a key role in the full cycle of advanced mathematical thinking, which helps conjectures to be made in order to develop mathematical theories and generates new mathematical knowledge. According to Chamberlin and Moon (2005); consider divergent thinking as one of prevalent descriptors of mathematical creativity. According to Laycock (1970) described mathematical creativity as an ability to analyze a given problem from different perspective, see patterns, differences and similarities, generate multiple ideas and choose a proper method to deal with unfamiliar mathematical situations.

CHARACTERISTICS OF MATHEMATICAL CREATIVITY:

- An aesthetic sensibility ,identifying unity and analogy present in mathematical solutions and proofs and in an appreciation of the structure of the particular field.
- Observing the problems in data or in situations which arouse no particular curiosity in the other children.
- An intrinsic motivation to improve the structure of a probable solution.
- Finding out connections between a problem, axioms, proposition, or concept and how they are inter linked with each other and what would follow from it.
- Independent Working attitudes.
- Interested in communicating concerning mathematics with others of equal ability and interest around them.
- Adding to the knowledge of the class by producing another solution or another proof .

- Interested in working with the symbols of mathematics.
- Mentioning other meanings for symbols than those the teacher has revealed.
- . The making up of mathematical symbols of his own.
- The tendency to generalize particular results either by finding a common thread of induction or deduction method or by seeing similar patterns and structures by analogy.
- The ability to see a whole solution at one time or to visualize a proof as a whole. Ability to move from Whole to part in analysing and solving problems
- A intuitive imagination concerning the way things appear in space, the relation of things to each other.
- predicting concerning the resulting paths or relationships of objects which have motion.
- A tendency to speculate concerning unusual applications for the results obtained by the class.
- The belief that every problem has a solution.
- Persistence in working on particularly difficult problems or proofs.
- Boredom with repetition or working of a large number of problems which she/he has well in hand.
- Intuitive thinking ability in act upon problems, i.e.Ability to perform many operations without much thinking involved.

PSYCHOLOGICAL MODELS OF DEVELOPING MATHEMATICAL CREATIVITY:

Interactive environment is one of the very important step in fostering mathematical creativity Though a new idea usually is attributed to the creator of that idea, it is result of interaction with other and pervious experiences of persons who have worked on this idea. For instance, the Poincaré Conjecture that mathematicians made effort to prove it for almost one century and lastly in 2003, after 99 years, it was proved by Russian mathematician Grigory elman. We dare say that Perelman's proof was the result of creative attempts of group of the mathematicians for about 100 years, though their proofs consisted of flaws and deficiencies. With studying creative persons' thinking processes such as Einstein, this reality is exposed that many of their creative insights relied on cooperation, collaboration and social support. Sawyer expresses that collaboration is as a secret key to creative breakthroughs Furthermore, Sriraman (2009) conducted a qualitative study involving five creative professional mathematicians about the processes used during their studying mathematics in order to explore how mathematicians create mathematics. The results indicated that all of the mathematicians in this study appreciated the interaction they had with their graduate students and also all of them valued the role of social interaction in general as a major aspect that can stimulate their creative mathematical activities. For instance, many of these mathematicians stated the benefits of getting in touch with their colleagues through e-mail and going to related conferences and meetings. Also Neumann conducted a study for finding the best conditions in a research organization with the aim of enhancing the creativity of its scientific staff and concluded that

an interactive environment is a vital condition for enhancing creativity. To answer the question that what interactions are best for creativity, he states that if one just consults persons who want rock-solid data and all proven, then it will not lead to generate a flow of ideas. But talking with qualified people and exchanging of ideas cause to flashing a new idea/ thinking

CREATIVITY AND LEARNING MATHEMATICS

Chamberlin and Moon (2005) state that mathematical creativity is exposed when one generates a non standard solution for a problem which may be solved by using a standard method .Ervynck considers solving an old problem in a new way as example of creative mathematical activity and exemplifies solutions of a word problem of the real life at three various levels of mathematical creativity. At the first two levels, solutions to the problem are usual and predicated ,whereas at the third level, one is utilizing a much more sophisticated manner for solving the problem based on experience, intuition, perception, insight and several plausible guesses embedded in the intrinsic structure of the problem. In this level, some known information in the problem may not be used by one, but many plausible and reasonable assumptions embedded in the nature of the problem are considered which could lead to an unusual and novel method at a high level of mathematical creativity.

CONCLUSION:

The main objective of any educational system should be fostering creative people who are able to develop cognitive academic domains to make appropriate choices and decisions in unexpected situations. Creativity is dynamic in nature and human mind that can be improved and should be appreciated. It is important to study creativity and determine its characteristics. Since nature of mathematics makes it appropriate to be used as a scaffold for fostering creativity, creativity should be evident in the mathematical activities. Therefore, one of the important tasks of mathematics educators is to identify and develop mathematical creativity.

Mathematical creativity is not related to the innovative work of mathematicians but also discovering something which is not already known by one even if the result is known to others. Usually at the school levels, creativity in mathematics is generally related with problem solving and or problem posing. Here the Students should be provided opportunities to engage to solve mathematics problems which are usually open ended. Solving such challenging mathematics problems have led students to experience creativity in mathematics and doing mathematics and also try to think as a mathematician, which means, students are encouraged to reflect on their own idea. So, aesthetic aspects of mathematics should be emphasized in teaching and learning mathematics. For this purpose, it is necessary to improve

teachers' ability to plan and implement educational environments that provide an atmosphere of security that students are encouraged to take risks, make mistakes and interact with others and share their points of view.

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