Some Effective Measures for Fostering Mathematical Creativity among School Students

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1. Welcome students’ original ideas

Teachers that want to encourage creativity in the classroom should make sure they are giving their students a lot of choice and different options when it comes to assignments and projects. Fleith (2000) found in her research that teachers encourage creativity by, "not imposing too many assignments and rules on students, but giving students choices, providing students opportunities to become aware of their creativity, and accepting students as they are."
Teachers can do a number of things to make sure students have the chance to show their creativeness. One example would be when students are given a research assignment, teachers could encourage students to either write a paper, do a presentation, perform an experiment, or use technology to present information. This gives all students the chance to complete the assignment in their own creative style.
Fleith (2000) determined that, "in a climate in which fear, one right answer, little acceptance for a variety of students products, extreme levels of competition, and many extrinsic rewards are predominant, it is difficult to foster high levels of creativity." The true reward a student should receive for being creative is purely intrinsic.
2. Provide congenial environment

In order to avoid a competitive and extrinsically rewarding classroom, the teacher needs to provide a friendly and comfortable environment that students can feel comfortable enough to voice their opinions and explore new ideas. One way to get students comfortable enough to do this is for teachers to model creativity and show their own interests. Beth Hennessey (1997) suggests teachers, "Show students that you value creativity, that you not only allow it but also actively engage in it."
Fostering Mathematical Creativity among School Students (Contd.)

Creative mathematics lessons need a conducive and pleasant learning environment. Integrating playing into mathematics lessons makes learning an interesting endeavour. To create a conducive learning environment, teachers should often invite pupils to feedback and question.
Some Strategies for ......(Contd.)

Teachers should create an environment that will further individual and social components of creativity, like motivation, curiosity, self-confidence, flexibility, engagement, humor, imagination, happiness, acceptance of self and others, satisfaction, success. Teacher should encourage curiosity, exploration, experimentation, fantasy, questioning, testing, and the development of creative talents.

The students must develop important abilities. They must learn to explore and to visualize a problem, to invent own or to modify given techniques, to listen and argue, to define goals, to cooperate in teams.
3. **Redefining and posing problems by students**

Derek suggested a number of things that we can do to help foster creativity in Maths, including:

- **Setting problems with many solutions** (one example would be ‘They are both’ ‘They both’ style questions when comparing pairs of numbers/shapes etc.)

- **Get the children to pose problems themselves** (based on a graph for instance).

- **Re-definition problems** (i.e. how many sets can you create for a list of numbers).
Problem posing, along with problem solving, is central to the discipline of mathematics and the nature of mathematical thinking (Silver, 1994). Through the use of inquiry-oriented mathematics instruction that includes opportunities for problem posing and problem solving, teachers can assist students to develop greater representational and strategic fluency and flexibility and more creative approaches to their mathematical activity.
4. **Using creative teaching techniques**

Teachers should acquire various creative techniques. They should know conditions that stimulate creativity. The brainstorming technique, for instance, allows pupils to generate ideas in a non-threatening environment. Problem solving enables pupils to use information available to search for possible solutions.
Kordemsky (1958) emphasizes special significance of problems—puzzles in developing essential elements of mathematical thinking in pupils, promoting the aspiration to search independent ways and means of solving a problem; fostering pupils’ ingenuity, flexibility and criticality of mind.
Fostering Mathematical Creativity among School Students (Contd.)

Teachers should adopt the inquiry approach to teaching. Open-ended questions are employed to attract pupils' opinions and possible answers. In an open-ended learning structure, teachers are likely to attract multiple solutions because pupils are allowed to express freely. Even if there is only one answer to a closed question, pupils are encouraged to present it in more than one way (Girl, 1998).
5. Using both formative & summative evaluations

Teachers should be experts in assessment. Formative and summative assessments are meant to find out pupils' learning progress at the end of a unit or a series of units. Diagnostic assessment can be used to find out weaknesses of individual pupils. Suitable contents and activities can then be designed.
6. **Using appropriate pedagogical activity**

An activity that is fun but ineffective is an undesirable pedagogical activity. A creative pedagogical activity should observe guidelines for an effective instructional activity. An effective instructional activity facilitates learning and evaluation. It is a foundation for continuous learning and self-improvement (Kyriacao, 1986).
A creative mathematics lesson maintains pupils’ learning interests, stimulates pupils’ thinking, and encourages pupils to discover new knowledge. Individual needs of pupils are considered. It is indispensable to arouse pupils’ interests in mathematics at their young age (Smith, 1996).
Motivation is one of the prerequisite conditions for continuous learning and self-education. Mathematics can be an interesting subject, if teachers can associate this subject with pupils' pleasant learning experiences. Learning mathematics does not confine to memorising formulae. Games and quizzes that invite pupils' active participation can be infused into mathematical activities (Baer, 1994).
Mathematics is a practical subject for every individual. Mathematics teaching and learning should draw upon pupils' experiences, and should resemble real life. Teachers should relate mathematical intelligence to other types of competencies such as common sense (Sternberg et al., 1995), and practical intelligence (Sternberg & Wagner, 1989).

Taking teaching estimation as an example, teachers can relate it to a real life situation, asking pupils to round off to the nearest 10 the number of pupils in a hall. The interrelation of mathematics and other subjects should also be revealed.
Fostering Mathematical Creativity among School Students (Contd.)

- This ‘meaning making’ approach to creativity may be especially useful for classroom-based educational research as it may allow us to provide an initial conceptualisation of the potential processes involved in creativity in classroom mathematics (Clack, 2009).
8. Using technology for teaching

Technology is a powerful tool that could be used in the teaching and learning context to make a difference to our traditional teaching methods. It has the capacity to “amplify” and “organise” our thought, teaching and learning process (Pea, 1987).

If used effectively, computers are a proven medium for fostering creativity and divergent thinking in the classroom (Edwards, 2001). They have the potential to provide a teacher with an enabling situation to create a rich and challenging learning environment that can foster the creative potential of learners.
Some Strategies for.......(Contd.)

On the other hand, computers can give learners the opportunity to explore their own creative potential. One of the factors that limit learner creativity in mathematics is their inability to recognise and connect mathematical structures and objects in different situations. In this respect, technology can help learners uncover shared and unshared patterns of a class of mathematical objects.

Researches have been shown that technologies can help teachers to develop an environment that can facilitate creative behaviour in their learners.
9. Using metaphors and analogies in teaching

Metaphors and analogies can be used to lead students into an illogical state for situations where rational logic fails. The intention should be for the students to free themselves of “convergent thinking” and to develop empathy with ideas that conflict with their own.
10. **Efficient & effective teacher**

Teachers should be good at inspiring students to ask questions and guide students to solve their own problems, to stimulate students’ curiosity, thirst for knowledge and cognitive needs to create internal motivation of students. While focusing on the role of external inducement, the correct use of incentive measures to encourage students to participate in various forms of creative activities to stimulate students to create motivation,
Some Strategies for .......... (Contd.)

- for example, teachers can focus on a particular topic, and organize several students to participate in the discussion to learn. In this “brainstorming” type of communication, students can make all kinds of ideas, play to their strengths. In teamwork, we believe students will be more profound awareness of the problem; students can fully utilize their own creativity.
11. **Using action researches**

There is a growing concern in mathematics education to think about creativity in the teaching of mathematics, due to a rising demand for creative competence in an ever changing society. Rigorous action researches to explore the impact of teaching with the intention of promoting mathematical creativity need to be carried out in order to gain insight into the actual effect on attainment in the subject.
Conclusion

Current testing regimes, pressures on curriculum time and traditional compartmentalised timetable structures all impose limitations on the ability of teachers to offer students the opportunities to work in such ways, and could be contributing to the masking of mathematical creativity.
Although the current examination system requires little in the way of creative thinking in mathematics, perhaps a greater focus on teaching for creativity might engage and enthuse young mathematicians enough to equip them with the skills and confidence to want to study mathematics to higher levels.
In order to facilitate the development of the kind of mathematical creativity which could benefit industry and the economy, mathematics as a domain, and the individual pupils and teachers, a greater level of respect and attention must be afforded to the nature of, the value of and the teaching for creativity in mathematics in schools.