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20 Can games help develop mathematical thinking?

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What are games for? One may reply, 'Of course for playing.' More specifically, what is the objective of games in a mathematical class? Every time we went to Sultan Muhammed Shah Primary School to practise teaching mathematics, the students expected games to play or activities to do. They would say goodbye to us and as we left would ask, 'Are you going to bring games tomorrow?' The question arises - is a game in a mathematics class only for fun or more than that? Let us clarify what games are. According to the *Dictionary of Education*, 'Game refers to (a) a type of teaching technique, used specially in management education and training, but also in other areas of education; (b) organized play having definite objectives and rules, mostly competitive' (Anmol Publication, New Delhi). It is commonly known that games are enjoyable and generally non-threatening. Pupils often may be unaware of the learning element in games. They increase 'on-task' activity; develop social skills such as co-operation, sharing and turn-taking; help develop language in a group setting; promote pupil-pupil discussion and encourage children to teach each other. Games provide an alternative way of teaching; aid in classroom management and allow diversity of thinking and originality. A very salient point of using games in a mathematics class is that it develops *mathematical thinking*.

What is mathematical thinking? Why is it necessary? How can we develop it in learners and in ourselves as well? Mathematical thinking is a dynamic process which, by enabling us to increase the complexity of ideas, allows us to handle and expand our understanding of mathematics. It develops our reasoning and critical thinking skills. It is a relational understanding of things, in which one can learn by relating one thing to another and construct new concepts. Unlike instrumental understanding, in relational understanding the knowledge is more meaningful and not easily forgotten. It is a critical reflection on doing. By developing mathematical thinking we get a deeper understanding of ourselves and a more coherent view of what we know. It leads to a more effective investigation of what you want to know and a more critical assessment of what we hear and see. We test our mathematical thinking about problems which we come across every day. All thinking involves both pain and pleasure; the pain of incomprehension and struggling to understand, and the pleasure of insight and convincing arguments. One can enhance the development of mathematical thinking by creating an atmosphere of questioning, challenging and reflecting with ample space and time. Encouraging one's curiosity is an essential step in developing mathematical thinking. One has to pose relevant questions and allow the learners to solve them.

Of course, there are many strategies used to develop mathematical thinking. One might choose other activities or techniques such as debates, discussions, the inquiry method, co-operative learning, etc. We as teachers want our students to experience valuable and meaningful activities. We are certain that mathematical games fall into this category. Another important reason why we chose games to develop mathematical thinking is that we had an opportunity to work with

primary school students (age 9-10 years); children of this age group are always eager to play. The point is not that the teachers have to play with children all the time, but that they have to identify appropriate time to motivate and make learning more meaningful. Games can be effective for more than drill-and-drill practice and for more than low level learning of skills and concepts. Games can be used along with other instructional methods. This feature is especially important as more and more attention is given to problem solving. The use of challenge, fantasy and curiosity may enhance the effectiveness of instructional games. We do hope that teachers will be free to experiment with a variety of games and to adapt existing games to new contexts and instructional settings.

Games should be relevant to the age levels, interests and abilities of students. Some games can be easily modified or adapted to a new context. The following is an example of one of the games introduced by our group during our teaching practice at SMS school.

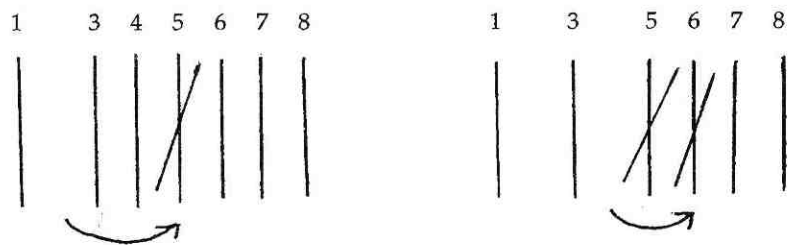
The name of the game is *Eight Magic Sticks*. For this game one needs several sticks (e.g. toothpicks or matchsticks). It can be played individually, in pairs or in groups. In a group, players take it in turns to play a whole game each. The rules of this game are:

- a) Eight sticks are placed side by side in a straight horizontal line;
- b) Any stick may jump over *two consecutive* sticks and make a cross with the third one;
- c) It cannot jump over one or three sticks;
- d) A stick can also jump over a cross as there are two sticks in a cross;
- e) At the end eight sticks should make four crosses in a straight line.

Note: A player who finishes first should not tell others and spoil the pleasure for them of finding the answer.

This game encourages the students' logical reasoning skills, mental arithmetic, predictions and thoughts of different possible alternatives. If the players find it easy the instructor may add two more sticks to the eight and play *Ten Magic Sticks* or add four more sticks making the task more complex to provoke the students' higher order mathematical thinking.

For example:



Reference

Taneja, R.P. (1991) *Dictionary of Education* (New Delhi, Anmol Publications).