

GOOD PRACTICES IN MATHEMATICS TEACHING AND TEACHER DEVELOPMENT

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Since 1992, the Singapore mathematics curriculum has been revised several times to encourage teachers to help pupils develop competencies that are useful for the global, technological economy. This paper provides an overview of what is considered good mathematics teaching. The focus of this paper is on teacher development. How can and to what extent do teachers develop such good practices?

INTRODUCTION

In 1992, the Singapore mathematics curriculum was changed to make problem solving the focus of the curriculum. In 1997, the Singapore Ministry of Education launched an initiative Thinking Schools, Learning Nation to encourage schools to explicitly teach thinking skills. In 2001, the mathematics curriculum was revised to reflect this emphasis. As a result, textbooks included a wider variety of problem-solving heuristics. There is also a conscious effort to teach problem solving explicitly. The focus, however, is on skills and techniques. In 2003, the Singapore Ministry of Education launched a follow-up initiative Innovation and Enterprise to encourage schools to help pupils develop good habits of mind.

In 2004, the Prime Minister asked, in his national day speech, schools to teach less so that pupils can learn more. The theme Teach Less, Learn More philosophy is encouraged in schools. Teachers are encouraged to help pupils master the basics well and to apply these basics in a wide range of situations rather than attempt to tell pupils everything. The Teach Less, learn More call underlines the Singapore Ministry of Education's effort to help pupils develop thinking skills and thinking habit. In 2005, the Ministry set as its aim to nurture every pupil. In line with this, all grade one class size was reduced to thirty (previously it is typical to have forty pupils in each class) and teachers are encouraged to use different strategies to help pupils develop in an effective and engaged manner. Presently, grade one and grade two teachers are using the SEED approach in their classrooms. SEED stands for strategies for effective engagement and development.

In 2007, the mathematic curriculum is revised to emphasize the recent initiatives. Specifically, teachers are encouraged to de-emphasize paper-and-pencil computation and to emphasize mental computation and skills like visualization.

Overall, the education system and the mathematics curriculum aim to help pupils develop competencies that are useful in a global, technological knowledge-based

economy. What are some good practices that contribute to the realization of this vision? How do teachers develop such good practices?

GOOD PRACTICES

In analysing the recent initiatives by the Singapore Ministry of Education, good practices in the mathematics classroom can be characterized as the following:

- Good practices provide pupils opportunities to develop competencies and attitude that put them in good stead in the global, technological economy.
- Good practices aims to develop good thinking by enhancing pupils' thinking skills and thinking habit.
- Good practices instil among pupils a belief that they are able to extend their own knowledge.
- Good practices engage pupils in the learning process.
- Good practice is effective as in *all* pupils develop key ideas in mathematics.

In a project involving five primary schools in Singapore, one part of the study aims to study how teachers can be engaged in developing innovative approaches and exemplify good practices. Briefly, the Think-Things-Through (T³) Project provides worksheets for teachers to use in their mathematics lessons. Teachers are encouraged to read notes for teachers provided by the research team and to discuss with each other before the implementation. The two sources for teacher development are (1) the worksheets and (2) the discussion. The worksheets are available at <http://math.nie.edu.sg/T3>

In traditional mathematics classrooms, teacher actions are limited to providing explanation. In good practices, teachers should be able to engage in a wider range of roles. Other than providing explanation, are teachers able to model certain way and habits of thinking? Are they able to guide pupils to think in a certain way? Are they able to provide the necessary materials and environment to create opportunities to engage in certain way of thinking? In brief, do teachers take on more roles in the learning process?

AN ILLUSTRATION

The lesson was for a grade three class. Pupils were supposed to for the letters I and T using sticks. Specifically, each letter I is formed using three sticks and the letter T using two sticks. Pupils were given 19 sticks and asked to find the number of Is and Ts that can be formed. Subsequently, the pupils played a game where they may use any of the observations that they have made in the first part of the lesson.

- Good practices aims to develop good thinking by enhancing pupils' thinking skills and thinking habit. Various parts of the lessons required pupils to make observations, make generalizations and extend their thinking.
- Good practices instil among pupils a belief that they are able to extend their own knowledge. Pupils were expected to use the ideas from the first part of the lesson to determine a winning strategy for the game.
- Good practices engage pupils in the learning process. Pupils were actively involved in solving the problem. They were given concrete materials to work with. As they were paired up, pupils were talking and discussing with each other.
- Good practice is effective as in *all* pupils develop key ideas in mathematics. The problem is accessible to every pupil. Every pupil in the class was able to achieve some degree of success in this activity. The use of sticks made the problem even more accessible. In the game, pupils were asked to observe generalization. The activity did not emphasize the computation aspects. Instead big ideas such as making generalization were given emphasis.

This lesson was designed by the teacher. Previously, she had conducted lessons prepared by the research team. The lesson that she designed and conducted had features that are similar to the lessons designed by the research team.

TEACHER-INNOVATOR MODEL

A teacher development model for good practices is proposed to investigate the extent of teacher development through activities such as lesson study. The model comprises four stages.

Level 0

Teachers at this level are indifferent to the stimulus provided. Such stimuli include the lessons designed by the research team and any discussion the teacher may have with his colleague. Other than the lessons designed by the research team, no change is detected in other lessons.

Level 1

Teachers at this level respond to the stimulus provided in a superficial manner. For example, the lessons they design are identical to those designed for them. Any modifications are superficial.

Level 2

Teachers at this level respond to the stimulus provided in a structural manner. For example, the lessons they design are structural modifications of the lessons designed for them.

Level 3

Teachers at this level have become innovators of good practices. They no longer modify lessons they receive from the research team. Instead, they design their own lessons.

Using this model, it may be possible for us to answer the questions to what extent do teachers develop such good practices. Subsequently, we may be able to study the conditions under which each level is achieved.