THIS SCHOOL-BASED INTERVENTION STUDY aims to provide research-based evidence and practical suggestions for promoting the effective use of new assessment strategies in Singapore’s mathematics classrooms. Focusing on four new assessment strategies—project assessment, performance assessment, student self-assessment, and communication assessment—the study involved classroom-based implementation over a period of 3 school semesters in 8 primary and 8 secondary schools. Overall, the qualitative data endorsed the view that the new assessment strategies were helpful in developing students’ skills in higher-order thinking, communication, self-regulation, and self-reflection in learning. The quantitative data suggested that most intervention classes performed better than, or as well as, comparison classes in both the cognitive and affective domains. Moreover, both the teachers and students had positive views about the value and feasibility of integrating these new assessment strategies into their daily teaching and learning activities.

INTRODUCTION
The Mathematics Assessment Project was a large research study carried out by the National Institute of Education (NIE) from 2004–2007. The main purpose of the study was to provide research-based

KEY IMPLICATIONS
• When implementing the new assessment strategies in the classroom, teachers should start with small steps and gradually move on so that the effort can be sustained and more achievable results can be obtained.
• New assessment strategies should be consistently integrated into the teaching and learning process, as an integral part of the curriculum and not added on.
• Relevant resources and professional development courses must be made available to teachers through different channels, including teacher training programmes.
The study aimed to answer the following three broad research questions:
1. What are the influences of new assessment strategies on students’ learning of mathematics in their cognitive domain?
2. What are the influences of new assessment strategies on students’ learning of mathematics in their affective domain?
3. How can new assessment strategies be effectively integrated into mathematics classrooms?

The study was undertaken collectively by a large research team that comprised faculty members and researchers from NIE, mathematics curriculum specialists from the Ministry of Education, and teachers from the participating schools.

RESEARCH DESIGN

In this study, assessment was defined as the process of teachers gathering information about students’ learning, including their achievement and behaviour in both the cognitive and affective domains, thus enabling teachers to make informed decisions for classroom instruction. This was consistent with the assessment standards defined by the National Council of Teachers of Mathematics (1995).

The study focused on four new assessment strategies: project assessment, performance assessment, student self-assessment, and communication assessment.

- **Project assessment** refers to the assessment practice whereby the teacher gathers information about the students’ learning through their work on project tasks.
- **Performance assessment** refers to the assessment practice whereby information about students’ learning is gathered through students’ performance on communication tasks, including mainly journal writing and oral presentations.

This study focused on these four relatively new strategies as they are more clearly defined among the community of mathematics educators and practitioners. The strategies also have more practical importance and relevance to Singapore’s educational system (e.g., see Clarke, 1997; Kulm, 1994; Pearce, & Davison, 1988; Pugalee, 2001; Quek & Fan, 2009; Zehavi, Bruckheimer, & Ben-Zvi, 1988).

The study involved classroom-based intervention over a period of 3 school semesters in 31 classes— in 8 primary schools at the Primary 3 and 4 levels, and 8 secondary schools at the Secondary 1 and 2 levels. The sample included both high- and low-performing schools.

Comparison classes from the same school, stream, and grade were selected and the same textbooks were used whenever possible. This provided a benchmark to better discern the influence of the use of new assessment strategies in the intervention classes.

A number of instruments were designed for the project. The quantitative data were mainly collected through survey questionnaires, pre- and post-tests, and school-based examination scores; and qualitative data through classroom observations, video-recordings, and interviews with teachers and students.

KEY FINDINGS

Overall, both the teachers and students had very positive views about the value and feasibility of integrating these new assessment strategies into their daily teaching and learning activities.

As a whole, the qualitative data indicated that the new assessment tasks were helpful in developing students’ skills in higher-order thinking, communication, self-regulation, and self-reflection in learning. The quantitative data also showed that most intervention classes performed better than or as well as comparison classes in both the cognitive and affective domains.

In particular, performance assessment appeared to be the most effective among the four assessment strategies. The results show that all the classes using
this strategy performed significantly better than or as well as their comparison classes (see Fan et al., 2008 for details).

Both the participating teachers and students found the use of new strategies challenging at the start. They needed time to become familiar with the concept, value, methods, and skills of these new assessment strategies. However, given adequate time and help, both the teachers and students were capable of working on the new assessment strategies.

Due to the complexity of factors that might affect students’ academic achievements, the researchers think that further study, particularly with an experiment-based methodology, is needed to investigate the impact of the intervention on students’ performance in regular school examinations. However, based on data collected in this study, it is believed that the use of the new assessment strategies will not adversely affect students in their learning of mathematics, as measured by their performance in regular school examinations.

**IMPLICATIONS**

*For Practice*

In the process of implementing new assessment tasks, teachers must make their expectations of both the process and end-product clear to the students at the beginning. They also need to give enough guidance and help on students’ work, and offer timely feedback at the final stage, so that the assessment can be more effective.

In practice, the appropriate use of new assessment tasks (e.g., open-ended and authentic tasks, project and investigative tasks) is recommended, first as part of students’ continual assessment, and with more experience, as part of their semestral assessment.

School teachers, especially for those who are relatively new to these assessment strategies, should start with small steps and gradually move on. For example, they can give guided and less challenging project tasks at the beginning, so that the effort can be sustained and more achievable results can be obtained.

*For Policy*

For educational administrators and policy makers, it is important to create a school environment and culture that supports the use of new assessment strategies. It should be kept in mind that the effects of using new assessment tasks on student learning might not be readily reflected in the regular semestral examinations. In a sense, the new assessment strategies are for better teaching and learning, not for traditional testing.

New assessment strategies should be consistently integrated into the teaching and learning process. In particular, the new strategies should replace some of the traditional and less important tasks; they should be an integral part of, but not add on to, the mathematics curriculum and classroom instruction. To reach this goal, policy makers, curriculum developers, school administrators, and classroom teachers need to share a common vision about the value of these forms of assessment and make a concerted and sustained effort.

*For Teacher Training*

It is recommended that basic new assessment concepts and strategies be introduced to prospective teachers in their pre-service training programmes. There is also a need to provide relevant professional development courses to in-service teachers.

The most challenging work in this study was to design the intervention tasks and assessment criteria or rubrics. Currently, the resources available for local teachers and students are inadequate (see Fan & Zhu, 2007). Therefore, relevant resources must be provided and made available to teachers through different channels.

**REFERENCES**


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