



Chapter 3

Integration of Information Technology into Teaching: The Complexity and Challenges of Implementation of Curricular Changes in Singapore

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INTRODUCTION

Singapore schools have been undergoing radical educational reforms to meet the challenges of the 21st century. Spurred by the globalization of economic and cultural activities and the rapid advancement of knowledge and technology, the challenges have been characterized by the Director-General of Education in the Ministry of Education (MOE) as follows:

- A faster pace of life is straining the fabric of society and eroding traditional values like respect for our elders and teachers;
- Economic competition is becoming more intense, and Singapore must continue to remain a few steps ahead of our competitors;
- Singaporeans need to develop a global outlook, and yet remain rooted and committed to Singapore. (Wee, 1997, p. 1)

To prepare the younger generation of Singaporeans to meet the challenges, the MOE is implementing three major initiatives in the schools. One is the introduction of National Education, which intends to cultivate in students a sense of national cohesion, an instinct for survival and confidence in the future. Another is the systematic introduction of information technology (IT) into the curriculum as represented in the Masterplan for IT in Education (IT-masterplan). The third is the concept of thinking schools that emphasizes the introduction of creativity and critical thinking skills into the curriculum. These initiatives are underpinned by related innovations, like reduction in

curriculum content, the introduction of project work, and changes in school-based assessment and in the examination system, as well as such systemic changes as the introduction of cluster schools, moves towards self-appraisal of schools, and modifications to teacher preparation and teacher development.

The curriculum has been used as the key agent in implementing these initiatives in the belief that "the curriculum is the medium through which most initiatives in teaching and learning take effect" (Wee, 1997, p. 2). The above three initiatives have been brought together in a comprehensive Curriculum Review Masterplan in which the following curricular changes have been proposed:

- Reduction of content in each subject, with emphasis on broad-based learning at the earlier stages and greater depth and specialization at the higher stages of education;
- Emphasis on the joy of learning and development of habits of continual learning;
- Development of skills for higher order thinking, effective communication and teamwork at all levels; and
- Incorporation of National Education themes and the use of IT in the curriculum. (Wee, 1997, p. 2)

As teachers are believed to be the key to the reforms, professional development for teachers has been declared as being extremely crucial to successfully carrying out the three initiatives (Tan, 1998; Teo, 1998a; Wee, 1997). The MOE has sought to introduce teacher professionalism by providing a 100-hours-a-year training entitlement for all teachers. All teachers are to be trained in the use of IT, the infusion of thinking skills into teaching, and the implementation of National Education. Another innovative approach to teachers' professional development created by the MOE is the Teachers' Network that aims at enhancing the collegiality of teachers in learning new ideas and trying out new teaching approaches (Teo, 1998b). The National Institute of Education (NIE) in response has already embarked on major curricular changes to all the initial teacher education programs, and revamped the training programs for potential principals and heads of department (Tan,

1998).

The authors are interested in understanding what challenges and difficulties teachers will have to face as they implement these mandated curricular changes, and what innovative approaches to teachers' professional development would support the implementation process. In this chapter, the authors focus the discussion on the curricular changes embedded in the IT-masterplan initiative, which is very crucial for Singapore's efforts to achieve thinking schools.

Drawing on the scholarly literature, the authors will first introduce the enactment perspective on implementation which emphasizes the role of a teacher as interpreter and enactor for curricular changes (Snyder, Bolin, & Zumwalt, 1992), and the proposition that implementation of curricular changes entails changes in instructional resources, in teaching practices, and in teaching beliefs. Next, there will be an elucidation of the complexity and challenges of implementation of curricular changes through scrutinizing two implementation cases - namely, the Mathematics Reform in California and the Project-based Instruction in Michigan - from the enactment perspective, in the light of the proposition. The objective is to identify important lessons for the implementation of curricular changes in Singapore. Further, there will be analysis of the difficulties and challenges Singapore's teachers are likely to encounter as they implement the curricular changes pertaining to integration of IT into teaching. Finally, recommendations on teachers' professional development are formulated, which will, in the opinion of the authors, increase the likelihood of success.

The authors believe that the discussion is a crucial and timely one. Fullan and Stiegelbauer (1991) observed that one of the basic reasons why so many innovations have failed is that implementation tasks have been underestimated or misunderstood. According to Cuban (1986), there has been a history of failed attempts to introduce "new" technology into schools; one reason is the failure of reformers to think through all the challenges teachers have to face in successfully introducing a new technology into their teaching. The major thesis of this chapter is that the proposed changes pose significant challenges to teachers in terms of new teaching beliefs, new teaching approaches, and new instructional resources and technology. Therefore, providing opportunities and resources for teachers to learn what they need to know in the light of the complexity and challenges and engaging them in such learning are crucial to

effective implementation. By appropriately acknowledging the complexity and challenges of implementing the curricular changes, as well as learning some lessons drawn from the experiences of the implementation effort in California and Michigan, the participants will be in a better position to understand what will be needed for the effective implementation of curricular changes in Singapore.

THE ENACTMENT PERSPECTIVE AND THE COMPLEXITY OF IMPLEMENTATION

According to the enactment perspective, while other factors (e.g., curricular materials, school/state policies, parental expectations, and students' characteristics) can affect implementation, teachers are the key players in the implementation of curricular changes. The role of teacher is one of initiator, of interpreter, and of enactor (Snyder et al., 1992). This perspective seems to fit well with the belief in Singapore that the teacher is the key to successful reform.

The proposition adopted for the analysis is that implementation of curricular changes entails changes in instructional resources, in teaching practices, and in teaching beliefs or assumptions (Fullan & Stiegelbauer, 1991). This proposition implies that the implementation of curricular changes is multidimensional. An individual teacher may implement changes in one, two, or all three dimensions. A teacher could adopt the new instructional resources without changing his or her teaching practices, or a teacher could use the new instructional resources and alter some teaching behavior without grasping the assumptions underlying the curricular changes. It is also possible for a teacher to value and even articulate the assumptions without grasping their implications for his or her teaching practices. Fullan and Stiegelbauer (1991) points out that all three aspects or dimensions are necessary for achieving fundamental change because together they represent the means of accomplishing a particular set of goals.

To illustrate the complexity of implementation of curricular changes, two cases - Mathematics Reform in California and Project-based Instruction in Michigan - are to be examined here. These two cases are chosen because they are "good" examples available in the recent literature - relatively well documented through a series of case studies - that capture the complexity and challenges of implementation of curricular changes from the enactment

perspective. While originally written as documentation about educational reform or innovation in the United States, they provide ideas and suggestions that seem more generally useful to the implementation of curricular changes, regardless of any given cultural context. As the following discussion will make clear, the lessons identified from these two cases - concerning the difficulty of changing teaching practices, the need for changes in all three dimensions, and the crucial role of teachers' professional development - are extremely useful for the task of implementing curricular changes in Singapore.

MATHEMATICS REFORM IN CALIFORNIA

The Californian attempt at mathematics reform began when the State Education Department issued in 1985 a new Mathematics (Curriculum) Framework, which called for more intellectually challenging instruction, for more mathematically engaging learning activities, and for teachers to help students develop conceptual understanding and higher-order thinking in mathematics. Educational reformers first used the Framework to press textbook publishers to revise the content and pedagogical suggestions in their books, and encouraged the development of new curriculum materials. The reformers then launched a major revision of students' achievement testing programs so that they were aligned with the Framework. The Framework, new textbooks and instructional materials, and new testing programs, all of which constitute the first dimension of changes, were expected to steer teachers toward new forms of teaching practices (Cohen & Ball, 1990a, 1990b).

The second dimension of changes is teaching practices. The Framework envisioned a new kind of teaching practice, namely "teaching for understanding," which was seen as departing radically from conventional teaching practices. In teaching for understanding, the central role of teachers is to select materials and create meaningful activities that can engage students to think and to stimulate them to move beyond the acquisition of facts - to "sense making" in mathematics. Teachers are to function as guides, coaches, and facilitators of learning through posing questions, challenging learners' thinking, and guiding them in examining mathematical ideas and relationships; students in turn function as explorers, constructors, and communicators of their own learning (McLaughlin & Talbert, 1993). As a contrast, teachers in conventional practice virtually monopolize the entire instructional process, telling and showing students how to execute particular procedures or solve problems; students are noted as learning mathematics through repetition, drill,



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