<table>
<thead>
<tr>
<th>Title</th>
<th>The IT-Masterplan and <em>Thinking Schools</em> initiatives: The complexity and challenges of curriculum implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Author(s)</td>
<td>Deng, Zongyi and S. Gopinathan</td>
</tr>
<tr>
<td>Source</td>
<td><em>ERA Conference, Singapore, 23-25 November 1998</em></td>
</tr>
<tr>
<td>Organised by</td>
<td>Educational Research Association of Singapore (ERAS)</td>
</tr>
</tbody>
</table>

This document may be used for private study or research purpose only. This document or any part of it may not be duplicated and/or distributed without permission of the copyright owner.

The Singapore Copyright Act applies to the use of this document.
The IT-Masterplan and Thinking Schools Initiatives: The Complexity and Challenges of Curriculum Implementation

Deng, Zongyi & S. Gopinathan
School of Education
National Institute of Education
Nanyang Technological University

Introduction

Singapore schools have been undergoing very radical educational reforms to meet the challenges of new economic and social changes, particularly globalisation. To prepare the younger generation of Singaporeans to meet the challenges, three major initiatives have been undertaken. The first one is the introduction of National Education that intends to cultivate the sense of national cohesion, the instinct for survival and confidence in the future. The second one is the systematic introduction of information technology (IT) in education as represented in the IT Masterplan, aiming at creating an IT-based learning environment in every school. The third one is the concept of thinking schools, which emphasises the introduction of creativity and thinking skills in teaching.

Curriculum has been used as a key agent for these initiatives. The above three initiatives have been brought together in a comprehensive Curriculum Review Masterplan according to which the curriculum needs to be made the following changes:

- Reduction of content with emphasis on broad-base learning at the earlier stages and greater depth and specialisation at the higher stages.
- Emphasis of 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.
- Incorporation of National Education themes and the use of IT in the curriculum (See Wee, Dec 1997; MOE, Mar 1998).

The teacher is believed to be the key to the reforms. And professional development for teachers is believed to be extremely crucial to carrying out the three initiatives successfully.

We are interested in understanding what it would take for teachers to succeed in implementing the curricular changes and what innovative teachers’ professional development approaches would support successful implementation. In this article we focus our discussion on the curricular changes embedded in two initiatives—the IT Masterplan and the concept of thinking schools—which should not be seen as two single and isolated measures.

Drawing on the scholarly literature we will first present two propositions that capture the complexity of the implementation of curricular changes from the enactment perspective—the perspective that emphasises the role of a teacher as the one of an interpreter and of an enactor for curricular changes (See Snyder, Bilon, & Zumwalt, 1992). We will next elucidate the complexity through scrutinising the experience of curriculum implementation in the California Mathematics Reform in the light of the two propositions. We hope thereby to identify important lessons for the implementation of curricular changes in Singapore. Thirdly, we will analyse the difficulties and challenges Singapore’s teachers would encounter in implementing the curricular changes embedded in the two initiatives. We will finally formulate recommendations on teachers’ professional development that will, as we believe, increase the likelihood of success.
A major thesis of this article is that the implementation poses significant challenges to teachers in terms of new teaching beliefs, new teaching practices, and new instructional resources and technology. Accordingly, we believe that providing opportunities and resources for teachers to learn what they need to know and engaging them in such learning are crucial to effective implementation. By appropriately acknowledging the complexities and challenges of implementing the curricular changes as well as learning some lessons drawn from the mathematics reform effort in California, we are in a better position to formulate recommendations for effective curricular change implementation to bring about the success of the two initiatives.

Implementation of Curricular Changes: The Enactment Perspective

According to the enactment perspective, while outside factors (e.g., curricular materials, school/state policies, parental expectations, and students' characteristics) could affect implementation, teachers are the key players in implementation of curricular changes. The externally created instructional materials and programmes are seen as tools for teachers to use as they implement reform ideas (Snyder, Bilon, & Zumwalt, 1992). We adopt two propositions for our analysis:

1. Implementation of curricular changes may result in change in instructional resources, in teaching practice, and in teaching beliefs or assumptions (Fullan 1991).

2. Rather than simply adopt curricular changes, teachers would interpret and thus enact curricular changes in light of their inherited teaching practice, and beliefs or assumptions (Snyder, Bolin, & Zumwalt, 1992).

In what follow we illustrate these complexities of implementation of curricular changes through analysing the experience of implementation in reform of mathematics curriculum in California.

The Mathematics Reform in California: The Challenges of Implementation of Curricular Changes

In 1985 the California State Education Department initiated a very ambitious effort to improve teaching and learning of school mathematics when it issued a new Mathematics (Curriculum) Framework. 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. Then reformers 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 were expected to steer teaching toward the new form of teaching practice (Cohen & Ball, 1990a & b). How California elementary teachers implemented the curricular changes has been documented by US researchers through a series of case studies (Cohen & Ball, 1990a & b; Cohen, 1990; Wiemers, 1990).

The curriculum framework 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. The Framework envisioned a new vision of teaching practice, namely "teaching for understanding," which departs radically from conventional teaching practice. In teaching for understanding the central role of teachers is to select materials and create meaningful activities that can engage students to think and stimulate them to move beyond acquisition of facts to "sense making" in math. Teachers function as guides, coaches, and facilitators of learning through posing questions, challenging learners' thinking, and guiding them in examining mathematical ideas and relationships; students function
as explorers, constructors, and communicators of their own learning (McLaughlin & Talbert, 1993). However, in conventional practice teachers virtually monopolise the entire instruction, telling and showing students how to do particular procedures or problems. Teaching emphasises rules, procedures, and memorisation. Students learn mathematics through repetition, drill and practices. They rarely have chances to confront challenging mathematical problems, and to reason and communicate about mathematical ideas. (Cohen & Ball, 1990b).

Underlying this new vision of teaching practice are constructivist assumptions about knowledge, learning and teaching, which represent a radical departure from those embedded in conventional practice. In teaching for understanding knowledge is perceived as a human construction that is emergent, contestable, and subject to revision. Learning is seen as the active process of learners' constructing and reconstructing knowledge. And teaching is viewed as the process of guiding and facilitating learners in their process of constructing knowledge, and of helping learners learn how to construct knowledge plausibly and sensibly (Cohen, 1988). In conventional practice, on the contrary, knowledge is regarded as something being discovered and handed down from authorities, not constructed, and non-contestable. Learning is defined in terms of listening, watching, practising, and memorising. Accordingly, teaching is primarily viewed in terms of telling, showing, and explaining (Cohen, 1988).

Therefore, if teachers are to fully implement the curricular changes, they need to undergo changes not only in the use of instructional materials, but also in their ways of conducting classroom practices, and in their understanding about the nature of knowledge, how learning occurs and how teaching should be conducted. This indeed is a manifestation of the multidimensionality of implementation of curricular change as represented in above Proposition 1.

The documentation of how teachers implemented the curricular changes in the California mathematics reform revealed tremendous difficulty of changing teaching practice, and it highlighted the crucial role of teachers' inherited beliefs and practice in the implementation process. While the curricular changes were adopted in classrooms, teachers made use of them in a variety of ways, most of which indicated no fundamental change at all:

One thread in the cases is that teachers have responded to policy [represented by the instructional framework and revised textbooks] in quite varied ways: Some have made what they see as major changes, while others have changed little or not at all. Another thread is that the changes we saw depended partly on what we looked for. Had we attended only to the forms of instructional discourse—asking whether these were traditional lecture, recitation, and seatwork classes—we probably would have concluded that little was new, and that policy had not much affected instruction. (Cohen & Ball, 1990a, p. 237)

Furthermore, the documentation revealed what is captured in the above proposition 2. That is, teachers don't simply adopt or assimilate curricular change; rather, they interpret—and thus enact—curricular changes in terms of their inherited beliefs, knowledge, and practice. Cohen & Ball (1990b) observed,

"...Teachers do not simply assimilate new texts and curriculum guides, altering their practice in response to externally envisioned principles. Rather, they apprehend and enact new instructional policies in light of inherited knowledge, beliefs, and practice. Moreover, teachers' interpretations are diverse. Some...missed the new framework's message; they thought they already did everything that the new policy exhorted them to do. Others changed their teaching, but in doing so reframed the new policy in terms of various preexisting ideas and practices. (p. 335)"
Cohen & Ball (1990b) attributed these "mixed" and "confusing" effects of implementation of curricular changes to the lack of opportunities and resources for teachers' professional development that could support the curricular changes. They explained:

California has launched a reform of great ambition and noble purpose, but its demands are imposing. So far teachers have been asked to make great changes, but they have not been offered many of the resources that might support such change. Few teachers have had the opportunities to see the examples of this sort of teaching that the state thinks it wants. Few have been given opportunities to cultivate a new sort of teaching practice, and even fewer have been offered assistance in the endeavour. In a word, teachers have not yet to be engaged in the sort of conversation—with themselves, with other teachers, with university mathematicians, and many others—that would support their efforts to learn a new mathematics, and a new mathematical pedagogy (p. 336).

In short, three lessons can be identified from the experience of implementation of curricular changes in California mathematics reform. The first one concerns with the great difficulty of changing teaching practices through implementation of curricular changes. The second one testifies the critical role of teachers' inherited practice and beliefs or assumptions in implementation of curricular changes, and the need of transforming teachers' inherited beliefs and practices. The third one suggests that teachers' professional development is the key to successful implementation.

The IT-Masterplan and Thinking School Initiatives: The Challenges of Implementation of Curricular Changes

Now we analyse what it might take for teachers to succeed in implementing the curricular changes embedded in the IT-Masterplan and Thinking Schools initiatives. We will show that Singapore teachers have to face perhaps even greater challenges than the teachers in California mathematics reform.

New instructional resources and technology. The IT-Masterplan has created high expectations of teachers' competencies in their use of information technology in teaching and learning. Teachers need to demonstrate a wide range of IT skills, such as desktop publishing, spreadsheet and date-base construction, information searching and compiling of on-line resources. In addition, they need to demonstrate the ability to use a wide range of software, media clips, web pages, and school-wide networks for instructional purposes. Furthermore, they need to have the ability to select, evaluate, and adapt available software to their instructional needs, as well as the ability to discern active from passive use of educational software (MOE, Mar 1997). All these are new skills and new abilities for most Singapore teachers—especially the older ones—who currently are mainly competent in using chalkboard and overhead projectors.

New teaching practices. Embedded in the IT-Masterplan and Thinking Schools initiatives is a vision of teaching practice that poses significantly new demands on teachers. First of all, teachers and students are expected to gain access to a wide range of educational resources, and communicate knowledge within and beyond the local community, using IT as information and communication tools:

Teachers and pupils will tap into a growing wealth of educational resources outside the school. They will also communicate and collaborate with other educational institutions, local and foreign, and the community at large (MOE, Mar 1997).
Secondly, teachers are expected to encourage students’ independent learning, critical and creative thinking, using IT as cognitive tools:

Pupils will develop competencies in accessing, analysing and applying information, and develop habits of independent learning. IT-based learning strategies will also seek to develop pupils’ ability to think innovatively, to cooperate with one another and to make sound value judgements (MOE, Mar 1997)

Thirdly, teachers need to become role models of learners themselves, and be adaptable, innovative, and creative in developing IT-based teaching approaches:

... Our teachers will need to go beyond their traditional roles of information-giver and even facilitator, and be positive role models of learners themselves—continually reflecting on their own practices, sharing good ideas and seeking out best practices, constantly challenging themselves to find better ways of approaching a task or solving a problem. We cannot hope to produce or inspire a new generation of adaptable, innovative and creative students if we do not have adaptable, innovative and creative teachers and schools (Teo, 24 Jan, 1998).

This new vision of practice and new roles of a teacher depart radically from the conventional teaching practice and the traditional roles of teachers in Singapore schools. The kind of teaching practice widely prevailed in Singapore school tends to be examination oriented with an emphasis on the acquisition of content from a singular source of knowledge (i.e., textbooks). In most classrooms, teachers transmit knowledge and skills to students through didactic telling and explaining, and students absorb knowledge and skills through passive listening, watching, drilling and practising (See Koh, 1994; Khoo & Ng, 1985).

Therefore, to learn to teach in the reformed ways, teachers must make fundamental changes in their teaching practices and roles. Teachers will find making such major changes very difficult. Conventional practice usually resists change. Teaching practice in Singapore has been remarkably stable at all levels of schooling through the many decades, in spite of many curricular changes (Toh, 1994). Cuban (1993) observed that despite many reform efforts in the US which aimed at changing teaching toward more engaging and student-centred, classroom teaching has largely remained unchanged. Breaking away from traditional practice and adapting a form of new practice and new roles would create tremendous challenges to teachers. Teachers would have to take more risks and become more uncertain; the uncertainties and risks multiply, as does teachers’ vulnerability (Lampert, 1988; Cuban, 1993).

New teaching beliefs or assumptions. Teachers’ pedagogical practices are informed by distinctive and particular beliefs or assumptions about knowledge, how learning occurs, and how teaching should be conducted (Cohen, 1988). In conventional practice Singapore teachers tend to view knowledge as a body of facts and concepts of a given subject contained in school textbooks upon which students are tested during examinations. Accordingly, they are inclined to describe teaching in terms of giving out or imparting knowledge in school textbooks, and learning in terms of acquiring, assimilating, and practising this knowledge (See Toh, 1994).

Underlying the new vision of teaching practice are new assumptions and beliefs about knowledge, teaching and learning. Implementation of the major curricular changes signals a sea change in teachers’ inherited beliefs or assumptions. Teachers need to recognise that knowledge is available from a variety of sources, and is subject to renewal and revision. They need to rediscover knowledge as something that is constructed and contestable, rather than handed down by authorities. They need to realise that students learn the best—in terms of conceptual understanding, critical and creative thinking—when they are actively engaged in search for information, solving problems, questioning, sharing and communicating their understanding. They need to re-
conceptualise the role of a teacher as the one of a co-learner, the one of a learning guide or a facilitator, and the one of an innovator. Furthermore, teachers need to learn to conceive fully the multiple role played by IT in the process of teaching and learning—that is, the role of information tools, of communication tools, and of cognitive tools.

Therefore, to propose that teachers shift from conventional practice to the new form of practice embedded in the IT-Masterplan and Thinking Schools initiatives is necessarily a proposal that they fundamentally transform their beliefs about the nature of knowledge, and teaching and learning. Yet such changes in teachers’ beliefs or assumptions are extremely difficult because they often challenge the core value held by individual teachers (Pullan, 1991). They would have to allow their core values regarding what knowledge is and their roles as teachers to be questioned and challenged (Cohen & Barnes, 1993). Such changes entail a revolution in belief system. Many scholars argue that a revolution in human belief system is very difficult to achieve (e.g. Nisbett & Ross, 1980; Kuhn, 1970).

In Short, the IT-Masterplan and Thinking Schools initiatives are to intend to lead teachers toward a new paradigm which is constituted by three essential components—new instructional technology, new teaching practice, and new teaching beliefs—and which is fundamentally incompatible with the existing one. Implementation of the curricular changes that aims at achieving this paradigm shift poses tremendous challenges to teachers, in terms of new instructional resources and technology, new teaching practices, and new teaching beliefs or assumptions.

**Toward a New Paradigm of Teachers’ Professional Development**

As revealed from the above analysis, the two initiatives have established new and demanding expectations for teachers that most of them have not been adequately prepared for. To implement the proposed curricular changes, teachers will have to undergo significant changes in their use of instructional resources, especially instructional technology, in their beliefs or assumptions, and in their classroom practices. Therefore, providing opportunities and resources for teachers to learn what they need to know and engaging them in such learning are crucial to the implementation.

What do we know of professional development programmes for teachers that are essential to successful implementation? Conventional models of teachers’ professional development—focused on either expanding teachers’ repertoire of classroom approaches, or assimilating new instructional resource and techniques into their existing patterns of practice, useful as they are—are not adequate to preparing teachers to implement radical educational reforms which entail substantial changes in teachers’ beliefs and practices (Little, 1993; Darling-Hammond & McLaughlin, 1996). The implementation of curricular changes embedded in the IT-Masterplan and Thinking School initiatives requires not only that teachers master new instructional resource and techniques but also, more importantly, that they re-conceptualise and thus reinvent their teaching practices through allowing their personal beliefs to be questioned, challenged, and transformed. Realising the curricular changes thus demands a paradigm shift in approaches to teachers’ professional development.

The Ministry of Education (MOE) has embarked on implementing two innovative approaches to teachers’ professional development, namely the Comprehensive In-service Training Programme and the Teachers’ Network. The in-service programme is aimed at training all teachers in the use of IT and the infusion of thinking skills to achieve curricular objectives. The Teachers’ Network is an innovative attempt to provide a place and a forum for teachers to continually share and learn about new development and best practices. One thing seems to be
missing, however, is a clear sense of what the reformed teaching embedded in the two initiatives is like and what teachers would have to know, believe, and do in order to carry it off.

Therefore, it is very necessary to develop a new and comprehensive paradigm of teachers' professional development that takes into account the challenges of implementing major curricular changes, and a practical vision of new instructional practice. While a full articulation of this paradigm is outside the purposes and scope of this article, in what follows we present two recommendations that we believe to be crucial to the articulation of such a paradigm. We will discuss it more fully in another paper that is being developed (Deng & Gopinathan, 1999).

First, the new paradigm should be grounded in a sound understanding of what the vision of new teaching practice is and what it would take for teachers to implement the curricular changes. Without such an understanding, debates on professional development for teachers would remain centred on low-level concerns primarily involving skills or strategies for using IT and teaching thinking.

Implementation of the major curricular changes thus requires serious attention to research that can enhance our understanding of the complexity and challenges of the implementation process. The analysis presented here only represents an initial attempt to think through the implications of the reforms for teaching practice, for what teachers need to know and to able to do in order to change their practices and fulfil new roles. More comprehensive and in-depth investigation is necessary. More specifically, there is a need for documentation of how teachers undergo the process of changing their practice and roles as they implement the curricular changes, in the form of written case studies or videotapes. These can offer examples that communicate the reform vision in a more concrete manner, that suggest what might be possible, and from which teachers might learn (McDiarmid, 1995).

Second, the new paradigm should take into account the complex demands of implementing the curricular changes as well as the complex contexts of teaching and schooling. It is important to acknowledge that the contexts of teaching and schooling in Singapore would create further challenges to the implementation. The implementation of curricular changes is embedded in "multiple layers of context" (i.e., students, departments, school organisation and system, parent community and culture, and assessment/examination system), each of which has the capacity to shape what teachers should teach and how they should teach it (Talbert & McLaughlin, 1993). Drawing on the scholarly literature that analyses the needs and modes of teachers’ professional development in the context of educational reforms, we put forth a set of new propositions that seem to us to be crucial to the successful implementation of the curricular changes. We hope this set of propositions will stimulate us to rethink and redesign the current approaches to teachers’ professional development in carrying out the IT-Masterplan and Thinking Schools initiatives.

- Teachers need to have opportunities to understand the assumptions underlying the two initiatives and figure out the implications for new practice. (Little, 1993; McDiarmid, 1995).
- Teachers need opportunities to re-examine their beliefs or assumptions and teaching practice. (Nelson & Hammerman, 1996).
- Teachers need to be a part of a larger community. They need opportunities to interact with colleagues, both in and out of the school. (Little, 1993; McDiarmid, 1995; Darling-Hammond & McLaughlin, 1996).
- Teachers need opportunities to experience learning in ways consistent with the two initiatives, and to observe teaching in accord with the new direction. (McDiarmid, 1995).
• Teachers need the support and advice of a principal or a head of department who understands the demands reform places on teachers and what it takes to change teachers' roles and practice (McDiarmid, 1995).

• Teachers need a new culture of teaching that would encourage reflection, experimentation, innovation, on-going learning, uncertainty, in which creativity and innovation are encouraged for everyone—teachers, students, and principals (Talbert & McLaughlin, 1993; Lieberman, 1996).

• Support for professional development must be sustained and long term (McDiarmid, 1995).

Finally, it is necessary to keep in mind that this article only discusses the importance of innovative professional development for teachers in implementation of the curricular changes. Indeed, innovative professional development should be provided for the full range of educational professionals, including school principals, heads of department, teacher trainers, and educational headquarters staff. Furthermore, reform in professional development alone is not sufficient because successful implementation requires simultaneous systematic innovations in all aspects of education. Reform in professional development must act together, not in isolation, with other innovations and development.

References


