

The Metamorphosis of the 'Virtuoso':  
Pedagogic Patterns  
in Hong Kong Primary Mathematics Classrooms

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# The Metamorphosis of the Virtuoso': Pedagogic Patterns in Hong Kong Primary Mathematics Classrooms <sup>(1)</sup>

## Abstract

Classrooms in the East Asian region are primarily portrayed as teacher-centred, with a tense atmosphere stressing mechanical or rote learning. Using data derived from a project that evaluated the impact of a major curriculum reform in Hong Kong this paper argues that these descriptions fail to capture many salient features of pedagogy. A total of 122 Primary One mathematics lessons were observed in twelve schools over a three-year period from 1995 to 1998. Analysis indicated that although whole-class instruction was still the dominant mode of pedagogy, the role of the teacher as a virtuoso performing to a whole class was being modified.

Keywords: curriculum reform, Hong Kong, mathematics, pedagogy, teacher role

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# The Metamorphosis of the 'Virtuoso': Pedagogic Patterns in Hong Kong Primary Mathematics Classrooms

## Introduction

Under the influence of the views of valid pedagogy prevailing in the west, curriculum reforms in Hong Kong have attempted to shift the dominant pedagogy to one which is characterised as pupil-centred, using group-based learning and a variety of resources. The most recent example is the Target Oriented Curriculum (TOC) which was introduced by the Hong Kong Government in the early 1990s. At the policy level, TOC portrayed its purpose as an attempt to shift teaching and learning away from a behaviourist approach towards one based on a social constructivist (Vygotskian) perspective on learning. Classroom processes in the former were portrayed as teacher-centred and rote oriented with textbooks providing the major source of knowledge.

The paper draws on quantitative and qualitative data in an attempt to describe the features of mathematics lessons in primary schools in Hong Kong which have adopted the Target Oriented Curriculum. The quantitative analysis provides an indication of the patterns of interaction across a large sample of lessons, whilst two illustrative lessons are used to provide a more substantive portrayal of the structure of lessons.

## Portrayals of Asian Classrooms

Classroom teaching in the East Asian region has predominantly been described in terms of a whole-class instructional style. For example, Stevenson and Lee (1997) note that the typical American view of East Asian education fifty years ago was that of a stern, demanding teacher who stressed mechanical learning and rote memory. Many recent analyses have painted a similar picture, but increasingly there are attempts to identify the subtle variations within whole-class – teacher-centred pedagogies. For example, recent portrayals by Paine (1990), Leung (1995) and Stevenson and Lee (1997) have recognised the variations between the whole-class pedagogies used in different countries such as Japan, China and Hong Kong. Moreover, following the successful performance in Science and Mathematics achievement in Asian countries reported in the IEA studies, there is a trend to advocate whole-class

interactive teaching in Britain and other Western countries (Reynolds and Farrell 1996). Ironically there are movements in the opposite direction in many Asian countries as they promote alternative teaching models designed to improve critical thinking and individual creativity (Cortazzi, 1998).

The prevalence of a whole-class instructional style has frequently been reported in Hong Kong. For example, the 1982 Llewellyn Committee commented that:

The lessons we observed tended to be teacher-centred, with little use of aids beyond chalk and blackboard. In 'non-exam' years, the atmosphere seemed fairly relaxed, but in the examination preparatory forms all was deadly earnest and pupils were seen taking notes, laboriously completing model answers and learning texts by rote. (Visiting Panel, 1982; Morris, 1995, p. 112.)

More recent work by Leung (1995) focuses on the secondary mathematics classrooms and highlights the differences between both Asian and Western classrooms and between classrooms in Hong Kong and Beijing. Classroom observations in Beijing, Hong Kong and London indicated that whole-class instruction was much more common in both Beijing and Hong Kong than in London, where the students spent more time in seat-work (or individual work) than those in Beijing and in Hong Kong. The seat-work in Beijing and Hong Kong was essentially practising skills just learned from the teacher, whereas students in London were allowed to move on at a different pace in following either non-individualised or individualised programmes. As far as whole-class instruction was concerned, Hong Kong teachers used more time than those in Beijing and London in reviewing previous work every lesson, usually at the beginning of the lesson. Further, Hong Kong teachers used most of the teacher-talk time for demonstrating solutions to mathematics problems and usually appeared to be rushing through the subject content. A salient similarity in Beijing and Hong Kong is that "teaching was predominantly done with the teacher expounding mathematical content in front of the whole class of pupils, and during classwork time, pupils were to practise the skills just learned" (p. 314). Leung also argues that Chinese teachers held a more rigid view of mathematics as a product rather than a process and perceived their most important role as to expound the mathematics content clearly.

Paine (1990) describes teachers of Chinese (in normal colleges, elementary and secondary schools) in China in terms of the 'virtuoso model' in which the role of the teacher is mainly demonstrating and pupils are expected to follow the teacher's model. The central aim of teaching in the 'virtuoso model' is to provide knowledge and the similarities between

classrooms are salient. Typically they are arranged with a podium at the front. Textbooks are seen as the source of knowledge and the teacher is the presenter. The mode of delivery is direct, whole-class instruction using a lecture and explanatory format. Interaction between individual pupils and the teacher generally takes the form of explication of text upon the teacher's request. Teachers' questions aim to review materials, inspect for pupil comprehension and train pupils' speaking ability, but are not directed at determining how the pupil came to a particular understanding. The teacher consistently makes an effort to treat pupils equally and to avoid singling out individuals. Emphasis is placed on the systematic character of knowledge. A similar portrayal of appropriate pedagogy is provided by the most popular university text (Beijing Renmin Jiaoyu Chubanshe, 1982, p.112) used by teacher trainers. It describes pedagogy as a purposeful, planned leading of students by the teacher to the speedy mastery of knowledge.

Stevenson and Lee (1997) focus on the structure of whole-class instruction in which the main feature they identified was the prevalence of a series of instruction-practice-feedback cycles. They observed that the majority of Japanese and Chinese mathematics lessons in elementary schools adopted the whole-class instruction approach. A typical lesson in a Japanese mathematics class included several three-part cycles consisting of instruction-practice-feedback. The teacher began instruction by presenting a word problem and asking pupils to discuss the meaning of the problem. After giving the pupils time to think about the problem, the teacher asked several pupils to present and explain their answers. Whole-class discussion was led by the teacher by calling on other pupils to evaluate what the first pupils had reported. Additional activities might consist of the whole-class reading and completing worksheets, and the teacher summarizing, clarifying and elaborating the pupils' answers – aiming at providing feedback and facilitating their understanding of the topic. The three-part cycle was also observed in the Chinese mathematics lessons. The teacher-centred nature was similar, yet different from Paine's virtuoso model. The Japanese teachers responded to individual differences among the children they were teaching and there was a greater degree of interaction between pupils and teachers. In addition high levels of pupil attentiveness and inter-pupil collaboration were also reported.

Overall these portrayals focus on the teacher-centred, didactic and whole-class nature of Asian classrooms, but there is a growing recognition of the need for more subtle portrayals of classrooms, especially with regard to the extent and nature of interactions in whole-class

teaching contexts. The recent analysis by Stigler and Hiebert (1997) of video-recorded eighth-grade mathematics lessons in Germany, Japan and the USA, as part of the TIMMS study, provides an example of such a portrayal – albeit at the junior secondary rather than primary level – and an explanation for the relative success of Asian students in mathematics achievement tests. Specifically, they describe the typical Japanese classroom as follows:

The lesson focuses on one or sometimes two key problems. After reviewing the major point of the previous lesson and introducing the topic for today's lesson, the teacher presents the first problem. The problem is usually one that students do not know how to solve immediately but for which they have learned some crucial concepts or procedures in the previous lessons. Students are asked to work on the problem for a specified number of minutes and then to share their solutions. The teacher reviews and highlights one or two aspects of the students' solution methods or presents another solution method. Sometimes this cycle is repeated with another problem; other times, students' practice the highlighted method or the teacher elaborates it further. Before the lesson ends the teacher summarizes the major point of the day. Homework is rarely assigned.

The success of this approach is attributed to the tradition of teacher professional development in Japan, whereby teachers engage in 'lesson study groups' designed to improve teaching.

## The Target Oriented Curriculum

The Target Oriented Curriculum (TOC) was developed in accordance with the recommendations of the Education Commission's Report No. 4 (Education Commission 1990). The goals of and rationale for TOC derive essentially from Western precepts of what constitutes a 'good' teaching environment which is effectively the converse of those characteristics associated with Asian classrooms. These precepts have been identified by Biggs (1996, 45-46) as defining good teaching in the following ways:

- teaching methods are varied, emphasising pupil activity, self-regulation and pupil-centredness, with much co-operative and other group work
- content is presented in a meaningful context
- classes are small
- there is a warm classroom climate
- high cognitive level outcomes are expected and addressed in assessment
- assessment is classroom-based and conducted in a non-threatening atmosphere

In addition, the conceptual bases of the proposed pedagogy are rooted in the contemporary conceptions of learning advocated by proponents of constructivism and social

constructivism. For example in the document outlining the formal doctrine of TOC, Clark et al. (1994), explain that:

Learning is now conceptualised as an active, holistic, purposeful process of constructing, using and reconstructing knowledge (Vygotsky 1978, Segal et al 1985, Resnick 1987). Learning means developing an ever-improving capability to make sense of the world and to act upon it. (p.14)

And go on to elaborate that:

Learning involves the active construction of knowledge... Learning is interactive..... occurs where learners make their implicit knowledge explicit... occurs in a context of use. (ibid., p.16)

These strictures embody an implicit critique of the prevailing pedagogies used by teachers and at times this becomes explicit. For example,

Many current educational practices in Hong Kong and elsewhere can be said to be based on the partial conception of learning set out by behaviourist psychologists. Their learning theory was based on studies of animal behaviour from which they generalised their findings to human learning. In so doing they set aside the question as to whether the human brain with its capacity for connected thought might invalidate this..... Learning meant mastering and accumulating the facts and practising the sub-skills, one after another, until they became fixed or automatic. Thus progress in learning meant learning more and more facts and mastering more and more skills. (ibid., p.14)

Despite the introduction of a series of curriculum reforms promoting elements of change compatible with TOC (e.g., the Activity Approach and the communicative method), the orientation of schooling and classroom practices have been notably resistant to change (Morris and Adamson, 1997).

The TOC can thus be seen as one phase in a long history of initiatives designed to change the prevailing perception of pedagogy as teacher, textbook and test centred. However, in contrast to earlier curriculum reform initiatives, the TOC went beyond an exercise in symbolic action and it was for a period supported by the provision of resources, teacher training and commitment by the government. The TOC framework is designed to bring about curriculum renewal in the three core primary school subjects: Chinese, English and mathematics. As the focus of the current paper is on mathematics classrooms, only the measures that have a direct impact on mathematics teaching will be summarised in this section.

## TOC Mathematics

The major changes advocated by TOC in the mathematics curriculum can be summarised in four areas:

- (1) the clarification of targets and objectives and the fitting of the current teaching content into the TOC framework;
- (2) changes to the styles of learning and teaching;
- (3) the promotion of tasks and the distinction between tasks and exercises;
- (4) the development of formative systems of assessment and reporting.

Other key features of the reform are summarised below.

The content of the syllabus is divided into five learning dimensions, viz., number, measures, algebra, shape & space, and data handling. There are four key stages and they refer respectively to the current partition of school years, primary 1-3, primary 4-6, secondary 1-3 and secondary 4-5. The curriculum is structured around an increasingly specific hierarchy of learning targets. Five fundamental and generic learning skills are identified and subsumed within the targets for all subjects, namely – inquiring, conceptualising, reasoning, problem-solving and communicating. The learning targets are also designed to develop pupils' abilities "to inquire, communicate & reason mathematically, formulate & solve mathematical problems, appreciate the beauty and apply mathematics to different contexts through the learning of the knowledge, concepts and skills/procedures". (Ref?) The new objectives keep the essence of the 'objectives' stated in the 1983 primary mathematics syllabus and are consistent with global attempts, in particular the national curriculum in England (see NCTM, 1989; National Curriculum Council, 1991; Cheung, 1993) to promote outcomes-based curricula.

Overall, there is no change in the subject's content, as compared with the 1983 syllabus, as the major changes advocated by the TOC involve a clarification of the subject's objectives and the promotion of less didactic teaching strategies. As far as the latter is concerned, the TOC is premised on the value of task-based learning and a distinction is drawn between tasks and exercises. A learning task in TOC should have a context. For example, 'buying candies in a candy shop' is a meaningful context for a TOC learning task, whereas ' $24 \div 8 + 7$ ' is an exercise. Apparently, this distinction is designed to serve as a gatekeeper to avoid excessive

drilling and the use of meaningless symbolic exercises. The exemplar tasks given in the government documents were influential on textbook publishers and teachers who made an effort to locate classroom teaching activities within a meaningful “context”. Nevertheless, Wong K.M. (1997) points out that the bipolar distinction between exercises and tasks contributes neither to the understanding of “authentic” mathematics nor to the facilitation of problem solving activities in the Vygotskian sense. He argues that the simplified act of equating meaningful learning with contextualized learning is a risky instructional strategy.

As far as suggested teaching methods are concerned, the *Programme of Study* (1995) also recommends: exposition by teachers, discussion between teacher and pupils and between pupils, appropriate practical work, consolidation and practice of fundamental skills and routines, problem solving (including the application of mathematics to everyday situations) and investigational work. Furthermore, taking into account that pupils at key stage one are at an early developmental level, teachers are encouraged:

to use demonstrations and concrete examples in teaching mathematical concepts and procedures. This implies the use of teaching aids that provide physical representations of ideas as far as possible. Pupils should also be provided with opportunities for experimenting with materials in order to accommodate new understandings and to discover information for themselves. In this connection, discovery learning, which emphasises active participation, is most appropriate. Besides, the language abilities of pupils are in general developing. Teachers should therefore use simple straightforward and familiar terms as far as possible in the lessons. (p.45)

Finally, the document assigns great autonomy as well as responsibility to teachers. For example,

Teachers are expected to engage pupils in mathematical tasks and exercises that help develop these process skills. (p.44)

Teachers need to use selectively whole class teaching, group work and individual teaching as appropriate to the task in hand. (p.46)

Despite the indications in early generic documents promoting the TOC, which defined the formal doctrine as designed to shift pedagogy away from the behaviourist model (with its emphasis on drilling and the products of learning) towards a social constructivist / Vygotskian model (with its focus on peer interaction and the process of learning), these intentions become less explicit in the documents at the subject level. Thus, at one level, the TOC stresses the value of discovery learning, interactions and the active participation of pupils, and suggests that learning should take place in a context relevant to the pupil. At

another level, it recognises the importance of demonstration, the usage of simple straightforward language and practice for consolidating basic mathematics skills.

For those schools that adopted the TOC the teachers were provided with a range of new classroom resources (e.g. Programme of Study, exemplar tasks, textbooks), access to external training programmes and to intensive three-day school-based programmes provided by the Education Department of the government. The extent of these inputs was, relative to previous reform efforts, unprecedented. Whilst Hong Kong teachers do not operate the system of professional development that Stigler and Hiebert identified in Japan, the introduction of the TOC served to encourage greater teacher collaboration as they sought to resolve the puzzles of practice that were generated by the reform (Lo, 1999).

## Questions and Methodology

Data in this paper are derived from the TOC evaluation project, which started in 1995 (Morris, et al., 1996). The overall purposes of the study were threefold: to examine the nature of the policy, its impact on the organisation of schools, and its impact on Chinese, English and mathematics classrooms. This paper draws on the third level of analysis and attempts to describe the nature of mathematics classrooms through an analysis of the time devoted to different activities, and the extent of interaction. This portrayal is supplemented with a more detailed description of two typical lessons, based on the observer's field notes. In total, 197 mathematics lessons were observed altogether from 1995 to 1998. The distribution was 57 Primary-One lessons in 12 schools in 1995-96; 37 Primary-One and 24 Primary-Two in 12 schools in 1996-97; 28 Primary-One, 26 Primary-Two and 25 Primary-Three in 10 schools in 1997-98. This pattern reflected the fact that the TOC was progressively adopted in the schools (i.e. Primary-One first). To achieve a common context for comparison our analysis focuses solely on the 122 Primary One classes which were observed over the three-year period (95-96= 57, 96-97= 37 and 97-98= 28).

The classroom observations were conducted using an instrument developed by the research team over a six-month period, which was designed to describe the time devoted to different activities and the incidents of interaction between pupils, and between teachers and pupils. Two randomly selected pupils were observed throughout the lesson to quantify the incidents of interaction. After the first few minutes of settling down, systematic observation and contextualised notes were made in four seven-minute cycles. In the first four minutes

(systematic observation) of each cycle, the observer would code alternately the prevailing activities within a ten second period of the teacher and the two selected pupils (T, P<sub>1</sub>, T, P<sub>2</sub>, T, P<sub>1</sub>,...). Thus within each four minute cycle the teacher's activities were coded 12 times and those of each pupil coded 6 times. In the last three minutes (contextualised notes) of each cycle, the observer provided a summary of the classroom context with a focus on the extent of pupil engagement, the pedagogic contexts, and the nature of questioning. The validity of the instrument was established by an extensive trialling to ensure that it was able to describe the prevailing activities and patterns of interaction. Observations proceeded after an intensive training programme and after inter-rater reliability coefficients of greater than 0.9 were obtained.

The instrument provided data for two levels of analysis. First, analysis of the systematic coding provided a quantitative basis for describing the aggregate picture with regard to teacher and pupil activities in TOC classrooms. Second, from the data provided by the contextualised notes, more detailed and rich descriptions of the features of the lessons were also obtained.

## Results

### Patterns of Interaction

The overall pattern of teachers' and pupils' behaviour, in the 122 mathematics lessons observed, is described in Table 1 which indicates the distribution of time between types of teacher and pupil behaviour and the patterns of questioning. In the first year, for around one third of the time, the teachers were engaged in direct expository teaching. This declined to around a quarter of the time in the third year. Similarly, for about the same proportion of the total observed over time, they were engaged in questioning in the first year but this declined markedly by the third year. The decline in the proportion of time spent on direct teaching and questioning was largely taken up by an increase in other teaching related activities and assessment activities. This overall pattern of change is reflected in the data on pupil activities and assessment activities. Over the three-year period, pupils were observed to spend less time listening to the teacher and not participating, and more time engaged on activities set by the teacher. Overall there was a change in the distribution of teacher and pupil activities over the three-year period which involved a decrease in the extent of direct teaching and an increase in the extent of pupils' engagement in activities set by the teacher to

enhance learning. Teachers continued to play a dominant role in the lessons, but this increasingly involved them engaging pupils in learning tasks.

**Table 1 Analysis of teacher and pupil activities**

Teacher Activities / P1*	<u>Percentage</u>		
	95-96 (57 lessons; n <sup>#</sup> =2612)	96-97 (37 lessons; n <sup>#</sup> =1172)	97-98 (28 lessons; n <sup>#</sup> =1171)
● Direct teaching:	33.7	31.6	29.5 *
● Questioning:	38.7	23.8	23.1 *
● Listen to or answering pupils' questions:	1.4	2.7	1.6 *
● Explaining/Supervising/Tasks and Other teaching-related activity:	19.7	29.0	32.5 *
● Discipline control:	3.7	6.4	5.7 *
● Explicit assessment-related activity:	1.2	1.8	5.5 *
● Non-teaching activity:	1.6	4.6	1.4 *
● Others:	0	0	0.7
Total:	100	100	100

Pupil Activities / P1	<u>Percentage</u>		
	95-96 (57 lessons; n <sup>#</sup> =2717)	96-97 (37 lessons; n <sup>#</sup> =1169)	97-98 (27 lessons; n <sup>#</sup> =1173)
● Listen to/ looking at/ waiting for the teacher, other pupil(s) or resources in the context of teacher-centred activities:	56.4	41.7	42.1 *
● Imitative and repetitive behaviour:	1.5	0.8	0.5 *
● Attempting to ask or answer a question to or from the teacher:	8.6	5.7	7.0 *
● Answering the teacher's question, engaging in activity specified by the teacher:	15.1	27.2	36.1 *
● Asking the teacher a question or receiving an answer from the teacher:	0.1	0.2	0.2
● Non-participating, distracted or being disciplined:	12.1	11.8	4.8 *
● Explicit assessment activity:	0.9	1.2	3.5 *
● Other pupil behaviour:	5.2	10.7	5.5 *
● Others:	0.1	0.7	0.3 *
Total:	100	100	100

\* The percentages of teacher/pupil activities were derived from the systematic coding which reflected the duration of time when the teacher/pupil was observed.

# "n" = the number of lessons x 4 cycles x 12 codings – the number of invalid records. Each lesson consisted of 4 cycles, and each cycle was broken down into 12 intervals.

\* p<0.05, Kruskal-Wallis Test, grouping variable by year.

### Patterns of Classroom Organisation

The observations distinguished between four forms of pedagogic context based on how the classroom was organised: whole-class teaching without interaction, whole-class teaching with interaction, group work and individual work. Analysis indicated that whole-class teaching with and without teacher-pupil interaction were the prevalent pedagogic strategies in the lessons (see Table 2). All the mathematics lessons contained episodes of whole-class teaching. However, the overall pattern of change was one in which there was an increase in

the proportion of observed episodes which involved whole-class teaching with interactions, group work and individual work.

**Table 2 Analysis of the pedagogy patterns**

Pedagogy Patterns / P1	Percentage		
	95-96 (57 lessons)	96-97 (37 lessons)	97-98 (28 lessons)
● Containing episodes of whole-class teaching with or without interactions	100	100	100
● Containing episodes of whole-class teaching without interactions	10.5	16.2	7.1
● Containing episodes of whole-class teaching with interactions	89.5	83.8	92.9
● Containing episodes of individual work	31.6	32.4	42.9
● Containing group/pair work	57.9	73.0	53.6

Generally lessons were conducted in such a way that all pupils were expected to complete a common set of worksheets or exercises in the textbooks. Individual work seemed designed to allow pupils to finish their work at their own pace and for teachers to observe the progress of individual pupils and help them whenever necessary.

Another notable feature was the extensive and increasing use of group/pair work. The duration and nature of group activities varied according to the topic and the design of the lessons. All the activities had very specific content-oriented objectives that were consistent with the stipulations of the Programme of Study and textbooks, and nearly all of them involved manipulation of concrete objects. Examples are: making measurements by using a variety of objects in order to develop the concept of units and measures, dividing some given objects into groups in order to develop the concept of sharing and division, identifying different types of coins, identifying different shapes, and practising calculation via a role play of shopping. The teacher usually linked these activities to a worksheet and a pre-activity instruction. In all the activities the pupils were asked to undertake the same task(s) but these required different degrees of collaboration among pupils. Pupils were usually engaged in the activities in an atmosphere that was relaxed and teachers moved around groups in order to provide individual support whenever necessary.

#### *An Example: The Activities and the Nature of Interaction*

The above data provide at best a broad portrayal which suggests that whilst the lessons could be described as teacher-centred, this fails to capture the (increasing) extent and nature of interaction between teachers and pupils within the context of a teacher-centred pedagogy. In order to portray in greater detail how whole-class teaching was combined with group work

and individual work and the nature of the lessons in reality, two Primary-One lessons which illustrate how these were combined are analysed below.

The lessons shared the same teaching objective, i.e., telling the time. The first lesson focused on understanding how to tell the time at an hour, half-hour and close to the half-hour. The second lesson was a sequel to the first lesson and put emphasis on practice, feedback and consolidation of the new concepts. The lessons took place on two consecutive days, lasted for 35 minutes and were taught by the same teacher. Inside the classroom, there was a blackboard, a movable white board and a teacher's desk in the space at the front of the room. This area formed a 'base' where pupils could sit close to the teacher by moving their stools to it. The pupils' desks were arranged to form five large tables. Pupils would sit around the tables for individual / group work and for some whole-class discussion. This arrangement created a more relaxed atmosphere during whole-class teaching and group work, compared with those classrooms that had a podium at the front of the class. There were 30 pupils in the class.

There were five distinct phases or activities in the first lesson and four in the second lesson. Seven of these nine activities involved the whole class and two involved pair-work. In the whole-class activities, the teacher was the leader of the discussion and the centre of attention. Both whole-class and group work activities lasted for a short duration and had very specific objectives and focus. The sequence of the activities contributed to the flow and development of the concepts and skills for the lesson.

#### *The first lesson.*

The first activity was learning the nature and function of a clock face. Pupils moved to the 'base' of the classroom. The teacher showed a blank clock face and asked pupils to put the hour hand and minute hand on the clock face. The second activity was about the characteristics of the hour and minute hands and still took place at the base of the classroom. The teacher held up a toy clock and asked pupils questions such as, "How far will the hour hand move when the minute hand has moved one circle? Which hand is faster?" Via these problem-posing questions, the teacher helped the pupils to understand the relationship between the hour and minute hands. Thus, the first two activities ('the clock face' and 'the hour and minute hands') apart from acting as a form of 'set', provided both the *prelude* for and identified problems that were subsequently addressed by activity three ('telling the

time'). The questions raised by the teacher were very simple and pupils were very eager to participate and answer.

The third activity was the *major part* of the lesson and lasted for 14 minutes. The teacher aimed to teach pupils to *tell the time* by questions and answers. The sequence was from the simple (the time at an hour such as 'seven o'clock') to the more complex (the concept of close to a specific time such as 'nearly half past seven'). The teacher used a lot of examples to help pupils grasp the concept and skills of telling the time. Some examples were related to pupils' daily routine (e.g. when they get up in the morning, when the school begins.). Some were for illustration or practice. All questions demanded short closed answers. Pupils were usually eager to answer. The teacher sometimes used these opportunities to give feedback or to invite quiet pupils to participate. A typical example of questions and answers is translated and given below:

t: (Setting the toy clock to 1:00) When will school begin?

p: One o'clock (some pupils joined in chorus).

t: (Moving the minute-hand to the position of 'six') Now it is half past one. Can someone set the hour hand?

(A pupil came out and set the hour hand.)

t: Yes. The hour hand should be between '1' and '2'.

The fourth activity involved pair-work and was aimed at providing pupils practice of how to tell the time. Pupils moved back to their desks and worked in pairs. One showed a specific time on the clock face and the other told the time. The task was similar to the teacher-pupils interaction in the above episode. Nevertheless, the pairing enabled all pupils to be engaged in the task and communicate orally. During this period, the teacher would move about to check whether all pupils managed the tasks and gave help to individuals whenever necessary. Pupils' attention was no longer on the teacher and pupils interacted freely.

The fifth activity, which involved the whole-class, set an end to the lesson. Besides giving a *summary* of what had just been taught, the teacher continued to encourage interaction by asking pupils exemplar questions that demonstrated the main ideas in the

lesson. Finally, *homework* was given and it was in the format of worksheets containing items for practice.

### *The second lesson.*

The second lesson on the following day was primarily designed as a consolidation of the first lesson. It began with a whole-class discussion *recalling* what had been taught. The questions and answers were very similar to those in the first lesson. These questions and answers also helped pupils perform the subsequent pair-work.

The second pair-work activity was similar to that used in the first lesson except that it put emphasis on the link to daily events. It required a pupil to set a time on the clock face representing a specific daily event and the partner they had to read the time. It was again a kind of practice or reinforcement activity but with a greater degree of realism than in the previous lesson.

The third activity involved a *reporting/ evaluation* whole-class activity in which the pupils were organised into groups. Each group leader picked a card, which specified a daily event, and a group member was invited to show the time on the toy clock and read the time aloud to the whole class. Thus, the skills that were practised in the last activity were demonstrated in front of the whole class. There was an element of peer assessment as the teacher invited the pupils to comment on the accuracy by raising their hands to indicate if they agreed with the answer. When there was a mistake, another group member was encouraged to correct the response and the teacher gave hints occasionally. The last part of the lesson, which was extremely short, was simply the return of workbooks and the teacher's instructions for homework.

### *Overall*

These two lessons were typical of the observed TOC mathematics lessons that used a combination of whole-class instruction and group work. The development of the lesson was structured in terms of a sequence of phases that involved linked activities. The activities at the beginning usually involved the whole class and served as the prelude. The goal was multifaceted: motivation, helping pupils to recall necessary facts and prerequisite knowledge, and, to provide a link for subsequent activities. This was usually followed by a combination of demonstration and whole-class discussion that aimed at introducing and explaining

specific new ideas. The questions-and-answer interactions were specific and primarily used for practising purposes. This was then followed by activities for consolidation, which were organised around whole-class discussion or group work or individual work. In the exemplar lessons in this paper, the practice involved group work which was primarily designed to serve the purpose of promoting pupils' communication and participation skills rather than for constructing new ideas among peers. The tasks were simply an alternative form of practice that provided opportunities for the teacher to check pupils' progress or give support to individual pupils.

### The Changing Virtuoso

Overall the characteristics of the lessons observed contained both similarities and differences from those features described by Paine (1990), Stevenson and Lee (1997) and Stigler and Hiebert (1999). In terms of the mode of delivery the mathematics lessons involved a substantial usage of direct instruction in a whole-class context. However, whilst Paine describes the teacher as a 'presenter' and 'virtuoso' who provided demonstrations to pupils and relied on the textbook, this was not the case in the mathematics classrooms observed in Hong Kong. The teacher acted more as a conductor of the class than as a virtuoso performer. This involved a great deal of teacher-pupil interaction and of pupil-pupil interaction through the use of group work and peer feedback.

In some respects the lessons we described contained the instruction-practice-feedback oriented activities identified by Stevenson and Lee in Japanese classrooms. In both contexts, the teachers acted as "skilled professionals who approach their classes with a confident intensity and who present interesting lessons to their large classes with enthusiasm and vigor" (Stevenson and Lee, 1997, p.34). However the major difference between the Hong Kong lessons and the Japanese lessons was that the instruction-practice-feedback cycles did not appear as distinct phases in the structure of the lessons. Thus for example in the first lesson we observed, instruction was the main purpose of the third activity, whereas practice and feedback were combined in the subsequent activity. In the second lesson, the main agenda of the first three activities involved a combination of instruction, practice and feedback respectively. We also observed the simultaneous combination of demonstration and feedback within periods of teacher-student interaction.

It was thus evident that some typical features of the virtuoso / traditional whole-class teaching model had been adapted in ways which allowed it to incorporate some more interactive aspects of pedagogy, most notably group work and questioning. Three other elements emerged as key features of the lessons, which serve to provide further insights into the pedagogies used. These observations are derived from the contextualized notes and relate to the role of the textbooks, homework, and the teacher's role.

#### From textbook oriented to task-based learning

The emphasis on task-based and contextualized learning made the textbook-oriented characteristic less explicit in the lessons observed. As demonstrated in the exemplar lessons, learning activities were built upon hands-on experience with real objects (e.g., the toy clocks) and pupils' daily life experience (e.g., the schedule of their daily routine events). However the influence of textbooks in classrooms remained significant but less overt than is the case portrayed by Paine. Most learning and teaching tasks and activities were adapted from the textbooks by the teacher and the teaching schedule was usually planned in advance by the middle management with reference to the sequence used in the textbook. The teaching schedule and textbook tasks, which were the primary determinant of the lessons' purposes, followed closely the specific learning targets prescribed in the government documents. However, in contrast to Paine's portrayal, the lessons rarely involved the direct explication of the textbook content – rather the textbooks provided the source of the content and activities used by the teacher.

#### Practice and homework

There were different measures used to ensure conformity and provide opportunities for pupils to practise the skills taught. There seemed to be a pervasive assumption that every pupil should complete the same tasks and achieve the same objectives. Many specific and skill-based tasks still carried a strong sense of practice. Assigning homework was a regular routine at the end of lessons and contrasts markedly with Stigler and Hiebert's portrayal in Japan (where homework was rarely set even at a higher grade), and in the USA (where homework was set, but used to assign problems that were not completed in the lesson). The tasks set for homework were very similar to the activities used in the lesson and they effectively served as a post-lesson consolidation by means of pencil and paper practice. The

prelude of most lessons, which involved pupils recalling specific concepts and skills, created a strong obligation to do the necessary homework and revision.

### Change in the teacher's role.

In the virtuoso model, the teacher's role was portrayed as a demonstrator and pupils were expected to follow the teacher's model. In the lessons observed, whole-class teaching, in reality, was still predominant. However, the objectives of direct teacher instruction were multifaceted and not limited to exposition, for example they included: forming the prelude, recalling the prerequisite knowledge, delivery of new knowledge, giving demonstration for subsequent activities, encouragement, providing diagnostic feedback and encouraging peer assessment. Although the teacher-centred characteristics persisted, the teacher essentially played an orchestrating role of linking and developing a sequence of classroom activities. Throughout the lesson, pupils' motivation and attention was maintained via a range of short activities. For example, it could be seen throughout the exemplar lessons that liveliness was maintained via the teacher's effort, skilful mode of delivery, questioning and receiving answers.

### Summary

This paper began by reviewing the way classrooms in Asia are portrayed. It was argued with specific reference to Hong Kong that the focus on their teacher centredness and whole-class organisation, whilst not wholly inaccurate, fails to recognise both the processes which operate within those portrayals and the extent to which they have changed. Using data gathered from a study of the impact of a curriculum reform in Hong Kong, this paper has attempted to describe some of the key features of the pedagogy used in mathematics lessons in Hong Kong primary schools. Those identified include the extensive use of group work, questioning and of a combination of tasks and exercises. However, these features occurred within an overall classroom context that remained teacher-centred and organised around whole-class instruction.

To explore in greater detail how these lessons were structured two lessons were examined in detail. The lessons involved a substantial degree of interaction and both the structure of the lessons and the nature of interactions suggested that activities focussing on providing instruction-practice and feedback were evident but not strongly separated into distinctive cycles or phases. Classroom contexts were characterized by a combination of

whole-class teacher-pupils interaction and highly structured group / pair work. Homework was used to provide paper and pencil exercises to practise the skills taught in the lesson. Other elements of teaching, which displayed characteristics that deviated from the classic portrayals of teacher-centred whole-class teaching, included the role of textbooks.

Clearly some of the features we observed were consistent with some of the pedagogic strategies recommended by the TOC reforms, but the extent to which the patterns we observed were the result of the introduction of TOC is difficult to ascertain, given that we have not explored non-TOC classrooms nor analysed the pedagogy used by the teachers prior to the introduction of TOC. The overall indications are that the reform had not resulted in radical change but it had served to have an impact that was varied across teachers and schools. A number of indicators suggest that it may have contributed to an adaptation of the nature of pedagogy used in mathematics classrooms, specifically; the increasing incidence of group work over the three years, the decline in the extent of pupil non-participation, the increase in pupils answering teachers' questions and of engagement in learning activities are all consistent with the directions advocated by TOC. Further the majority of teachers themselves perceive that their classrooms had changed as a result of their use of aspects of TOC. As one explained:

“Traditional teaching was routine, e.g., simply 3+4. [In the TOC lessons,] using more examples, with more pictures, objects such as apples, with a context, it became more lively. Pupils would understand more quickly and be more engaged in the lesson. Pictures helped a lot more than simply numbers.” (The authors' translation)

Overall the prevailing pedagogy was dissimilar both to the virtuoso model described by Paine in China – in so far as the extent of expository teaching and the explication of text was limited – and the ‘script’ of mathematics lessons in Japan, as described by Stigler and Hiebert, which involved pupils working on and sharing their solutions to new problems. The structural patterns were characterized by the combination of instruction-practice-feedback oriented activities in contexts that involved high levels of teacher-pupil and pupil-pupil interaction as described by Stevenson and Lee, along with the use of problem identification at the outset of the lesson as in Japan. The role of the teacher that emerges from this study is thus one of a conductor orchestrating between common activities rather than a virtuoso performer. In comparative terms, this study also suggests a degree of variation across Asian contexts and thus the need for caution in using terms such as an ‘Asian’ or ‘Confucian’ model of teaching.



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