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What Else is Important besides the Teacher? The Case of a Hong Kong Mathematics Classroom

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Abstract:

A major contribution to the outstanding mathematics achievement outcomes in Hong Kong classrooms is how the mathematics lessons are taught and how the lessons are received. In this paper, I carried out analysis of the data of one Hong Kong teacher taken from the Learner's Perspective Study. The teacher was a very experienced teacher, recognized as a very good and competent teacher locally. A sequence of 18 consecutive lessons has been recorded. Analysis of the students' interviews and the teacher's interviews was carried out to find the pedagogical philosophy of the teacher and how the students received their mathematics lessons. Results show that the teacher took up a strong leading and guiding role in the lesson. Nearly all students liked the teacher and their mathematics lessons. In the interviews, the students showed their appreciation of how the teacher taught. They liked the demonstration and experiences of alternative methods for a problem and thought that knowing the steps for solving the problem helped their understanding. They respected both the teacher's authority in the classroom and the help from classmates. They learnt from the teacher's correction of students' mistakes and appreciated the discussion of mistakes.

Introduction

International comparative studies on student performance, such as TIMSS, have consistently reported outstanding performance of Hong Kong students in mathematics (Mullis et al., 1997, 2000, 2004). Increasing interest has been developed for understanding the teaching and teachers via comparative studies. For example, Ma (1999) studied the pedagogical content knowledge between the Chinese and the USA mathematics teachers. Stigler and Hiebert (1999) carried out a video study, which aimed to investigate the characteristics of teaching styles and methodology that could be identified across the diversified cultures in the USA, Japan and Germany. Nonetheless, often the studies of the teachers or the teaching have not included the direct impact on learners. How teaching and learning takes place in the classrooms is a very complex process. It is deemed necessary to provide a platform to the study what happens in the lessons and the key people (the teacher and students) involved in

order to give a comprehensive picture of the issue. The Learner's Perspective Study (Clarke, et al., 2006) provides the opportunities to study the teaching scenario and the key people (the teacher and students).

In this paper, I carried out a case analysis for one Hong Kong teacher taken from the Learner's Perspective Study (LPS) with a focus on the students' perspectives on their mathematics lessons and an attempt to make a connection between the teacher's and the students' perspectives. The synthesis drew upon the analysis of the data generated from the lesson videos, the teacher's and students' post-lesson interviews. The teacher was a very experienced teacher, recognized as a very good and competent teacher locally. A sequence of 18 consecutive lessons has been recorded. Analysis was carried out to seek answers for the following research questions:

1. What did the students see as important in the lesson?
2. How did the students perceive a lesson with strong teacher guidance?
3. How did the teacher perceive his students' responses in the lessons?

The background of Hong Kong: An era of changes and reform

With development in accordance with the recommendations of the Education Commission's Report No. 4 (Education Commission 1990), the introduction of a series of curriculum reforms (e.g., the Activity Approach and the communicative method, Target Oriented Curriculum (TOC)) have put in effort in promoting elements of change in the Hong Kong curriculum, with the initiatives to change the prevailing perception of pedagogy as teacher, textbook and test centred (Morris and Adamson, 1997; Mok and Morris 2001). Despite the orientation of schooling and classroom practices have been notably resistant to change, there were some reports of successful change of the classroom contexts. For evaluating the impact of TOC, Mok and Morris (2001) reported a change of pedagogical patterns, there were increasing use of group work in lessons and class activities were often organized in the a context with a combination of whole-class teacher-pupils interaction and highly structured group / pair work. However, with respect to group work in Hong Kong, the choice of pedagogy can be very diverse in reality. On the one hand, this pedagogical shift represented by an increase in group-based activities needs to be interpreted with caution. Not all group-based activities serve the same purposes in supporting learning. For example, Mok and Ko (2000) presented detailed analysis of three lessons with group-based learning serving very different purposes, namely, collaboration, organization and practice; and the authors concluded that it was possible that some interaction inside the classrooms could still very much controlled by the teacher despite the use of group work. In some cases the strong teacher guidance is still very much the teacher's choice. For example, Mok (2009) reported an exemplary lesson by a competent teacher in which there was hardly any use of group work. Generated from the study, strong teacher guidance remained a robust feature in the Hong Kong lessons.

Research Design: the Learner's Perspective Study

The Learner's Perspective Study (LPS), led by Professor David Clarke, began in 1999, represents an innovative venture in classroom video study in at least two perspectives. With respect to research issues, it complements emergent national norms of student achievement and teaching practices with an in-depth analysis of classroom learning from the perspective of the learner as well as the teachers. With respect to design and methodology, it provides the opportunities to combine videotape data with participants' reconstructions of classroom events of "well-taught" Grade 8 mathematics lessons (Clarke, et al. 2006).

The essential features of the LPS research design are (i) the on-site mixing of the images from two video cameras to provide a split-screen record of both teacher and student actions and (ii) the use of the technique of video-stimulated recall in interviews conducted immediately after the lesson to obtain participants' reconstructions of the lesson and the meanings that particular events held for them personally. A third camera recorded "corporate" student practices—that is, the practices common to the whole class group. Two students were interviewed after each lesson. Each teacher participated in three video-stimulated interviews and completed two substantial questionnaires before and after videotaping, as well as a shorter questionnaire after each videotaped lesson. Copies were also made of student written materials, textbook pages, and worksheets used in class. The Learner's Perspective Study (LPS) applying a complementary accounts methodology produced a rich data set for understanding the negotiated meanings in classrooms.

The background of the school, the teacher and the students

From the Hong Kong School HK1, data of 18 consecutive lessons were collected. HK1 was a school using Chinese as the medium of teaching, the choice of the majority of the schools in Hong Kong. The students were grade-8 students of average standard in Hong Kong. According to the teacher, the students could be counted as a combination of average and slightly above average in mathematics based on the internal screening of the school. This comment was consistent with their high International Benchmark Test IBT score (40.26 out of 50) reported in the project.

The teacher Mr. X is a teacher with more than twenty years of experience in both primary and secondary mathematics teaching. He is active in teaching, curriculum development and research activities. Local mathematics educators, his school principal, colleagues and students recommend him as a very good teacher.

Out of the 34 student interviews, 31 students expressed that they liked their mathematics lesson, two did not express any opinion and only one said that he did not like the lesson. Therefore, the students in general liked their mathematics lessons.

The student interviews

The interviews were conducted immediately after school each day and the split screen video record, mixed on-site from the Teacher and Student camera images of the day's

lesson, was used as a stimulus for the student interview. The student was invited to play back the video of the lesson of the day and stopped the video where they saw as important. They were asked to comment on the episode by telling what happened and why they saw it as important.

Method of analysis of the student interview transcripts

Kaur (2009) developed a coding scheme for the Singapore data by the grounded theory approach. The set of codes developed is given in table 1.

The Singapore findings showed that the three main aspects of her instructional practice were exposition, seatwork and review. Exposition was characterized by whole class mathematics instruction that aimed to develop students' understanding of mathematical concepts and skills; seatwork was characterized by the period during which students were assigned questions to work on either individually or in group at their desk and whole class review of student work was characterized by the period during which the teacher's primary focus was to review the work done by students and give them feedback. Transcripts of the student interview data were scanned carefully and the lesson segments that the student chose to comment on were annotated. The interview videos were watched to ascertain what the students were commenting on and the respective transcripts were coded.

As exposition, seatwork and review were also major instructional practice events happened in the Hong Kong lessons. The same coding scheme was used for the analysis of the Hong Kong student interviews after piloting the scheme.

In addition, the teacher's interviews was analysed to find out how the teachers received the students' responses during the lessons.

Table 1 The codes for the segment in the student interview transcripts

EC – explains / explains clearly; **D** – demonstrates a procedure: "teaches the method" or shows using manipulative a concept / relationship **NK** – introduces new knowledge; **GI** – gives instructions (assigning homework / how work should be done / when work should be handed in for grading, etc.); **RE** – uses real-life examples during instruction; **I W** – students working individually; **GW** – students working in groups; (sub-group: SD: student discussion.) **M** – material used as part of instruction (worksheet or any other print resource); **SD** – student discussion **PK** – reviews prior knowledge; **SP** – uses student's presentation or work to give feedback for in class work or homework; (SE: explains by student) **IF** – gives feedback to individuals during lesson; **GA** – gives feedback through grading of written assignments.

Results:

Table 2 The number of lesson video segments that the students saw the different instructional practice as important

Total no. of students	Total no. of segments	Instructional Practice		
		Exposition	Seatwork	Review & Feedback
		EC / D / NK / GI / RE	IW / GW / M	PK / SP / IF / GA
34	104	18/29/2/6/2	21/4/0	2/19/1/0
Student head count		29 (85%)	16 (47%)	15 (44%)

Legend: see Table 1

Most of the students (29 out of 34, 85%) saw the teacher's exposition as important. Many of the video segments were explanations (18) and demonstrations (29). 47% of the students (16 out of 34) saw seatwork as important. These seatwork segments were mostly seatwork segment (21). 44% of the students (15 out of 34) saw review and feedback as important. The most popular segments were those when the teacher used the student's presentation or work to give feedback for in class work or homework.

Some Examples of these episodes are given below.

Exposition – explains / explains clearly

Episode 1

HK1-1: From now on…from question 1 to 6…these examples help us to understand how to solve these problems step by step.

HK1-1: He goes through the examples from the easier ones to the difficult ones very slowly. It's easier to understand. He won't give you difficult examples at the beginning. *He explains well* too. The students…I think *his explanation is very clear and thorough.*

Episode 2

HK1-24: This part…was important, because he explained why there was no solution…the reason.

HK1-24: Because both equation were x plus y but their answer were not…the same

HK1-24: I was thinking why was there no solution, but I couldn't figure that out

Exposition – demonstrates a procedure: teaches the method or shows using manipulative a concept / relationship

Episode 3

HK1-5: Yes. He asked us what should be multiplied by five open bracket negative x minus y close bracket square in order to get five open bracket x minus y close bracket to the power three.

HK1-5: Yes. *He introduced an easier method*, so that we could use it in future.

Int.: Why is it easier?

HK1-5: He drew a shape and we can…

Int.: The rectangle?

HK1-5: We could multiply them like the way we do division. It's like dividing a polynomial.

Episode 4

HK1-11: Yes. Um… it should be the slogan that the teacher has just mentioned.

HK1-11: Yes. Maybe I have to… to memorize the slogan, you will… um… think about the things that you don't understand in this slogan. Maybe you can think about how to change from this slogan, or substitute it. Then it will be simple… can be that slogan.

Int: What is that slogan all about?

HK1-11: That's, the slogan is about checking the answer we have found and see if it is the right one to substitute into it… um… um… for example, x equals one, y equals one… um… this can make the linear equation… um… the left hand side and the right hand side … um… is like the left and right are equal and substitute into it. I can't remember clearly about the slogan.

Int: Ha ha. It's okay. It's just taught today.

HK1-11: Yes. He has talked about this.

Int: Do you think this is very important? It can make you…

HK1-11: Um… that is, *we can understand the calculation by thinking about that slogan*.

Seatwork – individual work

Episode 5

HK1-8: We should be calculating…the *last ten questions given by the teacher*.

Int.: Why is it important?

HK1-8: Um… it gives us the chance to do more exercises and practice more.

Episode 6

Int: Why…is it important? You say it's important

HK1-23: Because it's written on the blackboard. Usually, *the things that the teacher writes on the blackboard are important*.

Int: What's the importance of it? You say the things on the blackboard are important, but why is this shot important?

HK1-23: It's written for…for you to copy and calculate yourself

Review and feedback - student presentation

Episode 7

HK1-23: Em … was more or less the same watching him to do it and doing it myself, but … *Mr. X has pointed out his mistake* …

Int: That is twenty-six minutes?

HK1-23: Yes … pointed out our mistake.

Int.: So? Tell me once more.

HK1-23: So … that is … he started to tell … started to demonstrate his wrong steps …

Int.: Em …

HK1-23: Yes … even that student is quite good at mathematics; he got it wrong, too. So we have to be careful, watched … listened.

Episode 8

Int: Is that important?

HK1-27: This part…mm… is quite important. But I think the part in which *the student explained the reason for it is more important.*

Int: Explaining why y equals two?

HK1-27: Since he had given you the answer…the absolute answer, whatever you assign…that y does not change.

What the students saw as important

Exposition was seen as important. The students valued much the clear explanation by the teacher, when the teacher showed them how to solve the problems step by step, explaining the reasons behind the steps that helped them understand the mathematics (Episodes 1 and 2). They also valued moments when the teacher demonstrated specific method (Episode 3). The teacher had a strategy of creating slogans to help students remember and think about the mathematics and the students saw this as important (Episode 5).

Besides the exposition given by the teacher, the students saw seatwork as important because they saw that the exercises were opportunities for practice and consolidation. Sometimes even when they copied what the teacher wrote on the board was also important (Episodes 5 and 6). Feedback and review were important because they

could learn when the teacher corrected their mistakes or using the students for demo and further explanation (Episodes 7 and 8).

How the students saw a typical lesson: Naomi and Leo

An example of a lesson

This section describes in brief a typical lesson with strong teacher guidance in the LPS Hong Kong data set (see Mok, 2009 for details). The lesson was a grade-8 lesson on the topic, factorization of polynomials. The lesson lasted for 35 minutes. The first few minutes had been used for non-teaching matters. Therefore, the actual teaching time was about 27 minutes. The segments of different instructional instructional practice could be approximately described in this sequence:

1. Introduction in the form of teacher-led whole class discussion (4 minutes). In this part, the teacher introduced the name of the topic. (Exposition)
2. Main part (16 minutes) of teaching in the form of teacher-led whole class discussion, which included a very brief small group discussion (less than one minute). In this segment, the teacher led the class through the major features of factorization with 7 examples. (Mostly exposition, very little amount of seatwork)
3. Supporting activities included individual seatwork with assigned class exercises, teacher's between-desk-instruction, students working on the board and the teacher's comments on the students' board work (7 minutes). (Seatwork, feedback and review)

Naomi

Naomi said that the lesson was good because he appreciated that the teacher had gone through the problems in clear steps. He only stopped the video for one episode. He saw the sequence of the six questions from easy to difficult as important. In that episode, Naomi discussed about the negative sign in question 4 with his classmates and found a way to get the correct answer by applying the rule. In his comment, he paid attention to the contrast between questions and the different levels of difficulty.

With respect to the atmosphere of the lesson, Naomi preferred more jokes and activities to listening to the teacher all the time. He also pointed out that he sometimes chatted with his classmates on things not related to mathematics and had a relaxing time.

Leo

Leo had a background different from Naomi. He came from the Chinese mainland and he said that had learned the topic before. Despite that he learned the content in the past, he saw more episodes important than Naomi. He stopped and commented at 4 episodes.

1. The first episode was at the beginning because he said that revision and the beginning was important.
2. For the second episode, Leo picked at the moment when he had to answer the teacher's question and he thought hard to give a reason to justify the correct answer.
3. The third episode was about the handling of the negative sign. Leo said that difficult questions as important.
4. For fourth episode, he saw the checking of answers as important because they could learn not make the same mistake.

As far as atmosphere was concerned, Leo made a special comment about chatting, "We're doing a lot of other things, but the teacher doesn't see it such as chatting." Comparing the two students' remarks about chatting, Leo's special remark suggested an interesting implication. When Naomi mentioned about chatting, he seemed to be having fun and accepted chatting for some relaxing moments well justified. On the other hand, Leo showed concern that the teacher was not aware of what they were doing. The difference suggests the preference of the classroom atmosphere can vary between students. Leo's remark might be likely a consequence of his background of receiving education in his early years in mainland where chatting on off-task matters was unlikely to happen in a lesson.

How the teacher received the students' responses

The videoing of the lessons spanned over three weeks. The teacher was interviewed once each week. He was invited to choose a lesson video to review, stopped the video at episodes that he saw as important and explained his rationale for his choice. In the second interview, the teacher chose a lesson teaching the method of substitution for solving equations. He stopped the video for 8 episodes, all of which were related to the students (Table 3). Analysis reveals his beliefs and strategies in receiving student's responses.

He had different means to help build up the students' confidence and capacity for solving problems. These strategies included: asking students to do selected class exercise, providing corrective feedback either to individual or to the whole class, enabling the students to do the important steps by giving hints and giving specific question that helped them thinking.

He got feedback on how the students followed the lesson by various means, including: asking questions, listening to students' questions, asking them to show their work on the board, walking between desks during individual seatwork and asking them directly whether they could follow the teaching. He took students question seriously. For example, he made use of a student's question to share with the whole class how to sort out a common mistake. He believed that the public sharing would help the student work eagerly. He said,

> "It was in yesterday's lesson, the lesson before this lesson. Richard asked his question. The question was one that most students would have. That is, which

equation should be substituted into which equation and which unknown should be made as the subject… I'll pay attention to what my students ask under all circumstances. I'll talk about it openly, so that they would have the eager in doing mathematics."

Table 3 Summary of 8 episodes in the second teacher interview,

1	Referring to a student's mistake and difficulty, Matthew asked a question
2	Referring to how he made use of Richard's question in the last lesson; he showed the answer to the whole class
3	Students working on the board
4	Helping the students do the most important step
5	Between desk instruction: Answering individual questions
6	Getting feedback for whether the students can follow
7	A question with special purpose: how to find which step was wrong; let the student to think about it at home
8	Feedback: asking students to raise hands

Conclusion

According to Grouws and Hiebert (2007), there are few evidence-based studies for to provide connections between teaching and learning although there were several reviews. Furthermore, teachers and students were often studied in separate domains. This paper reports a case analysis of the data generated from the teacher's and students' post-lesson interviews aiming to shed lights on the connection between the two domains.

The early image of Hong Kong classrooms under strong influence of the Confucius Heritage Culture (CHC) was used to be described as examination-oriented, teacher-centred with emphasis on memorization (Biggs, 1994; Watkins & Biggs, 1996; Watkins & Biggs, 2001, Mok and Morris, 2000). Despite that efforts have been made to change this image in recent education reforms, the feature of strong teacher guidance remains prominent in the mathematics lessons in Hong Kong.

The results in this paper show that lessons with strong teacher guidance were not necessary unwelcome by students. The students liked their teacher and their mathematics lessons although a high proportion of the instructional practice is expository. The students valued the expository instruction that served the purpose of helping them to learn. The functions that they saw important were clear explanation, demonstration of methods, strategies helping them to think and understand. The next

thing that they saw as important were the opportunities to do work in the class and learning from either the teacher or other students. They appreciated the teacher's effort of corrective feedback for mistakes and peer support given either in seat work or public sharing in the lessons.

To conclude, teacher's beliefs always make a strong influence on how they teach the mathematics Hiebert & Grouws, 2007). How they perceive and believe about mathematics and the teaching of the subject will directly influence how their plan and action in the classroom. What the teachers do in the lessons will in turn translated into students' beliefs (Carter and Norwood, 1997; Thompson 1984). Supplemented with the information from the teacher's interview, the teacher's concern and care for the students need were very explicit in how he received the students input in the lessons. The teacher emphasis on helping students working through difficulty and mistakes met the students' goals readily. This harmonious matching is indeed important because students often have very direct goals. The simple match between what the teacher did and the students' goal of building their capacity for doing the mathematics in the class forms a basis for liking their mathematics (Middleton, 1995).

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