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The Mathematical Analysis Of Classroom Teaching Methods: Results From A Study Conducted In A Preeminent Chinese Educational Community

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Abstract

Considering the, "Due to the political climate in China until the 1980s, there have been few studies on how kids learned mathematics. Second, studies on how students learnt mathematics have been restricted since the 1960s (Wong, 1998; Leung, 1992), despite interest from Western scholars in understanding the causes for Chinese students' remarkable success in mathematics. Math lessons in Shanghai, a contemporary metropolis with strong links to Chinese culture, and those in Hong Kong, which has always been under the twin influence of long-inherited Chinese culture and imported Western values, are intriguing to compare and contrast on both a theoretical and practical level. Stigler and Hiebert (1999) argue that the act of teaching is culturally significant. The current study has the potential to shed insight on Chinese mathematics pedagogy, in addition to adding to a better understanding of mathematics classroom instruction in the two places "helpful. In a reiteration of the variation theory of education, "which has just recently been applied to studies of classroom teaching but whose original focus was on the learning process. There has never been an attempt like this before at a nationwide survey of math education in China. This idea will be enriched when its use is expanded into formal education settings. A comprehensive understanding of the practises in Hong Kong and Shanghai mathematics classrooms will be an excellent resource for the implementation of the reforms in the two cities, where "a number" of modifications have been "adopted in mathematics education "cities.

Keyword: Chinese mathematics pedagogy, theory of education

Introduction

The territory of Hong "Kong is situated in China's south-east. Six and a half million people live in an area measuring one square kilometre in size. Per capita GDP in 1999 was 183,000 HKD, or 23,000 USD, at market prices. People's Republic of China (PRC) government-affiliated city Shanghai is one of the country's major cities. The Long River Delta empties into the East Sea, where it is situated. A total of 13 million people live in an area of around 6,000 square kilometres, making up nearly 1% of China's total population. The GDP per capita in 1999 was 3,600 USD, or 30,000 RMB at current market values. Children in Shanghai "begin formal education at the age of six. They will be required

to attend school for nine years. There are two types of education: public and private. Primary, middle, and high school are divided into three distinct" levels: "5-4-3," "5-4-2," and "5-4-1." The "6-3"3" system, which covers six years of elementary, three years of junior high school, and three years of high "school, is another option. For elementary school enrollment since the mid-1980s, the neighbourhood approach has been used (Cai, 2019).

Students are advanced to the secondary level using the same approach. That implies that there is no public test for elementary and junior secondary school admissions. During the last year of obligatory school, pupils are required to take a public test to assess their ability. Students will be placed in several types of senior secondary schools based on the results of this test, including the comprehensive senior secondary (which includes normal and key" schools), and vocational schools. a) The Shanghai "Certificate of Senior Secondary is a public test that students must take after completing three years of high school. The Entrance Test for University is another public examination that students must pass if they wish to" continue their education at a university (Aguirre, 2019).

Background

East Asian pupils "consistently exceed their Western counterparts in math (Beaton et al, 1996; Husen, 1967; Lapointe as al., 1992; Mullis et al 1997, 2000; Robitaille., 1989; Stevenson et al, 1992;. 1993). For example, in the Third International Mathematical and Science Study (TIMSS), Singaporean, Korean, Japanese, and Hong Kongan students in primary and secondary schools took the top four places in mathematics achievement (Beaton et al 1996; Mullis et al 1997). Chinese pupils outperformed their Western counterparts in mathematics even though the country did not participate in TIMSS. As an example, in the 1992 IEAP Mathematics Study, Chinese students were placed first worldwide (Lapointe et al, 1992). International Math Olympiad champions" since 1990: They've won every year since 1990 (Alexandersson, et al., 2019).

In contrast to what "Western studies have discovered to be favourable to learning, a high class size, an examination-oriented curriculum, and teacher-centered teaching techniques were identified in East Asia. A number of scholars have been drawn to investigate the causes for East Asian students' higher arithmetic scores Some believe that kids' academic success or failure is linked to issues such as cultural values and curricula. According to Stevenson and Lee (1992), in East Asia, the social and cultural norms of emphasising education, attributing" success to effort, and family engagement in children's academic activities all contribute to pupils' exceptional academic performance. As a result, the results and "descriptions of math classes in the classrooms of students from Mainland China have been discordant in a few studies. According to Paine (1990) and Morris, et al. (1996), Chinese students were negative learners. Lee (1998) and Mok and Morris (2001) on the other hand concluded that Chinese students were positive learners. Even some research have shown that Chinese instructors favoured a constructive approach to learning and problem-solving procedures (Lee, 1998; Stevenson &" Stigler, 1992). Many additional findings (Morris et al. 1996; Paine, 1990) were in disagreement with this point (An, et al., 2019).

The purpose of the research

Because of the "political situation in China prior to the 1980s, studies on how students acquired mathematics have been limited. Secondly, although Western researchers have been interested in finding out the reasons for Chinese students' outstanding performance in mathematics since the 1960s (Wong, 1998; Leung, 1992), studies on how students acquired mathematics have been limited

since the 1960s. Despite the fact that many mathematics educators in China have actively participated in a variety of international conferences in recent years, only a small number of studies of Chinese mathematics education, particularly those involving students from Mainland China, have been published in international journals. Both theoretically and practically, a comparison of mathematics classes in Hong Kong, which has always been under the twin impact of long-inherited Chinese culture as well as imported Western ideals, and Shanghai, a modern metropolis with strong ties to Chinese culture, is fascinating. Teaching, according to Stigler and Hiebert (1999), is a form of cultural activity. In addition to contributing to a better knowledge of mathematics classroom instruction in the two locations, the current study may also provide light on Chinese mathematics pedagogy, which would be" beneficial. For the second time, the variation theory of learning, "which was initially concerned with the process of learning, has just lately been applied to research into classroom instruction. (Bauersfeld, 2019).

Literature Review

East Asian pupils "consistently exceed their Western counterparts in math For example, in the Third International Mathematical and Science Study (TIMSS), Singaporean, Korean, Japanese, and Hong Kongan students in primary and secondary schools took the top four places in mathematics achievement .Chinese pupils outperformed their Western counterparts in mathematics even though the country did not participate in TIMSS. As an example, in the 1992 IEAP Mathematics Study, Chinese students were placed first worldwide. Furthermore, TIMSS "statistics suggest that East Asian countries have more centralised and unified mathematics syllabuses, textbooks, and exams than Western countries (Schmidt et al., 1999). While textbooks in the United States were not" only 'a mile broad and an inch deep' but also prone to "redundancy and revision, in East Asia, textbook publishers have adhered to the syllabuses (Schmidt et al 1999, p.56). A 1999 study by Ma revealed that Chinese teachers often obtained 10 to 12 years of formal schooling, including teacher training, but US teachers typically received 16 to 18 years of formal schooling. The efficiency of instruction was suggested to be inversely related to the intellectual level of the instructor. According to Ma's (1999) findings, although though Chinese math instructors got less training, they were more knowledgeable about the topic and were able to implement successful teaching approaches. There has recently been a demand by Leung (2001) for a quest for an East Asian identity in mathematics education based on a large body of literature, stressing various dichotomies between East Asia and the West in characteristics and values Mathematical education in many cultural traditions" is currently the focus of the International Commission of Mathematical Instruction (ICMI) Committee (Bauersfeld, 2019).

Graf and Leung (2000) "conducted a comparative analysis of East Asia and the West. To fully grasp why East Asian children perform so well in mathematics, it is clear that the aforementioned research are essential. Comparative studies on how math is taught in classrooms across East Asia and the West have been overlooked in the past. Both teachers and classroom environments are seen to have an essential role in helping students create their mathematical conceptions (Cobb, 1994, quoted in Lee, 1998) When it comes to studying the teaching of mathematics in different cultures, researchers have made significant efforts to include students from China (Stevenson &" Stigler, 1992; Leung, 1992; Hiebert, 1999; the ongoing TIMSS-R Video Study), but these studies have often excluded Chinese students in Mainland China (Becker, et al., 2019).

As a result, the results and "descriptions of math classes in the classrooms of students from Mainland China have been discordant in a few studies. According to Paine (1990) and Morris, et al. (1996),

Chinese students were negative learners. Lee (1998) and Mok and Morris (2001) on the other hand concluded that Chinese students were positive learners. Even some research have shown that Chinese instructors favoured a constructive approach to learning and problem-solving procedures (Lee, 1998; Stevenson &" Stigler, 1992). Many additional findings (Morris et al. 1996; Paine, 1990) were in disagreement with this point (Biggs, 2019).

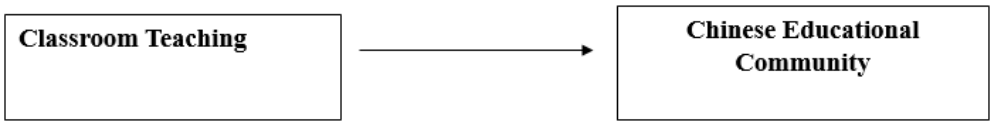
Research Question

1. What types of "patterns of variation may students in Hong Kong and Shanghai experience in the" mathematics classroom?
2. What are "the patterns of variance for students to experience the object of learning similar and different in Hong Kong and Shanghai's mathematics" classrooms?
3. Teachers' attitudes, "educational principles and curriculum policies all play a role in Hong Kong and Shanghai classrooms' similarities and differences. What are the various cultural interpretations of" this?

Methodology

Instead of being a "space where the instructor just performs planned regular tasks, the classroom is a place where many different aspects interact with one another. The relationship between students and the teacher has a significant impact on how a class proceeds and if it is effective (Tsui, 1995). From a variety of viewpoints, there has been a lengthy tradition of investigating classrooms for quite some time. An observation instrument with preset categories in coding classroom data is typically employed in earlier classroom research, which focused mainly on quantitative approaches 72. More recent research has emphasized qualitative approaches that are concerned with the interrelationship between the teaching and learning processes in the classroom, rather than" quantitative ones.

6.1 Conceptual Framework of the Study



6.2 Sampling and Data collection

The data will be collected according to strict procedures:

(1) **Videotaping:** "Each class will be videotaped with the use of two cameras. One of the cameras, which will be largely focused on the teacher, will be controlled" manually.

(2) **Teacher "Questionnaires:** Teachers' backgrounds, teaching techniques, attitudes, and professional development will all be explored via the use of a questionnaire developed" to gather information.

(3) **Student "Questionnaires:** A questionnaire will be administered to students in order to better understand their histories and aspirations for" schooling.

(4) **Student's "Written Work:** a sample of students' work in the lesson; examples of text pages, worksheets, and other materials that will be used in the session; and examples of tests that the instructor used to assess students' grasp of a specific idea that will be" taught in the lesson.

6.3 Data Analysis

TRVS "cassettes will be collected and submitted to a laboratory for transcription, coding, and analysis once they have been transcribed. After being digitised and saved in a multimedia database, the tapes will be combined with scanned files of auxiliary materials such as instructor questionnaires and students' questionnaires, and then archived in another multimedia database. As soon as the videos are digitised, the lessons will be transcribed, and the transcripts will be connected to the films in the multimedia database by time codes. The discussions between the teacher and the students in each class will then be translated into English by bilingual mathematics educators who are native speakers of English. A fair amount of inter-rater reliability of codes across coders will be tested in order to attain a high level of coding reliability. Coders can have immediate access to the video while working with the connected transcript thanks to the multimedia database software system known as vPrism. This makes it simple to get the context essential" for deciphering the transcript (Stigler, 1998).

Results

In order to give a sense of what a class may look like in Hong Kong before examining its emphasis and organization, a typical Hong Kong lesson will be detailed in depth. 5.1.1 Hong Kong as a Teaching Example Mr. DavicT2, who taught the HK7 filmed lesson, did not complete college but did complete teacher preparation. There have been seven years of him teaching science and math. His workplace is an all-English, secondary school for students in grades 7 through 12. The session, which typically lasts 40 minutes, had 40 pupils today. See Appendix C for a transcript of this lesson, which covers topics including examining the hypotenuse's features in right triangles, discussing Pythagoras' Theorem, proving the theorem, applying the theorem, and providing homework.

The aspects of variation that showed up at each step of these teachings will be evaluated here, and their overall pattern will be illustrated for you. 5.2.1 Introduction 5.2.1.1 Identification of Dimensions ofVariation 102 Initially, teachers attempted to aid students in remembering the properties of the hypotenuse of a right-angled triangle by generating multiple dimensions of variation, including varying the orientation of right-angled triangles and labeling their vertices and sides. These aspects of variation will not be examined in depth because their primary purpose is to provide background for understanding Pythagoras' Theorem. At this point, only one instructor (HK5) has stated the theorem straight at the start of the courses without presenting any modifications; the remaining instructors have all tried to explore the concept in various ways. So, we'll talk extensively about the dimensions of variation that are especially relevant for probing the theory. The ability to identify essential features of learning objects is central to the notion of variation. Since it was necessary to separate the area-to-sides ratio (I) and the side-to-area ratio (II), we found that there are two possible ways to uncover the theorem: D1 gets us to II directly (E3, E4), while D2 gets us to 11 by way of I (El, E2) (see Figure 5.3). In addition, two dimensions of variation were introduced using the Dl method. One involves determining the invariability, or the theorem, by comparing the square areas of several diagrams (E3), and the other involves speculating on the relationships between the sides by looking at a single triplet (E4).

The steps involved in applying Pythagoras' Theorem were broken out in earlier sections. This section will provide a comprehensive overview of how the topic is addressed in various Hong Kong

classrooms. Strategies for Beginning – Diving In Seven out of eight educators planned lessons on Pythagoras' Theorem's discovery. One educator dissected an area to show the area relationship and then deduced the side relationship, whereas the other half of the educators created activities in which students were tasked with deducing the side relationship by investigating the area relationship. The kids benefited from the firsthand discovery of the 135 side connection through the activities planned by two professors. It follows that Hong Kong educators place a premium on students' investigation of the theorem, with a focus on geometrical depiction. Diverse Methods of Justification Without justification, verification, and purely mathematical proofs were the three basic approaches of supporting the theorem.

In prior sections, we identified and depicted the dimensions of variance and the space of variation in the Hong Kong lessons. Students' participation in developing the dimensions of variety is also thought to play a significant role in determining how much they learn. Two different ideas were used to describe the students' involvement in this research. The funnel pattern and the concentrating pattern are two examples of classroom interaction patterns. There is also the conflict between teacher-centered and student-centered approaches to instruction (for definitions, see Chapter 4.5). In addition, when we combine these two ideas, we can draw the following conclusions: • For focused pattern, the teaching approach must be student-centered; • For funnel pattern, the teaching strategy may be either teacher-centered or student-centered. It was discovered that there were two types of student involvement in the Hong Kong classes: I. Funnel pattern involvement and student-centered involvement. II. A pedagogically focused, funnel-like structure. In what follows, you'll see examples of both kinds of student involvement. 137 Student-focused and funnel-shaped the definition of funnel pattern is that while assessing student knowledge, teachers always offer questions regarding facts to which they already know the answers.

"In this section, we studied the range of possible outcomes for these classes. The most important results are as follows: • Educators favored having pupils learn the theorem on their own by having them solve puzzles that required them to investigate the side relationship via area relationship. • There was a wider variety of approaches to the justification. Only three of the eight professors ever attempted to present proofs in mathematics. Six of the eight lectures had some form of verification, if we include some exploratory actions as verification. Each instructor underlined the importance of this comprehensive visual-based practice. Only about half of the exercises were meant to get students ready to use the theorem in practice, while the other half were meant to help them retain what they had learned. Concerning student participation, research shows that over half of educators make some effort to use a learner-centered approach. However, all of the lecturers used the funnel method of student-lecturer communication in the classroom. Conclusion Teachers maintained control over classroom activities, but they also encouraged student participation in the learning" process.

Discussion

Both the Hong Kong and Shanghai methods of teaching Pythagoras' Theorem depicted in the preceding chapters have their similarities and differences. From the standpoint of educational value and teachers' attitudes in general, as well as schooling culture such as teacher education and curriculum policy, this chapter seeks to understand the findings. The study's conclusions will be drawn at the" end. "This study's overarching goal, as stated in Chapter 1, is to gain insight into the nature of mathematics education in Hong Kong and Shanghai by analyzing the methods used to

teach Pythagoras' Theorem from a comparative viewpoint. The final three chapters presented the findings from a detailed comparison of the identical topic taught in eight Hong Kong classes and eleven Shanghai classes from the chosen viewpoint. The following is a summary of the most important findings from the study, which will be used for interpretation and discussion of the data. Parallels 8.1.1 Here are the significant parallels: Having a same instructional focus and format the curriculums in both cities are consistent and cover comparable ground:

Set the scene. To get started, let's go over some background info. The many applications of Pythagoras' Theorem were investigated in depth.

Justification: intellectually proving the theory or visually demonstrating the theorem.

Practicing: demonstrating examples, and conducting class activities; lessons finish with a review and homework assignment. 220 Putting an emphasis on investigating the issue at hand Teachers in both locations were seen to place a premium on allowing students to actively engage with the theorem through games, drawings, measurements,

Conclusion

So far as I can tell, "Exploratory activities, justification exercises, and a wide range of exercises are emphasised in larger Chinese classrooms, and teachers pay particular attention to how these strategies might best engage their students in the learning process. Therefore, it is proposed that the difficulty of Chinese mathematics instruction be examined once more. It was also shown that research into Chinese mathematics education is complicated by variances between Hong Kong and Mainland China "because to the differences between Hong Kong and Mainland China, should be done with caution.

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