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Using Video Study to Investigate Eighth-grade Mathematics Classrooms in Vietnam

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Zusammenfassung

Das *International Project for the Evaluation of Educational Achievement* (IEA) wurde in den 1950er Jahren gegründet. Seitdem führte das IEA viele Studien in Bereich mathematischer Bildung durch, insbesondere die *First International Mathematics Study* (FIMS) im Jahre 1964, die *Second International Mathematics Study* (SIMS) in den Jahren 1980–1982 und eine Reihe von Studien, die mit der *Third International Mathematics and Science Study* (TIMSS) begann und seit 1995 alle vier Jahre durchgeführt wird.

Nach Stigler et al. (1999) erreichten US-amerikanische Studenten bei FIMS und SIMS niedrigere Ergebnisse als Schüler anderer Länder (S. 1). Daher wurde TIMSS 1995 erweitert um eine 'Videotape Classroom Study' mit dem Ziel, „mehr über die unterrichtlichen und kulturellen Prozesse, die mit Leistung zusammenhängen", zu erfahren (S. 1; Übersetzung vom engl. Original).

Von den Ergebnissen der *TIMMS 1995 Video Study* ausgehend verglichen Stigler und Hiebert (1999) Unterricht mit „Gebirgszügen, die die Wasseroberfläche durchstoßen", womit sie ausdrücken sollten, was die Bergspitzen sichtbar, große Teile des Gebirges aber unter dem Wasser verborgen sind (S. 73–78; Übersetzung vom engl. Original). Durch die wiederholte Analyse videographierter Unterrichtsstunden aus Deutschland, Japan und den USA entdeckten sie, dass „die Arten des Unterrichts innerhalb jedes Landes von Stunde zu Stunde ähnlich sind. Zumindest gibt es bestimmte wiederkehrende Aspekte, welche für viele Stunden eines Landes typisch sind und die Stunden gegenüber anderen Ländern abgrenzen" (S. 77f.). Sie entdeckten außerdem, dass Unterricht eine „kulturelle Aktivität" ist, Unterrichtsarten also „verstanden werden müssen in Relation zu den kulturellen Überzeugungen und Annahmen, die sie umgeben" (S. 85, 88).

Hierauf aufbauend war es ein Ziel der Dissertation, kulturelle Aspekte des Mathematikunterricht zu untersuchen und die Ergebnisse mit Mathematikunterricht in Vietnam zu vergleichen. Ein weiteres Ziel war die Erhebung der Charakteristika vietnamesischen Mathematikunterricht durch eine Videostudie in Vietnam und der anschließende Vergleich dieser Charakteristika mit denen anderer Länder.

Im Einzelnen befasste sich diese Dissertation mit den folgenden Forschungszielen:

- Untersuchung der Charakteristika von Lehren und Lernen in unterschiedlichen Kulturen und vorläufiger Vergleich der Resultate mit dem Lehren und Lernen von Mathematik in Vietnam
- Einführung der TIMSS und der TIMSS Video Study und der methodologischen Vorteile von Videostudien für die Untersuchung von Mathematikunterricht in Vietnam
- Durchführung der Videostudie in Vietnam, um Unterrichtsskripte des Mathematikunterrichts in 8. Klassen in Vietnam zu identifizieren
- Vergleich ausgewählter Aspekte des Mathematikunterrichts in Vietnam mit denen anderer Länder auf der Grundlage der Videostudie in Vietnam und Diskussion von Ähnlichkeiten und Unterschieden zwischen Ländern
- Untersuchung der Herausforderungen für eine Innovation der Unterrichtsmethoden im Mathematikunterricht Vietnams

Diese Dissertation entstand in der Hoffnung, dass sie eine nützliche Referenz für Lehramtsstudenten zum Verständnis der Natur des Unterrichts und zur Entwicklung der eigenen Lehrerpersönlichkeit darstellen möge.

ABSTRACT

The International Project for the Evaluation of Educational Achievement (IEA) was formed in the 1950s (Postlethwaite, 1967). Since that time, the IEA has conducted many studies in the area of mathematics, such as the *First International Mathematics Study (FIMS)* in 1964, the *Second International Mathematics Study (SIMS)* in 1980-1982, and a series of studies beginning with the *Third International Mathematics and Science Study (TIMSS)* which has been conducted every 4 years since 1995.

According to Stigler et al. (1999), in the FIMS and the SIMS, U.S. students achieved low scores in comparison with students in other countries (p. 1). The TIMSS 1995 *"*Videotape Classroom Study*"* was therefore a complement to the earlier studies conducted to learn "more about the instructional and cultural processes that are associated with achievement" (Stigler et al., 1999, p. 1). The *TIMSS Videotape Classroom Study* is known today as the *TIMSS Video Study*.

From the findings of the TIMSS 1995 Video Study, Stigler and Hiebert (1999) likened teaching to "mountain ranges poking above the surface of the water," whereby they implied that we might see the mountaintops, but we do not see the hidden parts underneath these mountain ranges (pp. 73-78). By watching the videotaped lessons from Germany, Japan, and the United States again and again, they discovered that "the systems of teaching within each country look similar from lesson to lesson. At least, there are certain recurring features [or *patterns*] that typify many of the lessons within a country and distinguish the lessons among countries" (pp. 77-78). They also discovered that "teaching is a cultural activity," so the systems of teaching "must be understood in relation to the cultural beliefs and assumptions that surround them" (pp. 85, 88).

From this viewpoint, one of the purposes of this dissertation was to study some cultural aspects of mathematics teaching and relate the results to mathematics teaching and learning in Vietnam. Another research purpose was to carry out a video study in Vietnam to find out the characteristics of Vietnamese mathematics teaching and compare these characteristics with those of other countries.

In particular, this dissertation carried out the following research tasks:

- ❖ Studying the characteristics of teaching and learning in different cultures and relating the results to mathematics teaching and learning in Vietnam
- ❖ Introducing the TIMSS, the TIMSS Video Study and the advantages of using video study in investigating mathematics teaching and learning
- ❖ Carrying out the video study in Vietnam to identify the image, scripts and patterns, and the lesson signature of eighth-grade mathematics teaching in Vietnam
- ❖ Comparing some aspects of mathematics teaching in Vietnam and other countries and identifying the similarities and differences across countries
- ❖ Studying the demands and challenges of innovating mathematics teaching methods in Vietnam – lessons from the video studies

Hopefully, this dissertation will be a useful reference material for pre-service teachers at education universities to understand the nature of teaching and develop their teaching career.

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Vu Dinh Phuong

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

Abbreviation	Meaning
AH	Assignment of Homework
AO	Answered Only Problem
BK	Break
CACL	Calculator
CH	Chalkboard
CI 1	Public Interaction
CI 2	Optional, teacher presents information
CI 3	Optional, student presents information
CI 4	Mixed private and public work
CI 5	Private Interaction
COMP	Computer
CPCW	Concurrent Problem Class Work
CPM	Concurrent Problem Mixed Activity
CPSU	Concurrent Problem Set-Up
CPSW	Concurrent Problem Seat Work
CPV	Centrum Pedagogickesho Výzkumu (Educational Research Centre)
DESI	Deutsch English Schülerleistungen International
FIMS	First International Mathematics Study
GS	Goal Statement
HB	Historical Background
IBM	The International Business Machines
IEA	The International Association for the Evaluation of Educational Achievement
IP	Independent Problem
IPN	Leibniz – Institut für die Pädagogik der Naturwissenschaften und Mathematik
ITIP	Interruption Type: Independent Problem
ITPP	Interruption Type: Problem Piece
LES	Time of the lesson
LPS	The Learner's Perspective Study
MO	Mathematics Organization/Managements
NAEP	The National Assessment of Education Progress
NCES	The National Center for Education Statistics
NM	Non-Mathematical/Off-Topic
NMWP	Non-Mathematics Within Problems
NP	Non-Problem
OECD	The Organization for Economic Cooperation and Development
OI	Outside Interruption
P 1	Reviewing
P 2	Introducing new content
P 3	Practicing new content
PAMM	Program Against Micronutrient Malnutrition

PIRLS	The Progress in International Reading Literacy Study
PISA	The Program for International Student Assessment
PPS	Proportionate to Population Size
PRO	Projector
RLNP	Real Life Connection/Application – Non Problem
RWO	Real-World Object
SIMS	Second International Mathematics Study
SL	Summary of Lesson
SMM	Special Mathematical Material
TIMSS	The Third International Mathematics and Science Study
TP	Technical Problem
TV	Television or Video
TXW	Textbook or Worksheet
UNICEF	United Nations Children's Fund

LIST OF TABLES, EXHIBITS, IMAGES, AND FIGURES

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INTRODUCTION

> All children can benefit from studying and developing strong skills in mathematics. Primarily, learning mathematics improves problem-solving skills, and working through problems can teach persistence and perseverance. Mathematics is essential in daily life for such activities as counting, cooking, managing money, and building things. Beyond that, many career fields require a strong mathematical foundation, such as engineering, architecture, accounting, banking, business, medicine, ecology, and aerospace. Mathematics is vital to economics and finance, as well as to computing technology and software development underlying our technologically advanced and information-based world. (Grønmo et al., 2013, p. 11)

However, many students acquire a lot of mathematical knowledge, but they do not know why they have to learn it, nor how to use this knowledge in their day-to-day lives. It may be that the content of mathematical textbooks has not been written well enough, or that teachers have not been teaching mathematics well enough. Educators and educational researchers should play an important role in dealing with this problem.

According to Nguyen Ba Kim (2011), as a field of research, the field of mathematics education must answer three questions:

> ❖ What is the purpose of teaching mathematics? (i.e. the *purpose* of mathematics subject in school must be clarified);
> ❖ Which content in the science of mathematics should be chosen to teach in school? (i.e. the *content* of mathematics subject in school must be determined);
> ❖ How should mathematics be taught? (i.e. the principles, methods, organizational forms, and mathematics teaching aids, seen in general as *methods* in a broad sense, must be studied)[1]. (pp. 12-13) *(Translated from Vietnamese by Vu)*

Educational researchers will conduct studies to discover the answers to these questions. However, mathematics teachers are people who apply these findings to each specific lesson. So, before teaching each mathematics lesson, the teachers should know the answers to similar questions: *Why should I teach this lesson*? *What should I teach in this lesson*? *How should I teach this lesson*? The answers to these questions thus help teachers to know the particular *teaching purposes*, *teaching content*, and *teaching methods* related to a specific mathematics lesson.

Normally, before teaching any mathematics lesson, teachers have to study the textbooks and instructional guide-books to understand the purposes and the content of that lesson. After that, the teachers will decide on suitable methods to use to teach that lesson. This means that each teacher has his or her own teaching method to teach a specific mathematics lesson. All teachers are free to find ways of teaching mathematics that resonate most with their particular situations.

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1. "Lĩnh vực nghiên cứu Phương pháp dạy học môn Toán phải giải đáp các câu hỏi:
   - ❖ Dạy học Toán để làm gì? (tức là phải làm rõ *mục tiêu* môn toán);
   - ❖ Dạy học những gì trong khoa học Toán học? (tức là phải xác định rõ *nội dung* môn Toán trong nhà trường phổ thông);
   - ❖ Dạy học môn Toán như thế nào? (tức là phải nghiên cứu những nguyên tắc, phương pháp, hình thức tổ chức, phương tiện dạy học môn Toán, có thể nói chung là *phương pháp* theo nghĩa rộng)." (Nguyen Ba Kim, 2011, pp. 12-13)

But are their teaching methods totally different?

Most people think that each teacher has his or her own teaching method, and that different teachers will teach in different ways when teaching the same mathematics content. However, Stigler and Hiebert (1999) asserted that, in each country, teachers are teaching in the same way, which is called the "cultural script for teaching". (pp. 86-87)

To understand more clearly about *cultural scripts for teaching* in each country, we must investigate what happens inside the classrooms of that country. Traditionally, we usually investigate what happens inside the classroom through questionnaires or observation. But the events in the classroom may happen so quickly that we may overlook some important aspects when using the questionnaires or observing directly (see Stigler et al., 1999, p. 3). We might only see *the part of the iceberg above the water,* but not *the part of the iceberg under the water* as regards teaching with these two traditional methods of research.

Video study "overcomes" the weak points of the two traditional methods described above (Hiebert et al., 2003, pp. 4-5). We can qualitatively and quantitatively analyze many aspects in the classroom through watching videos (see Jacobs, Kawanaka, and Stigler, 1999, p. 718). By watching over and over again what happens in the classroom, we can see more deeply inside the *cultural scripts for teaching* which we may not see with traditional methods of research (see Stigler and Hiebert, 1999, pp. 73-101). From watching videos of teaching in different countries, we can understand how the teaching methods in one country are similar and different from those in other countries (see Hiebert et al., 2003, pp. 119-151).

Video study was first conducted in the education field in the 1930s (Hiebert et al., 2003, p. 9). However, a video study on a large scale across countries was first conducted in 1995 by the International Association for the Evaluation of Educational Achievement (IEA) and was funded by the National Center for Education Statistics (NCES) (Stigler et al, 1999, pp. 1-2). This video study was a complement to the Third International Mathematics and Science Study (TIMSS) to find out "more about the instructional and cultural processes that are associated with achievement" (Stigler et al, 1999, p. 1). This video study investigated mathematics classrooms in Germany, Japan, and the United States, and is also known as the TIMSS 1995 Video Study.

In 1999 the TIMSS Video Study was once again funded by the NCES. "Larger and more ambitious than the first", the TIMSS 1999 Video Study investigated eighth-grade mathematics as well as science in seven countries (National Center for Education Statistics, 2003, p.1). Since that time forward, many video studies have observed education all over the world. These video studies will be described in detail in Chapter 3 of this dissertation.

One video study based on the TIMSS Video Study was carried out to investigate eighth-grade mathematics classrooms in Vietnam and provided the major data for writing this dissertation. The main purpose of this video study was to bring to light the image, the scripts and patterns, and the lesson signature of mathematics teaching in Vietnam. The results of this video study were compared with the results of the TIMSS Video Studies and other studies on some aspects of mathematics teaching across countries. And the last purpose of this video study was to improve mathematics teaching and learning in Vietnam.

Because "teaching is a cultural activity," so the systems of teaching "must be understood in relation to the cultural beliefs and assumptions that surround them" (Stigler and Hiebert, 1999, pp. 85, 88). It means that if we want to improve teaching, we must study the cultural aspects of teaching and learning in each country. So, this dissertation started with an overview of "mathematics teaching and learning in different cultures" in Chapter 1. This chapter related mathematics teaching and learning to the culture. This chapter also presented the characteristics of teaching and learning in individualistic and collectivistic cultures, as well as in the so-called power distance cultures.

The video study providing the data for this dissertation was based on the TIMSS Video Study, so Chapter 2 of this dissertation presented the Third International Mathematics and Science Study (TIMSS). The First International Mathematics Study (FIMS) and the Second International Mathematics Study (SIMS) were also presented briefly in this chapter to provide a clearer historical background. In this chapter, a comparison between the Third International Mathematics and Science Study (TIMSS) and the Program for International Student Assessment (PISA) in mathematics and science was also presented.

Chapter 3 of this dissertation presented the TIMSS Video Study. Firstly, the video study was presented as a research method in mathematics education with advantages and disadvantages. After that, some aspects of the TIMSS video study, such as the purposes, objects, participating countries, and so on, were introduced. What researchers have already studied in the TIMSS Video Study and other video studies were also presented in this chapter. Based on what researchers have already studied in video studies, the dissertation conducted a similar video study in Vietnam, but this video study was modified so that it was suitable for individual research.

The methodology and the results of the video study in Vietnam can be found in Chapter 4 of this dissertation. In this chapter, the Vietnamese eighth-grade mathematics lesson signature was identified from 27 videotaped lessons at 22 schools in three provinces and cities in Vietnam. Of course, 27 videotaped lessons might not be representative of all Vietnamese lessons, and these teachers and students observed might have acted differently than usual under observation. However, Hiebert et al. (2003) believed that "teachers are likely to be constrained by what students expect and by their own repertoire of teaching practices. Videotaped lessons probably are best interpreted as a slightly idealized version of what the teacher typically does in the classroom." (p. 7)

So, the 27 videotaped lessons were approached as the lessons in which the teachers used their best methods to teach and the students used their best attitudes to learn mathematics. Or, at least the teachers thought that they used the best methods to teach mathematics in these lessons.

Although the teachers tried their best to teach mathematics in these videotaped lessons, or thought they tried their best, most lessons were not good as expected. There was a large gap between what the teachers knew about how to teach mathematics well and what the teachers actually did in the classrooms in Vietnam.

From the results of Chapter 4, mathematics teaching in Vietnam was compared with mathematics teaching in 8 other countries in Chapter 5. In this chapter, the images as well as the patterns of mathematics teaching in Germany, Japan, the United States, and Vietnam were also presented and compared.

Chapter 6 presented the demands and challenges of innovating mathematics teaching methods in Vietnam – lessons learned from the video studies. In this chapter, the dissertation presented the needs and goals of innovating mathematics teaching method in Vietnam. After that, from the results of previous chapters, the dissertation presented the elements that influence mathematics teaching and learning in Vietnam. These elements created a lot of challenges in the innovation of mathematics teaching methods, which were also presented in this chapter. Improving mathematics teaching requires the efforts of teachers, students, parents, schools, and politicians, and should take place as a long-term process with small changes happening in core classroom processes over time (Stigler and Hiebert, 1999, pp. 132, 135). From the results of coding the videotaped lessons, this dissertation proposed some measures which teachers and schools should do immediately to improve mathematics teaching and learning and innovate mathematics teaching methods in Vietnam. Other measures for significant improvement need to be studied in other careful research studies.

A short but important chapter is the last chapter. In this chapter, the dissertation summarized the main findings presented in previous chapters. After that, the dissertation proposed ideas for further studies.

This dissertation will hopefully provide good reference material for student teachers at Vietnamese universities seeking to understand more about the characteristics of teaching. They may carry out their own video studies on a small scale that support them in their teaching careers.

RESEARCH PURPOSE AND RESEARCH METHODS

1. Research purpose of the dissertation

The major research purpose of this dissertation is to investigate mathematics classrooms in Vietnam and to compare some aspects of mathematics teaching and learning in Vietnam with those in other countries.

With this purpose, the dissertation examined two recently popular studies comparing student achievement in secondary schools across a number of countries, namely the Third International Mathematics and Science Study (TIMSS) and the Program for International Student Assessment (PISA).

In 2012, Vietnam participated in the PISA for the first time, so many Vietnamese educational researchers have carefully studied the PISA recently. However, Vietnam has never participated in the TIMSS, so TIMSS seems to be a new topic of study for many Vietnamese educational researchers. For this reason, this dissertation introduces the TIMSS to educational researchers in Vietnam and other countries.

The International Project for the Evaluation of Educational Achievement (IEA) was formed in the 1950s (Postlethwaite, 1967). Since that time, the IEA has conducted many studies in the field of mathematics, such as the *First International Mathematics Study (FIMS)* in 1964, the *Second International Mathematics Study (SIMS)* in 1980-1982, and a series of studies beginning with the *Third International Mathematics and Science Study (TIMSS)* which has been conducted every 4 years since 1995.

According to Stigler et al. (1999), in the FIMS and the SIMS, U.S. students achieved low scores in comparison with students from other countries (p. 1). The TIMSS 1995 *"*Videotape Classroom Study*"* was thus conducted as a complement to find out "more about the instructional and cultural processes that are associated with achievement" (Stigler et al., 1999, p. 1). The *TIMSS Videotape Classroom Study* is known today as the *TIMSS Video Study*.

From the findings of the TIMSS 1995 Video Study, Stigler and Hiebert (1999) likened teaching to "mountain ranges poking above the surface of the water," whereby they implied that we may see the mountaintops, but we do not see the hidden parts underneath these mountain ranges (pp. 73-78). By watching the videotaped lessons from Germany, Japan, and the United States again and again, they discovered that "the systems of teaching within each country look similar from lesson to lesson. At least, there are certain recurring features [or *patterns*] that typify many of the lessons within a country and distinguish the lessons among countries" (pp. 77-78). They also discovered that "teaching is a cultural activity," so the systems of teaching "must be understood in relation to the cultural beliefs and assumptions that surround them" (pp. 85, 88). From this viewpoint, one of the purposes of this dissertation was to study some cultural aspects of mathematics teaching and relate the results to mathematics teaching and learning in Vietnam. Another research purpose was to carry out a video study in Vietnam to identify the characteristics of Vietnamese mathematics teaching and compare these characteristics with those in other countries. To achieve these research goals, the dissertation carried out the following research tasks:

❖ Studying the characteristics of teaching and learning in different cultures and relating the results to mathematics teaching and learning in Vietnam

❖ Introducing the TIMSS, the TIMSS Video Study and the advantages of using video study in investigating mathematics teaching and learning

❖ Carrying out a video study in Vietnam to identify the image, scripts and patterns, and the lesson signature of eighth-grade mathematics teaching in Vietnam

❖ Comparing some aspects of mathematics teaching in Vietnam and other countries and identifying the similarities and differences across countries

❖ Studying the demands and challenges of innovating mathematics teaching methods in Vietnam – lessons from the video studies

Hopefully, this dissertation will be a useful reference material for pre-service teachers at education universities to understand the nature of teaching and develop their teaching careers.

To carry out these research tasks, the dissertation used research methods which will be presented in the next section.

2. Research methods of the dissertation

There are many research methods in mathematics education, such as theoretical study, observation, survey, design experiments, and so on. From studying the TIMSS Video Study, the dissertation discovered that video study can be seen as a research method in mathematics education with a lot of advantages. This will be explained in the wider methodological context below:

❖ Theoretical study: this is a research method using the available documents, scientific results in various fields such as psychology, pedagogy, mathematics, and so on to find new knowledge to apply to mathematics education.[1] (Nguyen Ba Kim, 2011)

In this dissertation, the *theoretical study* method was used to study the books, scientific articles, and websites about culture, societal changes, mathematics textbooks, student achievement, and characteristics of teaching, among others, and apply the knowledge gained to the field of mathematics education.

1. Nghiên cứu lý luận là phương pháp nghiên cứu sử dụng các tài liệu, kết quả khoa học sẵn có ở nhiều lĩnh vực như Tâm lý học, Giáo dục học, Toán học … để tìm ra *cái mới* vận dụng vào Phương pháp dạy học Toán. (Nguyen Ba Kim, 2011, p. 27)

❖ Observation: This is a research method to obtain new information by observing educational phenomenon from an outside perspective without educational interventions.[2] (Nguyen Ba Kim, 2011, p. 28)

In this dissertation, the *observation* method was used to observe school- and university-level mathematics classrooms in Potsdam, Germany. The purposes of observation were to find out the similarities and differences between mathematics teaching methods used in Germany and Vietnam.

❖ Survey: This is a research method to obtain new information from within the educational phenomenon by using questionnaires and tests without educational interventions.[3] (Nguyen Ba Kim, 2011, p. 28)

In this dissertation, the *survey* method was used to ask Vietnamese teachers and students about the videotaped lessons and other related information through questionnaires. The questionnaires were based on the questionnaires used in the TIMSS 1999 Video Study and were translated into Vietnamese.

❖ Video study: This is a research method referring to "research of social or educational reality based on analysis of video recordings" (Janík, Seidel, and Najvar, 2009).

In this dissertation, the *video study* method was conducted through 4 stages: ***plans for data collection:*** studying the materials from the TIMSS Video Study, and randomly choosing Vietnamese schools in which to videotape lessons; ***data collection:*** videotaping 27 mathematics lessons and collecting additional materials such as questionnaires, copies of worksheets or textbooks, and so on; ***data coding:*** watching and coding the 27 videos; and ***data analysis:*** analyzing the data from the results of coding the videos to draw the important conclusions about eighth-grade mathematics teaching in Vietnam.

Each research method always has its own advantages and disadvantages. Thus, the dissertation combined these research methods to reinforce their advantages as well as to reduce their disadvantages. Many interesting findings resulted from these research methods, which will be presented in the following 7 chapters.

2. Quan sát là phương pháp nghiên cứu thu thập những thông tin mới bằng việc quan sát những dấu hiệu thông tin *bên ngoài* của những hiện tượng giáo dục mà không chủ động gây nên các tác động giáo dục. (Nguyen Ba Kim, 2011, p. 28)

3. Điều tra là phương pháp nghiên cứu sử dụng phiếu điều tra, các bài kiểm tra để thu thập những thông tin *bên trong* những hiện tượng giáo dục mà không chủ động gây nên các tác động giáo dục. (Nguyen Ba Kim, 2011, p. 28)

CHAPTER 1

MATHEMATICS TEACHING AND LEARNING IN DIFFERENT CULTURES

The main purpose of this dissertation is to use the method of video study to investigate eighth-grade mathematics classrooms in Vietnam. The procedure of this video study is based on the procedure of the TIMSS Video Study. From the findings of the TIMSS 1995 Video Study, Stigler and Hiebert (1999) discovered that "teaching is a cultural activity," so the systems of teaching "must be understood in relation to the cultural beliefs and assumptions that surround them" (pp. 85, 88).

Based on this viewpoint of Stigler and Hiebert, the dissertation starts by studying mathematics teaching and learning in different cultures. The findings of this chapter will be combined with the results of the video study in Chapter 4 to find out the demands and challenges of innovating mathematics teaching methods in Vietnam as presented in Chapter 6 of this dissertation.

Why should we study mathematics teaching and learning in different cultures? Hofstede (1986) asserted that

> As long as human societies have been in contact with each other, voluntarily or involuntarily, there have been cross-cultural learning situations: teacher/student pairs in which the partners were born, raised and mentally programmed in different cultures prior to their interaction in *school.* (p. 302)

Teaching and learning in different cultures are marked by different characteristics. For this reason, there may be difficulties in interaction between teachers and students if they come from different cultures. Understanding the characteristics of mathematics teaching and learning in various cultures may help us to overcome these difficulties.

This chapter clarifies the cultural aspects of mathematics teaching and learning that help us understand more about these activities.

1.1. Culture and cultural activity

1.1.1. Culture

Culture is a complex concept that is difficult to define. However, many researchers have attempted to describe it. Most of them considered culture to be *the learned behaviors*, *shared or held aspects in common*, or *cultivated behaviors* of a group of people, and these behaviors are transmitted from generation to generation.

> Culture is like the air we breathe, permeating all we do. And the hardest culture to examine is often our own, because it shapes our actions in ways that seem second nature. (Trumbul, Rothstein-Fisch, and Greenfield, 2000, p. 2)

Bates and Plog (1990) asserted that

> Broadly defined, **culture** is a system of shared beliefs, values, customs, behaviors, and artifacts that the members of a society use to cope with their world and with one another, and that are transmitted from generation to generation through learning. (p. 7)

Schein (1997) said that not every group of people has a culture, and that the culture is only formed and developed when the group "has had enough of shared history to have formed such a set of *shared* assumptions" (pp. 12, 15).

Normally, all people in each country share a common culture which includes language, customs, rituals, and so on. However, in each country, there may be smaller groups of people who have their own cultures.

Schein (1997) considered the culture of a group to be

> *a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems.* (p. 12)

The particular culture of a group is very important to consider in order to understand the culture of a school, which can be seen as a group consisting of principal, teachers, and students. According to Short and Greer (1997), as a company or business, each school has its own culture that differs from other schools' cultures (p. 26). The school culture can be described as "its essence, composed of the traditions, beliefs, policies, and norms of the school" (Short and Greer, 1997, p. 26 cited in Willower, 1984). The school's culture can be shaped, enhanced, and maintained through the school's leaders (Short and Greer, 1997, p. 26). The group of teachers in each country or in a school may have sufficient conditions to form their own teaching culture.

Eliot (1988) decided that

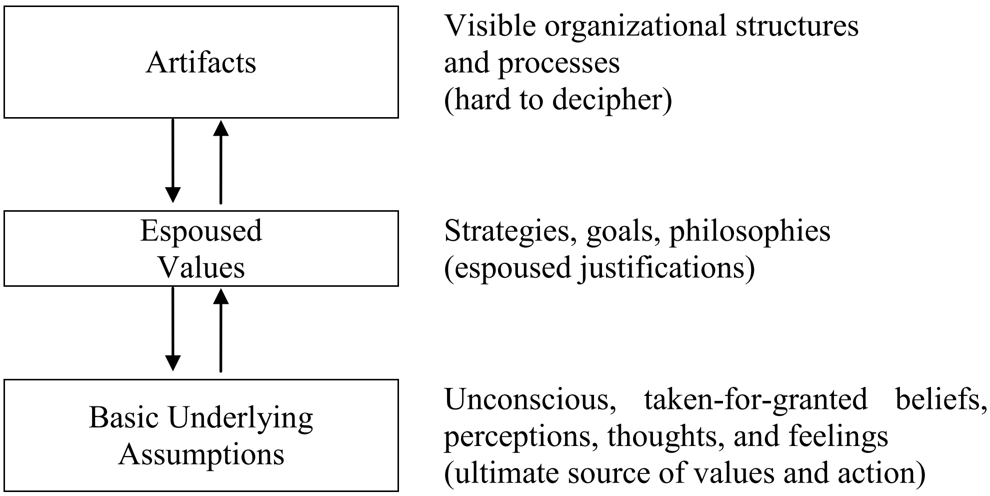
> The culture of the individual is dependent upon the culture of a group or class, and that the culture of the group or class is dependent upon the culture of the whole society to which that group or class belongs. Therefore it is the culture of the society that is fundamental, and it is the meaning of term 'culture' in relation to the whole society that should be examined first. (p. 21)

1.1.2. Three levels of culture

When we go abroad to other country, we can observe a classroom in that country. What is different between the classrooms in that country and in our own country that we can see, hear, or feel? Of course, we can hear the different language, we can see the different style of clothing, or we can feel the different manners of address of teacher and students. Those things are on the first level of the teaching culture. Let us study three levels of culture before looking back on teaching as a cultural activity.

Schein (1997) differentiated between the three "levels of culture" shown in Figure 1.1 as follows:

Figure 1.1. Levels of Culture



Source: Schein (1997, p. 17)

Schein (1997) asserted that

> Culture as a set of basic assumptions defines for us what to pay attention to, what things mean, how to react emotionally to what is going on, and what actions to take in various kinds of situations…
>
> The human mind needs cognitive stability. Therefore, any challenge to or questioning of a basic assumption will release anxiety and defensiveness. (pp. 22-23)

1.1.3. Cultural activity

Hiebert and Stigler (2000) asserted that "cultural activities are common everyday routines that have evolved, in ways that are consistent with underlying assumptions and beliefs, to deal with recurring tasks" (pp. 7-8). Cultural activities "are so widely shared that they are nearly invisible" (Hiebert and Stigler, 2000, p. 8).

Most Vietnamese people pick up food with chopsticks and they rarely ask themselves why they use chopsticks or how they should use chopsticks to eat their meals. They do this unconsciously, as though it were second nature to pick up food with chopsticks. If Vietnamese people go to Germany, they realize that it is very difficult to pick up a beefsteak with chopsticks. They have to try using a knife and fork to eat their meals. They also realize that using chopsticks is not the only way to eat meals, as they once thought. For most Vietnamese people, picking up food with chopsticks is a cultural activity.

Stigler and Hiebert (1998a) said that

> Cultural activities are represented in cultural scripts, generalized knowledge about the event that resides in the heads of participants. These scripts not only guide behavior, they also tell participants what to expect. Within a culture, these scripts are widely shared, and therefore they are hard to see…
>
> Cultural scripts are learned implicitly, through observation and participation – not by deliberate study. This differentiates cultural activities from other endeavors. (p. 1)

Other examples of cultural and non-cultural activities include the following:

- ❖ Driving on the left side of the road is a cultural activity for most English people but it is not a cultural activity for most Germans and Vietnamese.
- ❖ Playing tennis is not a cultural activity. People decide to learn how to play tennis.
- ❖ Breathing is not a cultural activity. It is called human nature.

1.1.4. Relating mathematics teaching and learning to culture

In this section, the dissertation applies the viewpoints of some other researchers about teaching in general to mathematics teaching in particular.

Stigler and Hiebert (1998a) asserted that "teaching is a cultural activity" that people learn to do through informal participation over long periods of time in a culture rather than by formal study in a school or university (p. 2).

From the point of view of Stigler and Hiebert above, we can assert that mathematics teaching, in particular, is also *a cultural activity*.

Why is mathematics teaching a cultural activity?

Some may argue that mathematics teachers learned how to teach mathematics in colleges or universities, so mathematics teaching is not *a cultural activity*. This sounds reasonable because most people must study three or four years or longer in colleges or universities to become mathematics teachers in most countries.

However, the fact is that mathematics teachers formed the "scripts for teaching" before they learned how to teach mathematics in colleges or universities (Stigler and Hiebert, 1998a, p. 2). These *scripts for teaching* were formed during the time people learned mathematics themselves in school. They saw their teachers teaching mathematics every week and learned the way to teach mathematics unconsciously from their teachers. What mathematics teachers learned in colleges or universities to teach mathematics just helped them understand more clearly or improve the *scripts for teaching* which were formed during the time they learned mathematics in school. For these reasons, mathematics teaching is also *a cultural activity.*

As mentioned above, Schein (1997) differentiated between three *levels of culture*. Mathematics teaching is *a cultural activity*, so it is also differentiated into three levels:

❖ *"Artifacts"*: including "all the phenomena that we see, hear, and feel when we encounter a new group with an unfamiliar culture" (Schein, 1997, p. 17). For example, if a Vietnamese teacher attends a mathematics classroom in Germany for the first time, that teacher will very easily observe some aspects of German classrooms that are different from Vietnamese classrooms, such as the language used in teaching (German), a lower number of students in the classroom than in Vietnamese classrooms (about 25 students in German classrooms (Stigler and Hiebert, 1999, p. 28), and about 45 students in Vietnamese classrooms), the teaching tools used by the teacher (there are overhead projectors and adjustable boards in most German classrooms), the mathematics content taught by the teacher, and the form of address in the classroom (German students may call the teacher by name inside the classroom, while Vietnamese students never call the teacher by name inside the classroom, only Sir or Madam without the name).

❖ *"Espoused values*: the articulated, publicly announced principles and values that [mathematics teachers] claim to be trying to achieve" (Schein, 1997, p. 9). For example, if we ask the teacher *what they will teach in the given lesson*, *what they will expect students to learn, and how they will teach the given lesson*, the teachers may tell you that *they will teach the similar triangles*, *they expect students to know how to prove two triangles are similar*, *they will teach in a student-centered manner*… these *espoused values* are written into the curriculum, and other documents guiding the teachers how to teach. Most teachers know these *espoused values* and they state openly they are trying to achieve them. But actually, they may not reach these goals in the practice of teaching. There is always the gap between what teachers want to do and what teachers actually do in the classroom.

❖ *"Basic underlying assumptions*: Unconscious, taken for granted beliefs, perceptions, thoughts, and feelings (ultimate source of values and action)" (Schein, 1997, p. 17). For example, most Vietnamese mathematics teachers start most mathematics lessons by checking the homework and giving grades. They do this automatically every lesson. They do not even ask themselves why they do this, or whether it is good or not. This is taken for granted and transmitted from generation to generation of teachers. This makes all students and teachers believe that it is second nature when every mathematics lesson is started by checking the homework and giving students grades.

In this section, the dissertation has related mathematics teaching to the overarching culture. It can be asserted that mathematics teaching in each country is always affected by the culture of that country. The next section will show the different characteristics of mathematics teaching and learning in different cultures.

1.2. Mathematics teaching and learning in different cultures

There are some dimensions used to classify cultures all over the world. This dissertation focuses on just two of them: individualism and collectivism, and power distance.

1.2.1. Mathematics teaching and learning in Individualistic and Collectivistic cultures

Firstly, we study the difference between individualistic and collectivistic cultures.

Morris, Davis, and Allen (1994) define individualism and collectivism as follows:

> Individualism refers to a self-orientation, an emphasis on self-sufficiency and control, the pursuit of individual goals that may or may not be consistent with in-group goals, a willingness to confront members of the in-group to which a person belongs, and a culture where people derive pride from their own accomplishments. In an individualistic environment, people are motivated by self-interest and achievement of personal goals. They are hesitant to contribute to collective action unless their own efforts are recognized, preferring instead to benefit from the efforts of others.
>
> Collectivism involves the subordination of personal interests to the goals of the larger work group, an emphasis on sharing, cooperation, and group harmony, a concern with group welfare, and hostility toward out-group members. Collectivists believe that they are an indispensable part of the group, and will readily contribute without concern for advantage being taken of them or for whether others are doing their part. They feel personally responsible for the group product and are oriented towards sharing group rewards. (p. 67)

Trumbul, Rothstein-Fisch, and Greenfield (2000) also brought out the "salient features of individualism and collectivism" in Table 1.1 below.

Table 1.1. Salient Features of Individualism and Collectivism

Individualism	**Collectivism**
1. Fostering independence and individual achievement	1. Fostering interdependence and group success
2. Promoting self-expression, individual thinking, personal choice	2. Promoting adherence to norms, respect for authority elders, group consensus
3. Associated with egalitarian relationships and flexibility in roles (e.g., upward mobility)	3. Associated with stable, hierarchical roles (dependent on gender, family background, age)
4. Understanding the physical world as knowable apart from its meaning for human life	4. Understanding the physical world in the context of its meaning for human life
5. Associated with private property, individual ownership	5. Associated with shared property, group ownership

Source: Trumbul, Rothstein-Fisch, and Greenfield (2000, p. 3)

From the results of a survey by the International Business Machines (IBM) Corporation, the individualism index values for 50 countries and three regions were presented in Hofstede (2001). Some values can be seen in Table 1.2 below.

Table 1.2. Individualism Index Values for some countries in the IBM sample

Country	**Individualism Index**
United States	91
Australia	90
Great Britain	89
Netherlands	80
Italy	76
Belgium	75
France	71
Switzerland	68
Germany (F.R.)	67
Spain	51
Japan	46
Hong Kong	25
Singapore	20
South Korea	18
Costa Rica	15
Indonesia	14
Panama	11
Guatemala	6
Mean of 53 countries and regions	**43**

Source: Adapted from Exhibit 5.1 in Hofstede (2001, p. 215)

Although the United States and Guatemala had the highest and lowest individualism index values, respectively (see Table 1.2 above), it did not mean that all people in the U.S. were individualists and all people in Guatemala were collectivists. In every country, there are always people who are individualists or collectivists. The individualists and collectivists have different beliefs and behaviors that relate to "individual fulfillment and choice versus interdependent relations, social responsibility, and the well-being of the group" (Trumbul et al., 2001, p. 4). Pinillos and Reyes (2011) asserted that:

> In the individualist philosophy, "I" is more important than "we", and success is a personal achievement. In the collectivist philosophy, in contrast, "we" is more important than "I", and individuals are willing to make sacrifices in favour of the position, performance and satisfaction of the group. (p. 26)

From the survey of the IBM Corporation, Hofstede (2001) presented some key differences between collectivist and individualist societies in the *family* and in *personality and behavior*. Let us see these differences in Table 1.3 below.

Table 1.3. Key differences between collectivist and individualist societies

Collectivist	Individualist
In the Family	
- Family provides protection in exchange for lifelong loyalty.	- Children are supposed to take care of themselves as soon as possible.
- Strong family ties, frequent contacts.	- Weak family ties, rare contacts.
- Children learn to think in terms of "we."	- Children learn to think in terms of "I."
- Nobody is ever alone.	- Privacy is normal.
- Harmony should always be maintained and direct confrontation avoided.	- Speaking one's mind is a characteristic of an honest person.
- Opinions predetermined by in-group.	- Personal opinions expected.
In Personality and Behavior	
- "Individualistic" not important as a personality characteristic.	- "Individualistic" important as a personality characteristic.
- Low public self-consciousness.	- High public self-consciousness.
- Other-directed behavior.	- Extravert and acting behavior.
- Attitudes toward others depend on their group membership.	- Attitudes toward others independent of group membership.
- Harmony: confrontations to be avoided.	- Confrontations are normal.
- More conformity behavior.	- Less conformity behavior.
- Managers stress conformity and orderliness.	- Managers stress leadership and variety.
- Women express emotion less strongly than men.	- Women express emotions more strongly than men.

Source: Adapted from Hofstede (2001, pp. 236-237)

According to Hui and Traindis (1986), the culture is labeled as a collectivistic culture (or individualistic culture) when most people in that culture are collectivists (or individualists) (p. 229). Of course, no society can be characterized entirely by its individualistic or collectivistic nature, because it is too "complex to fit neatly into any conceptual scheme" (Trumbul, Rothstein-Fisch, and Greenfield, 2000, pp. 3-4). From Table 1.2 above, we can see that most European countries have individualistic cultures while most Asian countries have collectivistic cultures. There are "about 70% of the world's cultures [which] could be described as collectivistic cultures" (Trumbul et al., 2001, p. 5 cited in Triandis, 1989).

Trumbul, Rothstein-Fisch, and Greenfield (2000) asserted that

> [In collectivistic culture], children are expected to understand and act on a strong sense of responsibility toward the group, the family, and the community. Self-worth and esteem are not defined chiefly in terms of individual achievement…. In sharp contrast, young people in individualistic societies are typically expected to make educational and occupational choices that develop their own potential – not necessarily with any consideration for how their success would benefit their families. (p. 4)

Theoretically, students are direct 'products' of the education system in each country, but students are also 'the products' of the expectations of the society. Teachers are teaching what their society expects their students to achieve. "In school, children further develop their mental programming. Teachers and classmates inculcate additional values honored in the culture" (Hofstede, 2001, p. 100). So teaching and learning in different cultures always have different characteristics as shown in Table 1.4 below:

Table 1.4. Differences in Teacher/Student and Student/Student Interaction Related to the Individualism versus Collectivism Dimension

Collectivist Societies	Individualist Societies
- Positive association in society with whatever is rooted in tradition[1]	- Positive association in society with whatever is "new"
- The young should learn; adults cannot accept student role[2]	- One is never too old to learn; "permanent education"
- Students expect to learn how to do	- Students expect to learn how to learn
- Individuals students will only speak up in class when called upon personally by the teacher	- Individual students will speak up in class in response to a general invitation by the teacher
- Individuals will only speak up in small groups[3]	- Individuals will speak up in large groups
- Large classes split socially into smaller, cohesive subgroups based on particularist criteria (e.g. ethnic affiliation)	- Sub-groupings in class vary from one situation to the next based on universalist criteria (e.g. the task "at hand")
- Formal harmony in learning situations should be maintained at all times (T-groups are taboo)[4]	- Confrontation in learning situations can be salutary; conflicts can be brought into the open
- Neither the teacher nor any student should ever be made to lose face	- Face-consciousness is weak
- Education is a way of gaining prestige in one's social environment and of joining a higher status group ("a ticket to a ride")	- Education is a way of improving one's economic worth and self-respect based on ability and competence
- Diploma certificates are important and displayed on walls	- Diploma certificates have little symbolic value
- Acquiring certificates, even through illegal means (cheating, corruption) is more important than acquiring competence	- Acquiring competence is more important than acquiring certificates
- Teachers are expected to give preferential treatment to some students (e.g. based on ethnic affiliation or on recommendation by an influential person)	- Teachers are expected to be strictly impartial

1. e.g. Treviño (1982)
2. Lieh-Mark et al. (1984)
3. Redding (1980, p. 211)
4. e.g. Cox and Cooper (1977)

Source: Hofstede (1986, p. 312)

From Tables 1.1 and 1.4 we can see that the characteristics of culture can affect the characteristics of teaching in general and mathematics teaching in particular. For example, Table 1.5 below shows the relation between the characteristics of society and characteristics of teaching in that society. Here one can see that in individualistic societies people promote "self-expression, individual thinking, personal choice" then in school, "individual students will speak up in class in response to a general invitation by teacher"; conversely, in collectivistic societies, people promote "adherence to norms, respect for authority elders, group consensus" and then in school, "individuals students will only speak up in class when called upon personally by the teacher" (Hofstede, 1986, p. 312; Trumbul, Rothstein-Fisch, and Greenfield, 2000, p. 3)

Table 1.5. The effect of cultural characteristics on mathematics teaching in individualistic and collectivistic dimensions

	In society	**In school**
Individualistic culture	1. Promoting self-expression, individual thinking, personal choice	Individual students will speak up in class in response to a general invitation by the teacher
	2. Associated with private property, individual ownership	Education is a way of improving one's economic worth and self-respect based on ability and competence
Collectivistic culture	1. Promoting adherence to norms, respect for authority elders, group consensus	Individuals students will only speak up in class when called upon personally by the teacher
	2. Associated with shared property, group ownership	Education is a way of gaining prestige in one's social environment and of joining a higher status group

Source: Adapted from Hofstede (1986, p. 312) and Trumbul, Rothstein-Fisch, and Greenfield (2000, p. 3)

By observing the mathematics classrooms in secondary schools and at the University of Potsdam, Germany, we can see that German students are very self-confident in the classroom. They can raise their hand to ask the teachers questions whenever they do not understand or to object to teachers' mistakes, while Vietnamese students are much quieter when learning. They only ask their teachers questions when the teachers allow them to do so.

In Vietnam and other collectivistic countries, sometimes the students seem to go to school because they are told to do so. They go to school and university to learn as well as possible to pass exams and ultimately get the certificates and diplomas which help them to get a job and to gain high prestige and status in society. They seem to learn for their parents, for their family but not for themselves. A lot of students have to learn a subject they do not like just because they are concerned with what they should learn as dictated by their family or society.

1.2.2. Mathematics teaching and learning in different Power Distance cultures

"All societies are unequal, but some are more unequal than others"
(see Hofstede, 1984, p. 108)

Hofstede (1986) asserted that

> *Power distance* as a characteristic of a culture defines the extent to which the less powerful persons in a society accept inequality in power and consider it as normal. Inequality exists within any culture, but the degree of it that is tolerated varies between one culture and another. (p. 307)

In most societies, "the family, the school, the job and the community" are four "fundamental institutions" in which there are always "pair[s] of unequal but complementary basic roles", such as ***Parent-Child*** and ***Man-Woman*** in the family, ***Teacher-Student*** in the school, ***Boss-Subordinate*** in the job, and ***Authority-Member*** in the community (Hofstede, 1986, pp. 301-302). Normally, in these pairs, *Child, Woman, Student, Subordinate,* and *Member* are *less powerful* people. If most of them tolerate the *inequality in power* well then they are living in a large power distance culture.

Some different characteristics *in societal norms* and *in families* between small and large power distance cultures can be seen in Table 1.6 below.

Table 1.6. Key differences between small and large power distance cultures

Small power distance cultures	**Large power distance cultures**
The societal norm	
All should be interdependent.	A few should be independent; most should be dependent.
Inequality in society should be minimized.	There should be an order of inequality in this world in which everyone has his/her rightful place; high and low are protected by this order.
All should have equal rights.	Power holders are entitled to privileges.
Powerful people should try to look less powerful than they are.	Powerful people should try to look as powerful as possible
The system is to blame.	The underdog is to blame.
Older people neither respected nor feared	Older people respected and feared.
In the family	
Parents treat children as equals	Parents teach children obedience
Children treat parents and older relatives as equals.	Respect for parents and older relatives is a basic virtue and lasts throughout life.
Children expected to be competent at a young age, especially socially.	Children not seen as competent until at a later age.

Source: Adapted from Exhibit 3.7 and Exhibit 3.8 in Hofstede (2001, pp. 98, 107)

In the school, teacher and student are unequal (Hofstede, 2001, p. 100). The teacher is a person who imparts the knowledge, evaluates the students' ability, determines whether students can move up to the next grade or not, and so on. The teacher seems to have power over students. However, in different cultures, the teachers use their power very differently. Vietnamese students are often asked to obey the teachers, while German teachers often let their students express themselves more freely.

From the results of the same research by the IBM Corporation, the power distance index values for 50 countries and three regions were also presented in Hofstede (2001). Some values can be seen in Table 1.7 below.

Table 1.7. Power Distance Index Values for some countries in the IBM sample

Country	**Power Distance Index**
Switzerland	34
Great Britain	35
Germany (F.R.)	35
Costa Rica	35
Australia	36
Netherlands	38
United States	40
Italy	50
Japan	54
Spain	57
South Korea	60
Belgium	65
Hong Kong	68
France	68
Singapore	74
Indonesia	78
Ecuador	78
Panama	95
Guatemala	95
Mean of 53 countries and regions	**57**

Source: Adapted from Exhibit 3.1 in Hofstede (2001, p. 87)

Vietnam was not a sample in this research. However, based on the reality of society in Vietnam, and relating to the characteristics of the different cultures which were presented in Tables 1.3 and 1.6 in this chapter, we can hypothesize that Vietnamese culture is a *large power distance* and *collectivistic* culture. This hypothesis is reinforced by the fact that Vietnam is an Asian country and most Asian countries in this survey have *large power distance* and *collectivistic* cultures, such as Singapore, Philippines, Thailand, Hong Kong, Malaysia, Indian, Japan, Taiwan, South Korea and so on.

We can see again the effect of culture on teaching and learning through this dimension of culture. The teachers and students also bring the societal norm into the classroom. Hofstede (1986) listed some "differences in teacher/student and student/student interaction related to the power distance dimension" in Table 1.8 below.

Table 1.8. Differences in Teacher/Student and Student/Student Interaction related to the Power Distance Dimension

Small power distance societies	Large power distance societies
- Stress on impersonal "truth" which can in principle be obtained from any competent person	- Stress on personal "wisdom" which is transferred in the relationship with a particular teacher (guru)
- A teacher should respect the independence of his/her students	- A teacher merits the respect of his/her students[1]
- Student-centered education (premium on initiative)	- Teacher-centered education (premium on order)
- Teacher expects students to initiate communication	- Students expect teacher to initiate communication
- Teacher expects students to find their own paths	- Students expect teacher to outline paths to follow
- Students may speak up spontaneously in class	- Students speak up in class only when invited by the teacher
- Students allowed to contradict or criticize teacher	- Teacher is never contradicted nor publicly criticized[2]
- Effectiveness of learning related to amount of two-way communication in class[3]	- Effectiveness of learning related to excellence of teacher
- Outside class, teachers are treated as equals	- Respect for teacher is also shown outside class
- In teacher/student conflicts, parents are expected to side with the student	- In teacher/student conflicts, parents are expected to side with the teacher
- Younger teachers are more liked than older teachers	- Older teachers are more respected than younger teachers

1. According to Confucius, "teacher" is the most respected profession in society
2. e.g. Faucheux et al., 1982
3. Revans, 1965; Jamieson and Thomas, 1974; Stubbs and Delamont, 1976

Source: Hofstede (1986, p. 313)

We also see the effect of culture on mathematics teaching in this dimension. For example, Table 1.9 below shows the relation between the characteristics of society and the characteristics of teaching in that society.

Table 1.9. The effect of cultural characteristics on mathematics teaching and learning in the power distance dimension

	In Society	In School
Small Power Distance Cultures	1. Inequality in society should be minimized	Students allowed to contradict or criticize teacher
	2. The system is to blame	In teacher/student conflicts, parents are expected to side with the student
	3. Older people neither respected nor feared	Outside class, teachers are treated as equals; Younger teachers are more liked than older teachers
Large Power Distance Cultures	1. There should be an order of inequality in this world in which everyone has his/her rightful place	Teacher is never contradicted nor public criticized
	2. The underdog is to blame	In teacher/student conflicts, parents are expected to side with the teacher
	3. Older people respected and feared	Respect for teacher is also shown outside class; Older teachers are more respected than younger teacher

Source: Adapted from Hofstede (1986, p. 313) and Exhibit 3.7 in Hofstede (2001, p. 98)

1.3. The benefits of studying mathematics teaching and learning in different cultures

Let us examine a situation in which the differences in culture may block communication in the school.

> *As a female European American teacher reports to an immigrant Latino father that his daughter is doing well in class – speaking out, expressing herself, taking an active role – he looks down at his lap and does not respond. Thinking that perhaps he has not understood, the teacher again praises his daughter's ability to speak out in class and explains that it is very important for children to participate orally. Looking even more uncomfortable, the father changes the subject. The teacher gets the impression that this parent is not interested in his daughter's school success, and she feels frustrated and a bit resentful. Toward the end of the conference, the father asks, with evident concern, "How is she doing? She talking too much?" The teacher is confused. This parent does care whether his daughter is doing well, but why doesn't he understand what she has been telling him?* (Trumbul, Rothstein-Fisch, and Greenfield, 2000, p. 1)

Trumbul, Rothstein-Fisch, and Greenfield (2000) asserted that the differences in culture blocked the communication in the situation above because the teacher thought that the student's behavior was very good in her culture while the father thought that it was not good in his culture. (p. 1)

The differences in culture do not only block the communication between teachers and students' parents as in the situation above, but they also present difficulties in understanding between teacher and students in the classroom. For example, the teacher, who comes from an individualistic culture, expects students to think individually while students who come from a collectivistic culture respect the teacher and wait for the teacher's instruction on how to do something (see Table 1.1). This may lead to an unsuccessful lesson.

As mentioned, *individualistic cultures* are found in most European countries and *collectivistic cultures* are found in most Asian countries. But the *distance power* dimension in these countries is different. From the results of the same research by IBM, Hofstede (1986) distinguished 50 countries and three regions into four groups:

- ❖ Small power distance and collectivistic cultures: Costa Rica
- ❖ Large power distance and collectivistic cultures: Singapore, Philippines, Thailand, Hong Kong, Malaysia, Indian, Japan, Taiwan, South Korea…
- ❖ Small power distance and individualistic cultures: Germany, Australia, United States, Denmark, Netherlands, Great Britain…
- ❖ Large power distance and individualistic cultures: France, Italy, Spain, Belgium, South Africa. (p. 309)

Recently, there have been an increasing number of Asian students going to the United States, Germany, Australia and other European countries to study. This leads to the situation in which the teachers come from small power distance and individualistic cultures while students come from large power distance and collectivistic cultures. If the teachers and students do not know the characteristics of mathematics teaching and learning in their partners' culture, contradictions in interaction between teachers and students may occur. So, studying the different aspects of teaching and learning in different cultures may avoid these contradictions.

1.4. Summary

This is an important chapter in this dissertation. Through this chapter, the dissertation would like to emphasize the cultural characteristics of mathematics teaching and learning. One of the purposes of this dissertation is to find the characteristics of Vietnamese mathematics teaching and learning, and then compare them with those in other countries. Thus, the interpretation of teaching and learning in different cultures is necessary.

In this chapter, we attempted to present the definition and three levels of culture. Teaching was related to culture to confirm the viewpoint of Stigler and Hiebert (1998a, 1999) that "teaching is a cultural activity". The aspects of teaching and learning in different cultures were also presented. The findings from this chapter will be mentioned again in Chapter 6 of this dissertation.

Hopefully, this chapter will help teachers and students, who want to go abroad for teaching and learning, to prepare carefully and adapt to new cultures.

CHAPTER 2

THE THIRD INTERNATIONAL MATHEMATICS AND SCIENCE STUDY – TIMSS

The video study in Vietnam which provides the data for this dissertation is based on the TIMSS video study. Before presenting the results of the Vietnamese video study, this chapter will describe the TIMSS in detail.

In brief, the Third International Mathematics and Science Study (TIMSS) is a series of international studies evaluating and comparing student achievement in Mathematics and Science world-wide. The first section below will start by describing its forerunners: the First and Second International Mathematics Studies.

2.1. The First International Mathematics Study (FIMS) and the Second International Mathematics Study (SIMS)

2.1.1. The history of the International Project for the Evaluation of Educational Achievement (IEA)

This section is based mainly on Chapter 2 of Postlethwaite's summary (Postlethwaite, 1967).

The First International Mathematics Study (FIMS) and the Second International Mathematics Study (SIMS) were conducted by the International Association for the Evaluation of Educational Achievement (IEA). According to Postlethwaite (1967), the IEA was first known as the "International Project for the Evaluation of Educational Achievement" (p. 23). The history of the IEA was presented briefly by Postlethwaite (1967) as follows:

❖ In the middle of the 1950s, international groups of educators and educational researchers held meetings to study school-related problems, and through these meetings, the demand "to establish evaluation techniques which would be valid cross-nationally" received much-needed attention (p. 23).

❖ In 1958, through the meetings in England and Germany, researchers from different countries "decided to carry out a pilot study to discover if an international research project would be administratively possible and if the results could be expected to be meaningful" (p. 23).

❖ The Research Centers participating in this 1958 pilot study were from Belgium, England, Finland, France, Germany, Israel, Poland, Scotland, Sweden, Switzerland, the United States, and Yugoslavia (p. 23). In total, 9,918 students 13 years of age participated in the tests of "reading comprehension, mathematics, science, geography, and non-verbal ability", and this pilot study "proved to be successful" (p. 24).

- ❖ From 1960, researchers from 12 countries (Belgium, England, Finland, France, Israel, Japan, the Netherlands, Scotland, Sweden, the United States, Australia and Germany) decided to start a cross-national "carefully designed study" on the subject of Mathematics (p. 24). The representatives of these 12 countries were selected to form the IEA Council, "whose main task was to agree on the overall policies of research work" and which conducted its business in English, with occasional French translation (p. 25).

The IEA became a legal entity in 1967, and is currently known as the International Association for the Evaluation of Educational Achievement.

2.1.2. The First International Mathematics Study (FIMS)

As mentioned above, after the success of the 1958 pilot study, the IEA decided to conduct a carefully designed study of Mathematics in 1960. Today, this study is known as the *First International Mathematics Study* (FIMS). The whole study was completed within four years and the data was collected in 1964 in 12 countries (Martin and Mullis, 2000, p. 3; Postlethwaite, 1967, p. 26).

The populations tested included 13-year-old and final-year secondary students. Most countries used "random probability sampling" to select the sampled population (Postlethwaite, 1967, p. 31). "In the United States, the sampling was in three stages": firstly, the communities were selected, then "the schools within the selected communities," and lastly "the students within the selected schools", while other countries used two-stage sampling in which schools were selected in the first stage and then the individual students in the second stage (Postlethwaite, 1967, pp. 31-32).

A brief introduction of the First International Mathematics Study (FIMS) as well as the key findings and major publications from FIMS can be found at http://www.iea.nl/fims.html (accessed 18 August 2013).

2.1.3. The Second International Mathematics Study (SIMS)

According to Eggen, Pelgrum, and Plomp (1987), in the 1960s, "important changes in mathematics education" took place in many countries, and these changes began to stabilize in the beginning of the 1970s (p. 119). So, in the late 1970s, the IEA decided to conduct a study known now as the *Second International Mathematics Study* (SIMS). The major purpose of this study was to investigate

> the relationships which exist between (a) the mathematics program (what is the content and the context of mathematics teaching?), the affective and cognitive results of the students (what is the output of mathematics teaching?) and (c) the teaching – learning process (in what way is the output achieved?). (Eggen, Pelgrum, and Plomp, 1987, p. 119)

The SIMS surveyed mathematics education in three curriculum levels:

Table 2.1. Schematic view of the SIMS

Study component	Object of study	Data from
Curriculum analyses	Intended Curriculum	Countries (educational systems)
Classroom processes	Implemented Curriculum	School and Class
Outcomes	Attained Curriculum	Student

Source: Eggen, Pelgrum, and Plomp (1987, p. 120)

The SIMS data were collected from 1980 to 1982 in 20 countries (Martin and Mullis, 2000, p. 3). Those countries were Belgium (Flemish), Belgium (French), British Columbia, England and Wales, Finland, France, Hong Kong, Hungary, Israel, Japan, Luxembourg, Netherlands, New Zealand, Nigeria, Ontario Canada, Scotland, Swaziland, Sweden, Thailand, and the United States (Garden, 1987, p. v).

The SIMS surveyed two populations: Population A was 13-year-old students (grade 8 in most countries), and population B was all students in the final year of secondary school "who were studying mathematics as a substantial part (approximately five hours per week) of their academic program" (grade 12 in most countries) (Garden, 1987, p. 1).

The suggested sampling procedures in the SIMS for most countries were the following:

i) Stratification by geographical region, school type or some other variable(s) of interest in a particular country.
ii) Systematic ordering of schools within strata followed by pseudorandom selection of schools by the random start-constant interval method.
iii) Random selection of one or two intact classes within selected schools.
iv) Replacement of refusing schools either from a parallel sample or by selecting the next on the list. (Garden, 1987, pp. 5, 6)

A brief introduction of the Second International Mathematics Study, as well as the key findings and major publications can be found at http://www.iea.nl/sims.html (accessed 18 August 2013).

Along with the FIMS and the SIMS, the IEA also conducted the First International Science Study (FISS) in 1970-1971, and the Second International Science Study (SISS) in 1983-1984 (Martin and Mullis, 2000, p. 3).

More information about the FISS and the SISS can be found at http://www.iea.nl/fiss.html and http://www.iea.nl/siss.html (accessed 18 August 2013).

2.2. The Third International Mathematics and Science Study (TIMSS)

2.2.1. Overview of the TIMSS

In 1994-1995, the IEA conducted the Third International Mathematics and Science Study, known as the *TIMSS 1995*.

According to Martin (1996), the TIMSS 1995 was “the largest and most ambitious international comparative study of student achievement” up to that time (p. 1-1). The TIMSS 1995 was “a cross-national assessment of the achievement in mathematics and science” of fourth-grade students, eighth-grade students, and students in their final year of secondary school (pp. 1-1, 1-2).

After the success of the TIMSS 1995, the TIMSS was conducted by the IEA again in 1999 in 38 countries. The TIMSS 1999 assessment (also known as the Third International Mathematics and Science Study Repeat or TIMSS-R) measured the mathematics and science achievement of eighth-grade students (aged 13 and 14 years) and collected extensive information from students, teachers, and school principals about mathematics and science curricula, instruction, home contexts, and school characteristics and policies (Martin and Mullis, 2000, pp. 3-8).

Four years later, in 2003, the TIMSS was again conducted by the IEA in 49 countries with the new name “The Trends in International Mathematics and Science Study” (Martin and Mullis, 2004, p. 3).

We should pay attention to the change of the full name of the TIMSS from 1995 to 2003. The TIMSS was known as the *Third International Mathematics and Science Study* in 1995. It was renamed the *Third International Mathematics and Science Study Repeat* in 1999. And finally, it was changed to the *Trends in International Mathematics and Science Study* in 2003. The significance of this change is considerable. With this change, the TIMSS was no longer a specific study, but rather a series of studies which are carried out every 4 years. Two recent studies were the TIMSS 2007 and the TIMSS 2011. The sixth assessment in the series will be TIMSS 2015, which will celebrate 20 years of TIMSS (from 1995 to 2015).

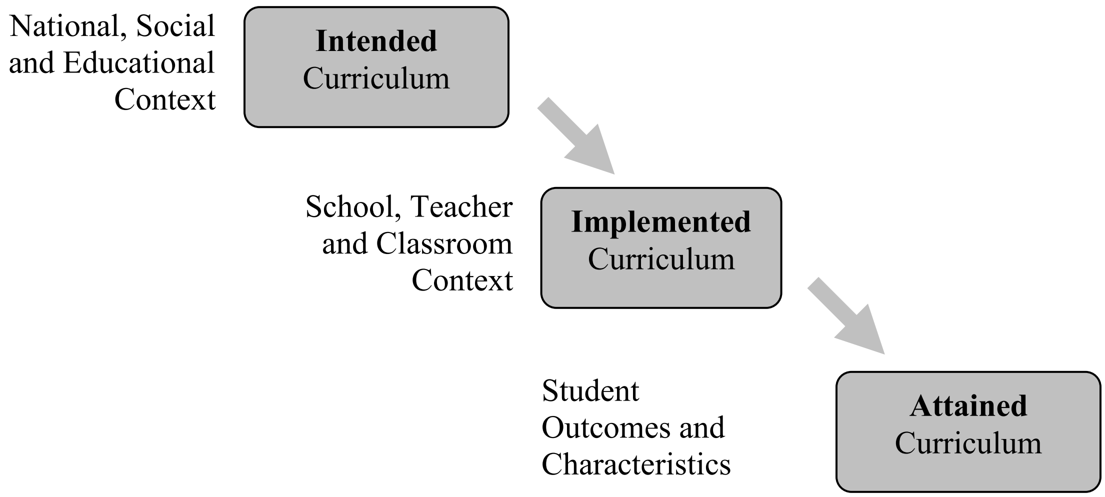
2.2.2. The purpose and focus of the TIMSS

According to Martin (1996), the TIMSS answers four general research questions:

- What are students expected to learn?
- Who provides the instruction?
- How is instruction organized?
- What have students learned? (pp. 1-4, 1-5)

To answer these four questions, the TIMSS examines three mathematics curriculum levels (see Exhibit 2.1 below).

Exhibit 2.1. TIMSS Curriculum Model



Source: Mullis et al. (2009, p. 10)

Martin and Mullis (2000) interpreted three curriculum levels as follows:

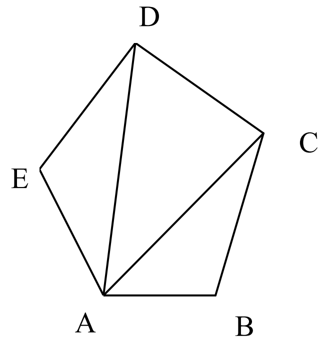
> The intended curriculum states society's goals for teaching and learning. These goals reflect the ideals and traditions of the greater society and are constrained by the resources of the education system. The implemented curriculum is what is taught in the classroom. Although presumably inspired by intended curriculum, actual classroom events are usually determined in large part by the teacher, whose behavior may be greatly influenced by his or her own education, training, and experience, by the nature and organizational structure of the school, by interaction with teaching colleagues, and by the composition of the student body. The attained curriculum is what the students actually learn. Student achievement depends partly on the implemented curriculum and its social and educational context, and to a large extent on the characteristics of individual students, including ability, attitude, interests, and effort. (p. 7)

In the TIMSS, the *intended curriculum* was studied by curriculum experts and educationalists to analyze "curriculum guides, textbooks, and questionnaires" in participating countries, while the questionnaires "completed by the mathematics and science teachers" and principals provided information for studying the *implemented curriculum*, and the student achievement survey provided data for studying the *attained curriculum* (Martin, 1996, p. 1-5).

2.2.3. The TIMSS test questions and questionnaires

The TIMSS uses test questions and questionnaires to collect information pertaining to three curriculum levels. In the TIMSS 2011, the test questions for the eighth grade were created around two dimensions, namely, the "content dimension" and the "cognitive dimension," in which four content domains were Number (30%), Algebra (30%), Geometry (20%), and Data and Chance (20%); and three cognitive domains were Knowing (35%), Applying (40%), and Reasoning (25%). (Mullis et al., 2012a, p. 6)

For example, one test question in the Geometry and Reasoning domains was:



What is the sum of all the interior angles of pentagon ABCDE?
Show your work. (Foy, Arora, and Stanco, 2013b, p. 18)

Another test question in the Number and Knowing domains was:

Which of these shows how 36 can be expressed as a product of prime factors?

A. 6 x 6
B. 4 x 9
C. 4 x 3 x 3
D. 2 x 2 x 3 x 3. (Foy, Arora, and Stanco, 2013b, p. 20)

A test question in the Algebra and Applying domains was:

A piece of wood was 40 cm long.
It was cut into 3 pieces.
The lengths in cm are
2x – 5
x + 7
x + 6
What is the length of the longest piece?

Answer: ……. cm

Show your work. If you use a calculator, you still must describe all the steps you used to obtain your answer. (Foy, Arora, and Stanco, 2013b, p. 32)

Lastly, a test question in Data and Chance and Reasoning:

The results of a long jump competition were reported as follows:

	Average Length
Team A	3.6 m
Team B	4.8 m

There were the same number of students in each team.
Which statement about the competition MUST be true?

A. Each student in team B jumped farther than any student in team A.

B. After every student in team A jumped, there was a student in team B who jumped farther.
C. As a group, team B jumped farther than team A.
D. Some students in team A jumped farther than some students in team B. (Foy, Arora, and Stanco, 2013b, p. 67).

To obtain information about teachers' backgrounds and curricula, TIMSS 2011 used questionnaires. Examples of questions in the Eighth Grade mathematics teacher questionnaire were presented in Foy, Arora, and Stanco (2013a): "What is the highest level of formal education you have completed?" (p. 245), "How many students are in this class?" (p. 248), or "How often do you usually assign mathematics homework to the students in this class?" (p. 255).

2.2.4. Some findings of the TIMSS

Relating to *intended curriculum* and *implemented curriculum,* the TIMSS International Study Center (1996) reported the highlights of TIMSS 1995 concerning teaching and learning:

- ❖ In many countries, students generally were in mathematics and science classes of fewer than 30 students. Korea was a notable exception, with most students in classes of 40 or more. (p. 3)
- ❖ Mathematics teachers in many countries reported a high frequency of calculator use in their classes, often for checking answers, routine computation, and solving complex problems. Again, Korea was the exception, where it was reported that calculators were seldom used. (p. 3)

Mullis et al. (2004) summarized the findings of TIMSS 2003 about *intended curriculum* as follows:

- ❖ Most countries had mathematics curricula defined at the national level (except Australia and the United States) and often supported by ministry directives, instructional guides, school inspections, and recommended textbooks [see more in Exhibit 5.1 and Exhibit 5.2 in Mullis et al. (2004, pp. 166-167, 170-171)].
- ❖ At the eighth grade, all participants emphasized understanding mathematical concepts and principles followed by mastering basic skills. At the fourth grade, mastering basic skills was emphasized most, followed by understanding concepts and principles [see more in Exhibit 5.5 in Mullis et al. (2004, pp. 178-179)]. (pp. 7-8)

Mullis et al. (2004) also summarized the findings of TIMSS 2003 about *implemented curriculum:*

- ❖ At both eighth and fourth grades, the textbook was often the foundation of mathematics instruction. On average, about two-thirds of students at both grades had teachers who reported using a textbook as the primary basis for their lessons, and another third as a supplementary resource [see more in Exhibit 7.9 in Mullis et al. (2004, pp. 284-285)].
- ❖ On average, the three most common instructional activities were teacher lecture, teacher-guided student practice, and students working on problems on their own

(totaling 59% of time at eighth grade and 61% at fourth grade) [see more in Exhibit 7.10 in Mullis et al. (2004, pp. 286-289)].

- ❖ At the eighth grade, on average, 56 percent of students were taught by teachers who used only or mostly constructed-response tests. These students had higher average achievement than did students whose teachers used only multiple-choice tests or a combination [see more in Exhibit 7.16 in Mullis et al. (2004, pp. 302)]. (pp. 8-11)

Relating to *attained curriculum,* Mullis et al. (2012a) presented the Trends in Mathematics Achievement of Eighth-Grade Students in the TIMSS as follows:

Table 2.2. Trends in Mathematics Achievement of Eighth-Grade Students in the TIMSS

Country	**1995**	**1999**	**2003**	**2007**	**2011**
Australia	509		505	496	505
Austria	531			505	508
Chinese Taipei		585	585	**598**	609
Czech Republic	541			486	511
Denmark				523	537
England	498	496	498	513	507
Hong Kong SAR	569	582	586	572	586
Hungary	527	532	529	517	505
Indonesia				397	386
Iran, Islamic Rep. of	418	422	411	403	415
Italy		479	484	480	498
Japan	581	579	570	570	570
Jordan		428	424	427	406
Korea, Rep. of	581	587	589	597	**613**
Lithuania	472	482	502	506	502
Malaysia		519	508	474	440
New Zealand	501	491	494		488
Norway	498		461	469	475
Palestinian Nat'l Auth			390	367	404
Romania	474	472	475	461	458
Russian Federation	524	526	508	512	539
Singapore	**609**	**604**	**605**	593	611
Slovenia	494		493	501	505
Sweden	540		499	491	484
Thailand		467		441	427
Tunisia		448	410	420	425
United States	492	502	504	508	509
International Average	**519**	**521**	**467**	**500**	**500**

Source: Adapted from Mullis, Martin, and Foy (2008, p. 35); Mullis et al. (2000, p. 36); Mullis et al. (2004, p. 34); and Mullis et al. (2012a, pp. 42, 56-59)

In particular, the TIMSS also studies the gender differences in Mathematics achievement. For example, from the TIMSS 1999, Mullis et al. (2000) asserted that

> On average across all countries there was a modest but significant difference favoring boys, although the situation varied considerably from country to country. In most countries the gender difference was negligible. The only countries with differences large enough to be statistically significant were Israel, the Czech Republic, the Islamic Republic of Iran, and Tunisia. The countries with the greatest differences were Iran and Tunisia, where the mean for boys exceeded the mean for girls by 24 to 25 scale-score points. (p. 48)

Table 2.3 below illustrates this assertion.

Table 2.3. Average Mathematics Achievement by Gender in TIMSS-R 1999

Country	**Girls** Average Scale Score	**Boys** Average Scale Score	**Difference** (Absolute Value)
Bulgaria	510 (5.9)	511 (6.9)	0 (5.5)
Russian Federation	526 (6.0)	526 (6.4)	1 (3.3)
Australia	524 (5.7)	526 (5.7)	2 (6.0)
Hong Kong SAR	583 (4.7)	581 (5.9)	2 (6.5)
Singapore	603 (6.1)	606 (7.5)	2 (5.7)
International Avg.	**485 (0.8)**	**489 (0.9)**	**4 (1.1)**
Indonesia	401 (5.4)	405 (5.0)	5 (3.3)
Netherlands	538 (7.6)	542 (7.0)	5 (3.0)
United States	498 (3.9)	505 (4.8)	7 (3.4)
Japan	575 (2.4)	582 (2.3)	8 (3.3)
Philippines	352 (6.9)	337 (6.5)	15 (6.1)
South Africa	267 (7.5)	283 (7.3)	16 (5.9)
Israel	459 (4.2)	474 (4.8)	16 (4.6)
Czech Republic	512 (4.0)	528 (5.8)	17 (5.0)
England	487 (5.4)	505 (5.0)	19 (6.5)
Iran, Islamic Rep.	408 (4.2)	432 (4.8)	24 (6.5)
Tunisia	436 (2.4)	460 (2.9)	25 (2.2)

( ) Standard errors appeared in parentheses. Because results were rounded to the nearest whole number, some totals might appear inconsistent.

Source: Adapted from Mullis et al. (2000, p. 50)

In summary, according to Mullis et al. (2009, p. 7), because mathematics and science are very important areas in education, the TIMSS "is dedicated to providing countries with information to improve teaching and learning in these curriculum areas". The TIMSS assesses student achievement at the fourth and eighth grade levels, and also collects "extensive background information" from students, teachers, and principals that may provide "an unprecedented opportunity to measure progress in educational achievement in mathematics and science together with empirical information about the contexts for schooling" for participating countries (Mullis et al. 2009, p.7).

According to Mullis et al. (2009), by participating in the TIMSS, countries can get "valuable information that helps these countries monitor and evaluate their mathematics and science teaching across time and grades," such as:

- Have comprehensive and internationally comparable data about what mathematics and science concepts, processes, and attitudes students have learned by the fourth and eighth grades.
- Assess progress internationally in mathematics and science learning across time for students at the fourth grade and for students at the eighth grade.
- Identify aspects of growth in mathematical and scientific knowledge and skills from fourth grade to eighth grade.
- Monitor the relative effectiveness of teaching and learning at the fourth as compared to the eighth grade, since the cohort of fourth-grade students is assessed again as eighth graders.
- Understand the contexts in which students learn best. TIMSS may enable international comparisons among the key policy variables in curriculum, instruction, and resources that result in higher levels of student achievement.
- Use TIMSS to address internal policy issues. Within countries, for example, TIMSS may provide an opportunity to examine the performances of population subgroups and address equity concerns. It is efficient for countries to add questions of national importance (national options) as part of their data collection effort. (pp.14-15)

A brief introduction as well as the TIMSS' key findings and major publications can be found at http://www.iea.nl

2.3. Comparing the Trends in International Mathematics and Science Study (TIMSS) and the Program for International Student Assessment (PISA) in Mathematics and Science

The TIMSS and the PISA are recently popular studies comparing students' achievements in secondary school world-wide. Firstly, the PISA is described as follows:

> The Program for International Student Assessment (PISA) is conducted by the Organization for Economic Cooperation and Development (OECD). The main objective of PISA is to provide regular, policy-relevant data on the "yield" of education systems, and so targets students at an age that is near the end of compulsory schooling in most countries (15-year-olds). PISA focuses on literacy – the ability to use and apply knowledge and skills to real-world situations encountered in adult life – in the key subject areas of reading, mathematics, and science. (Neidorf et al., 2006, p. 6)

The PISA was created in 1997 by the OECD member countries, and the data were first collected in 2000 and every three years thereafter (Neidorf et al., 2006, p. 6; OECD, 2013, p. 3). Currently, the PISA accesses students across countries in five subject areas: "mathematics literacy", "reading literacy", "scientific literacy", "problem-solving competency", and "financial literacy" (OECD, 2013, p. 3). Each cycle, the PISA focuses on a subject area which is the major domain. "When a subject area is the major domain it comprises a relatively greater share of the total assessment time, with a larger number of items and an assessment framework that is more fully developed and updated" (Neidorf et al., 2006, p. 6). For example, *reading literacy* was the major domain in the first cycle assessment in 2000 (32 countries) and in the fourth cycle in 2009 (65 countries); *mathematics literacy* was the major domain in the second cycle in 2003 (41 countries) and in the recent cycle in 2012 (66 countries); and *scientific literacy* was the major domain in the third cycle in 2006 (57 countries) (Neidorf et al., 2006, p. 6; OECD, 2013, p.15).

The PISA assesses *mathematics literacy, reading literacy, scientific literacy*, *problem-solving competency*, and *financial literacy* of students. This dissertation pays attention to *mathematics literacy* which was defined in PISA 2012:

> *Mathematics literacy is an individual's capacity to formulate, employ, and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena. It assists individuals to recognize the role that mathematics plays in the world and to make the well-founded judgments and decisions needed by constructive, engaged and reflective citizens.* (OECD, 2013, p. 25)

The TIMSS and PISA assess different aspects of student achievement. The TIMSS assesses students' knowledge related to the curriculum levels (*intended curriculum, implemented curriculum,* and *attained curriculum*), while the PISA assesses students' capacity to apply the knowledge to real life. With different purposes, the TIMSS and the PISA have different forms of test questions. While the test questions for the TIMSS are mainly in multiple-choice form (usually 4 choices), the test questions for the PISA are mainly in context form. For example, two test questions for the PISA and TIMSS are presented below:

❖ The TIMSS 2007 test question:

Which group of numbers is ordered from LARGEST to SMALLEST?

A. 10,011; 10,110; 11, 001; 11,100
B. 10,110; 10,011; 11,100; 11,001
C. 11,001; 11,100; 10,110; 10,011
D. 11,100, 11,001; 10,110; 10,011. (Foy and Olson, 2009, p. 22)

❖ The PISA 2006 test question:

M047: Lichen

A result of global warming is that the ice of some glaciers is melting. Twelve years after the ice disappears, tiny plants, called lichen, start to grow on the rocks.

Each lichen grows approximately in the shape of a circle.

The relationship between the diameter of this circle and the age of the lichen can be approximated with the formula:

$$d = 7.0 \times \sqrt{t - 12} \; for \; t \geq 12$$

where d represents the diameter of the lichen in milimetres, and t presents the number of years after the ice has disappeared.

Question 1: Lichen

Using the formula, calculate the diameter of the lichen, 16 years after the ice disappeared. Show your calculation…

Question 2: Lichen

Ann measured the diameter of some lichen and found it was 35 milimetres.
How many years ago did the ice disappear at this spot?
Show your calculation. (OECD, 2006, pp. 5-6)

For more detail, the comparison between the TIMSS and the PISA can be seen in Table 2.4 below.

Table 2.4. Comparing the TIMSS and the PISA in Mathematics and Science

	TIMSS	**PISA**
Purpose	"TIMSS collects achievement and background data to provide information on trends in mathematics and science achievement over time as well as on the curricular, instructional, and attitudinal factors that may be related to performance." (Neidorf et al., 2006, p. 5)	Monitoring the outcomes of education systems by measuring student achievement at the end of compulsory education (15-year-olds) on a regular basis. PISA has measured "how well students… are prepared to meet the challenges they may encounter in future life." (OECD, 2006, p. 13)
Partners	Assessment "conducted under the auspices of the International Association for the Evaluation of Educational Achievement (IEA)" (Neidorf et al., 2006, p. 5)	Assessment "conducted by the Organization for Economic Cooperation and Development (OECD)." (Neidorf et al., 2006, p. 6)
Population	Students in the fourth, eighth, and twelfth grades (Neidorf et al., 2006, p. 5)	Students at an age near the end of compulsory schooling in most countries (15-year-olds) (OECD, 2006, p. 13)
Framework dimensions	- Five content domains based on curricula: number, measurement, geometry, data, and algebra - Four cognitive domains: knowing facts and procedures, using concepts, solving routing problems, and reasoning - Communicating mathematically (Neidorf et al., 2006, p. 8)	- Four overarching ideas: change and relationship, quantity, space and shape, and uncertainty - Three competency clusters: reproduction, connections, and reflection - Four situations or contexts: personal, educational/occupational, public, and scientific (Neidorf et al., 2006, p. 8)
Item format	The majority of items are "multiple-choice" (Neidorf et al., 2006, p. 38)	The majority of items are "constructed response" ("short response, closed response, and open response") (Neidorf et al., 2006, p. 38)
Cycle of data collection	Every 4 years since 1995	Every 3 years since 2000

Source: Adapted from Neidorf at el. (2006); OECD (2013)

2.4. Summary

In this chapter, the First International Mathematics Study (FIMS), the Second International Mathematics Study (SIMS), and the Third International Mathematics and Science Study also known as the Trends in International Mathematics and Science Study (TIMSS) were presented briefly. The TIMSS is a very useful study. It helps the U.S and other participating countries know the trends in students' mathematics and science achievements world-wide. This chapter also presented a comparison between the TIMSS and PISA - two currently popular studies comparing achievements of students all over the world - in Mathematics and Science about purpose, partners, population, content, and item format.

This chapter provided a glance at the international comparison of student achievement programs and their results. It also introduced references which may help people study these programs in more depth.

A complementary video study conducted as part of the TIMSS 1995 and 1999 will be presented in the next chapter of this dissertation.

CHAPTER 3

THE TIMSS VIDEO STUDY

As mentioned, the main purpose of this dissertation is to use a video study to investigate eighth-grade mathematics classrooms in Vietnam. The procedure of this video study is mainly based on the procedure of the TIMSS Video Study. Before presenting the Vietnam video study in the next chapter, this chapter presents the purposes, procedures, and findings of the TIMSS Video Study.

According to Stigler et al. (1999), in the FIMS and the SIMS, U.S. students achieved low scores in comparison with other countries' students (p. 1). The TIMSS 1995 *"*Videotape Classroom Study*"* was thus added to complement the studies and find out "more about the instructional and cultural processes that are associated with achievement" (Stigler et al., 1999, p. 1). The *TIMSS Videotape Classroom Study* is now known as the *TIMSS Video Study*.

After the success of the TIMSS 1995 Video Study, many video studies were conducted after that, such as the TIMSS 1999 Video Study, the IPN Video Study, and the Pythagoras Video Study, among others.

By analyzing these video studies, this dissertation discovered that we can use video study as a research method in mathematics education that offers many advantages. Therefore, this dissertation presents the advantages as well as disadvantages of using video study to research mathematics education in the first part of this chapter before presenting the purposes, procedures, and findings of the TIMSS Video Study in the remainder.

3.1. Video study - one research method in mathematics education

Schoenfeld (2000) asserted that

> Research in mathematics education has two main purposes, one pure and one applied:
> - Pure (Basic Science): To understand the nature of mathematical thinking, teaching, and learning;
> - Applied (Engineering): To use such understandings to improve mathematics instruction.
>
> These are deeply intertwined, with the first at least as important as the second. The reason is simple: without a deep understanding of thinking, teaching, and learning, no sustained progress on the "applied front" is possible. (pp. 641-642)

Normally, researchers use a number of methods to study mathematics education, such as theoretical study, observation, survey, design experiment, and so on.

These research methods have been presented in detail elsewhere. According to Nguyen Ba Kim (2011),

❖ *Theoretical study* is a research method using the available documents and scientific results in various fields such as psychology, pedagogy, mathematics, and so on to find new knowledge to apply to mathematics education.[1] (p. 27)

❖ *Observation* is a research method to get new information through external observation of an educational phenomenon without educational interventions.[2] (p. 28)

❖ *Survey* is a research method to get new information from within the educational phenomenon by using questionnaires and tests without educational interventions.[3] (p. 28)

❖ *Design Experiment* is a research method of making educational interventions, then determining and evaluating the results of those educational interventions.[4] (p. 30)

Cobb et al. (2003) asserted that design experiment is a very useful research method in studying a complicated system with multiple interactive elements "by designing its elements and by anticipating how these elements function together" (p. 9). So, design experiment is also very useful in studying mathematics education, which is also a complex system involving many interactive elements.

Normally, these research methods are combined with each other in researching mathematics education; for example, we can use theoretical study, observation, and survey methods to propose a scientific hypothesis, then using the design experiment method to verify the hypothesis.[5] (Nguyen Ba Kim, 2011, p. 31)

According to Stigler et al. (1999), to investigate a classroom process on a large scale, the researchers normally use the survey method through teacher questionnaires (p. 2). Using questionnaires has many advantages, in that they are "simple to administer to large numbers of respondents, and usually can be transformed easily into data files that are ready for statistical analysis" (Stigler et al. 1999, p. 2). But there are still some limitations, such as that the teachers may not understand the words in the questionnaires "in a consistent way," that they may not understand what the researchers meant or may understand in their own way, or that teachers may report accurately "what they planned for a lesson", but they may report inaccurately "on the aspects of teaching that can happen too quickly to be under the teacher's conscious control" (Stigler et al., 1999, pp. 2 - 3).

1. Nghiên cứu lý luận là phương pháp nghiên cứu sử dụng các tài liệu, kết quả khoa học sẵn có ở nhiều lĩnh vực như Tâm lý học, Giáo dục học, Toán học … để tìm ra *cái mới* vận dụng vào Phương pháp dạy học Toán. (Nguyen Ba Kim, 2011, p. 27)
2. Quan sát là phương pháp nghiên cứu thu thập những thông tin mới bằng việc quan sát những dấu hiệu thông tin *bên ngoài* của những hiện tượng giáo dục mà không chủ động gây nên các tác động giáo dục. (Nguyen Ba Kim, 2011, p. 28)
3. Điều tra là phương pháp nghiên cứu sử dụng phiếu điều tra, các bài kiểm tra để thu thập những thông tin *bên trong* những hiện tượng giáo dục mà không chủ động gây nên các tác động giáo dục. (Nguyen Ba Kim, 2011, p. 28)
4. Thực nghiệm giáo dục là phương pháp pháp nghiên cứu chủ động gây nên những tác động giáo dục, từ đó xác định và đánh giá kết quả của những tác động giáo dục đó. (Nguyen Ba Kim, 2011, p. 30)
5. Những phương pháp nghiên cứu này thường được sử dụng kết hợp với nhau. Ví dụ, chúng ta có thể sử dụng Nghiên cứu lý luận, Quan sát, Điều tra để đề xuất những giả thiết khoa học, sau đó dùng Thực nghiệm giáo dục để kiểm nghiệm. (Nguyen Ba Kim, 2011, p. 31)

Researchers may observe the classroom directly to minimize the above limitations of the survey method. However, Hiebert et al. (2003) cautions that "direct observation of classrooms" also has some "important limitations," such as the fact that "different observers" from different countries may not record the activity in the classroom "in comparable ways," and that the aspects of teaching to be observed "must be decided" before the observation takes place (p. 4). "Although new categories might occur to observers during the study, the earlier lessons cannot be re-observed." (Hiebert et al. 2003, p. 4)

Video study overcomes some of the limitations of the questionnaires and direct observation of classrooms. Actually, video study may be considered a special observation method in which video technology is a tool to assist the observation.

Janík, Seidel, and Najvar (2009) asserted that "over the past centuries", scientists have exploited various tools to assist the observation, such as: "the microscope to observe very small objects and the telescopes to observe very distant objects" in the natural sciences, or "video technology…to observe phenomena that are too complex to be noticed by the naked eye" in the social sciences (p. 7).

Najvar et al. (2009) believed that "only after video study was introduced into classroom research has it been possible to appreciate fully and thus tackle the formidable complexity of classroom processes." (p. 108)

> The term *video study* refers to research of social or educational reality based on analysis of video recordings… *Video study* represents a complex methodological approach, which enables the employing of a number of various strategies, methods or techniques for generating, collecting and analyzing *video data*. (Janík, Seidel, and Najvar, 2009, p. 7)

The advantages and disadvantages of using video study in investigating mathematics education will be presented in the next sections.

3.2. The advantages of using video study in investigating mathematics education

There are many advantages of using video study in investigating teaching and learning in general. They have been documented by many researchers. In this dissertation, these advantages are related to mathematics education.

Stigler et al. (1999) explained that video study overcomes some of the limitations of questionnaires and direct observation in studying classroom instruction; for example, it "enables study of complex processes" and "provides a source of new ideas for how to teach" (pp. 3-5). Relating to using video study in investigating mathematics education, we can see that it is very difficult for a direct observer to simultaneously observe several aspects of the complex process of mathematics education in the classroom. However, by watching videos of mathematics lessons over and over again "in slow motion", researchers can observe a lesson "in great detail" from beginning to end many times, studying different aspects of the mathematics education process each time. For example, the first time, researchers can observe and code the public and private classroom interaction; in the second, the mathematical content activity; and in the third, the resources used in the mathematics lessons (Stigler et al., 1999, p. 4). Furthermore, questionnaires can help researchers and teachers to understand the "trends and relationships" in mathematics education, but they cannot help teachers to know new ways of teaching mathematics, while videos can provide teachers with "concrete and grounded" new ideas for how to teach mathematics (Stigler et al., 1999, p. 5).

Hiebert et al. (2003) also listed some advantages of using video study in investigating teaching, such as the fact that "video enables coding from multiple perspectives", "video stores data in a form that allows new analyses at a later time", "video facilitates communication of the results", and so on (pp. 5-6). There are many examples of using video study to investigate mathematics education: mathematics videotaped lessons can be watched and coded by psychologists, mathematicians, anthropologists, and educators for different aspects of the lessons; the researchers can use clips to illustrate what the code "non-mathematical/off – topic" means; and so on.

According to the authors of the book *The power of video studies in investigating teaching and learning in the classroom*, the advantages of using video study in investigating mathematics education are describe below:

❖ Because "video recording can be slowed down, stopped and replayed," the researchers can "focus on very short" segments of videotaped lessons "to capture the numerous and varied ways in which the [mathematics] educational content is represented." (Janík, Seidel, and Najvar, 2009, p. 13)

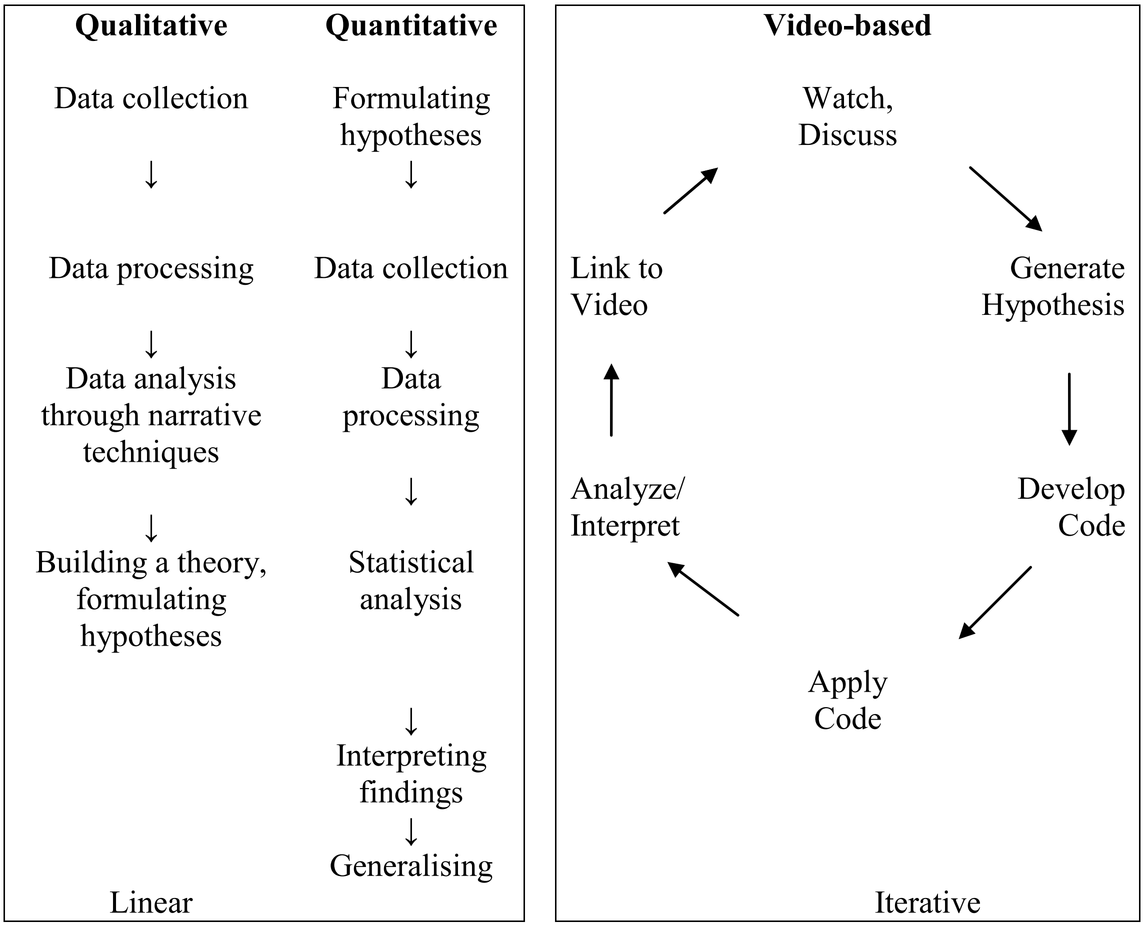
❖ International comparison in mathematics education previously experienced many difficulties in "methodology and technique", but can now be "adequately addressed through advances" in using technology such as "techniques and equipment for the collection" of video data in classrooms; tools for saving and processing the video and other data; "storage facilities that support networked access to large complex databases"; "data distribution systems that support secure, remote access for data entry and retrieval on an international scale"; and "analytical tools capable of supporting sophisticated analyses of such complex databases". (Clarke, Mitchell, and Bowman, 2009, p. 39)

❖ Videos "can be collected, edited and recombined" and they can "support processes of sharing and commonality in analyzing pedagogical practices". (Klette, 2009, pp. 64-65)

> ❖ Video documentation makes it possible to record and capture teacher-student, student-student interaction [in mathematical classrooms] and how these interactions are linked to contextual activities and content issues. Video methodology makes it possible to record, analyze and combine different texts at play in the [mathematical] classrooms simultaneously. These possibilities enrich our capacity to understand [mathematical] classroom teaching and learning as complex settings and which involves layers of actors and meanings. (Klette, 2009, p. 79)

❖ “International video studies offer the possibility to see beyond one’s own four walls and to learn from other teaching cultures.” (Dalehefte et al., 2009, p. 98)

Figure 3.1. Linear versus iterative research approach



Source: Jacobs, Kawanaka, and Stigler (1999, p. 719); Najvar et al. (2009, p. 108)

❖ “While the conventional [mathematics education] research is linear in nature, video data allow for cyclic reanalyses, the reformulating of objectives and applying of new codes which build on previous analyses” (see Figure 3.1). (Najvar et al., 2009, p.108)

❖ Through “repeated viewing of the same situation” on the video, the observers have the advantage of attaining a high consensus when discussing and refining the “coding guidelines”. (Najvar et al., 2009, pp. 108-109)

Jacobs, Kawanaka, and Stigler (1999) also wrote in their paper, “Integrating qualitative and quantitative approaches to the analysis of video data on classroom teaching,” about some advantages of using video study to investigate teaching and learning. Relating to mathematics education, these advantages can be understood as follows:

- Videos [of mathematics lessons] collected on a large scale can enable…an integration [of qualitative and quantitative approaches]…. Videos allow for novel research questions to emerge from the data, while at the same time providing a means to test these questions in a quantitative manner.

  Video data make possible a cyclical analytical process that takes advantage of the fact that they can be used as both quantitative and qualitative research tools. This cycle includes watching, coding, and analyzing the data, with the goal of transforming the video images into objective and verifiable information [see Figure 3.1]. Conventional quantitative or qualitative data must be collected and analyzed linearly, but video data allow for a unique iterative process. (p. 718)

- Videos of mathematics lessons, which can be uploaded on the Internet, could be used as qualitative research tools by remote researchers to "generate new research questions", or could be used as quantitative research tools by "coders working at different sites". (p. 720)

- "Video can be used to capture the [mathematical] lesson content and classroom events, including visual (such as the writing on the blackboard) as well as verbal content." (p. 720)

As mentioned, each research method has its own strengths and weaknesses. The strengths of video study are presented above. The weaknesses are discussed in the following section, along with ideas for overcoming them.

3.3. The disadvantages of using video study in investigating mathematics education and how to overcome these disadvantages

The disadvantages of using video study in investigating teaching and learning have also been documented by popular authors. These disadvantages are also related to mathematics education in this dissertation.

Stigler et al. (1999) indicated some disadvantages of video study:

> **Standardization of Camera Procedures**
>
> …different videographers will photograph the same [mathematics] lesson in different ways. One may focus on individual students, another may shoot the wide shots in order to give the broadest possible picture of what is happening in the classroom. Yet another might focus on the teacher or on the blackboard. Because we want to study classroom instruction, not the videographers' camera habits, it is important to develop standardized procedures for using the camera and then to carefully train videographers to follow these procedures…
>
> **The Problem of Observer Effects**
>
> What effect does the camera have on what happens in the classroom? Will students and teachers behave as usual with the camera present, or will we get a view that is biased in some way? Might a teacher, knowing that she is to be videotaped, even prepare a special lesson just for the occasion that is unrepresentative of her normal practices?...
>
> Changing the way a teacher teaches is [not easy]…. Teachers will obviously try to do an especially good job, and may do some extra preparation, for a lesson that is

videotaped. We may, therefore, see a somewhat idealized version of what the teacher normally does in the classroom.

Sampling and Validity

Observer effects are not the only threat to the validity of video survey data. Sampling – of schools, teachers, class periods, lesson topics, and parts of the school year – is a major concern….

Confidentiality

The fact that images of teachers and students appear on the tapes makes it more difficult than usual to protect the confidentiality of study participants when the data set is used for secondary analyses….

One option is to disguise the participants by blurring their faces on the video. This can be accomplished with modern-day digital video editing tools, but it is expensive at present [in 1999] to do this for an entire data set….

Logistics

Contrary to traditional surveys, which require intensive and thorough preparation up front, the most daunting part of video survey is in the data management and analysis phase. Information entered on questionnaires is more easily transformed into computer readable format than is the case for video images. Thus, it is necessary to find a means to index the contents of the hundreds of hours of tape that can be collected in a video survey. Otherwise, the labor involved in analyzing the tapes grows enormously.

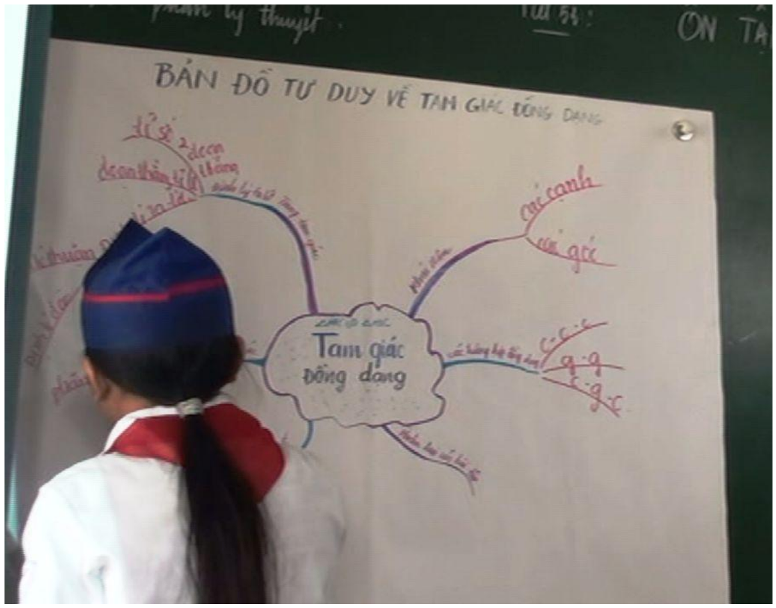
Once data are indexed, there is still the problem of coding. Coding of videotapes is renowned as highly labor intensive. (pp. 6-8)

From the experience of the TIMSS 1999 video study, Hiebert et al. (2003) also pointed out some of the disadvantages of video study, such as “coding reliability” or “the unreasonable power of the anecdote” (p. 8). One example of coding reliability in researching mathematics education is that sometimes researchers have difficulties deciding whether a given segment of the lesson is to be designated a “public interaction” segment or “optional, teacher presents information” segment (see definitions of these segments in Hiebert et al., 2003, pp. 53-54). This is because sometimes in these segments, the teacher presents information and the students listen. What researchers have to determine is whether all students in the classroom attend to the teachers’ presentation or whether some of them “work on an assignment privately” (see Hiebert et al., 2003, pp. 53-54). This is not an easy job and maybe different coders will decide differently. For another example regarding the unreasonable power of anecdote, Hiebert et al. (2003) asserted that “video images are vivid and powerful tools for representing and communicating information. But video images can be too powerful. One video image, although memorable, can be misleading and unrepresentative of reality.” (p. 8)

When watching the Vietnamese video of lesson 17.NA.TC (see Chapter 4 of this dissertation), we noticed that the teacher used “thinking maps” (Image 3.1) to review the mathematics content of previous lessons. If we watch only this video, we may have an anecdote that Vietnamese teachers often used the thinking maps in mathematics teaching and this may lead to the misunderstanding. However, in a video study, there are many other videos that we can use to validate the hypotheses. After watching 27 videos of the lessons, we found that there were only 2 teachers using the thinking maps in their lessons (lesson 7.TH.QX and lesson 17.NA.TC). So, we cannot validate the hypothesis above.

“Discoveries made through qualitative analysis of a few videos can be validated by statistical analysis of the whole set.” (Hiebert et al., 2003, p. 9)

Image 3.1. Using “thinking maps” in mathematics teaching in Vietnam



* Image was captured from video of lesson 17.NA.TC

Dalehefte et al. (2009) also implied in “Observing instruction “next-door”: A video study about Science Teaching and Learning in Germany and Switzerland” that despite “stratified and random aspects” of the data collection in their video study, “the outcome is still restricted by the make-up of the sample.” (p. 98)

Many people think that there are many advantages of video study while the disadvantages are not significant. Actually, the effects of the disadvantages are not small. For example, most teachers do not want to be videotaped for reasons of *confidentiality*. They do not want many people, especially researchers and experts, to watch what they do in the classroom because any mistake will be videotaped and they cannot change it again in the videos. These mistakes may have a negative influence on their career and life. If we cannot videotape the lessons, we will have nothing to study.

Another example is the *problem of observer effects*. We cannot assert that everything we watch from videos is happening as usual. The teachers maybe prepare for the lessons more carefully or the students maybe learn more actively in the videotaped lessons. This problem will make us have biased results.

If we overcome these disadvantages, we can employ video study more effectively in investigating mathematics education. Some video studies in mathematics education will be presented in the next sections.

3.4. The TIMSS Video Study

According to Stigler et al. (1999), in the First International Mathematics Study (FIMS) and the Second International Mathematics Study (SIMS), U.S. students received low scores "in comparison with other countries", however the findings in these studies were not enough "to explain their relatively low performance" (p. 1). "Finding out more about the instructional and cultural processes that are associated with achievement thus became a high priority in planning for the TIMSS." (Stigler et al., 1999, p. 1)

The story of the TIMSS Video Study began in 1993, when Ron Kelly (United States), Andrea Lindenthal (Germany), and Tadayuki Miyashiro (Japan) traveled around their country to videotape a different mathematics lesson each day over several months to collect data for the Third International Mathematics and Science Study (Stigler and Hiebert, 1999, p. 15). The TIMSS Video Study was conducted in 1995 (three countries) and in 1999 (seven countries).

3.4.1. The purposes of the TIMSS Video Study

The TIMSS Video Study was first conducted in 1995. This study was an international videotape survey of eighth-grade mathematics lessons in Germany, Japan, and the United States and was the first attempt "to collect videotaped records of classroom instruction" from nationally representative samples of teachers (Stigler et al., 1999, p. v). This study was funded by the National Center for Education Statistics (NCES) and the National Science Foundation.

Four years later, the TIMSS Video Study was conducted again in 1999. This video study investigated eighth-grade mathematics and science classrooms in seven countries in which students scored relatively higher than U.S. students on TIMSS assessments (National Center for Education Statistics, 2003, p. 1).

According to Stigler et al. (1999), the TIMSS 1995 Video Study was conducted in a total of 231 eighth-grade mathematics classrooms in Germany, Japan, and the United States with four goals:

- Provide a rich source of information regarding what goes on inside eighth-grade mathematics classes in the three countries.
- Develop objective observational measures of classroom instruction to serve as valid quantitative indicators, at a national level, of teaching practices in three countries.
- Compare actual mathematics teaching methods in the United States and the other countries with those recommended in current reform documents and with teachers' perceptions of those recommendations.
- Assess the feasibility of applying videotape methodology in future wider-scale national and international surveys of classroom instructional practices. (p. v)

For the first goal, the TIMSS 1995 Video Study collected 231 videotapes of mathematics classrooms and a lot of questionnaires as well as supplementary materials. For the second goal, the TIMSS 1995 Video Study developed the system of codes which allowed the quantitative investigation of classroom instruction. The third goal can be seen in books and scientific articles such as “The Teaching Gap: Best Ideas from the World’s Teachers for Improving Education in the Classroom” by Stigler and Hiebert (1999), or “A Proposal for Improving Classroom Teaching: Lessons from the TIMSS Video Study” by Hiebert and Stigler (2000). With the last goal, the TIMSS 1995 Video Study proved that using videotape methodology in future wider-scale national and international surveys of classroom instructional practices is feasible because after the success of the TIMSS 1995 Video Study, there have been many video studies conducted such as the TIMSS 1999 Video Study, the IPN Video Study, the Pythagoras Video Study and so on.

Unlike the TIMSS 1995 Video Study which investigated only mathematics classrooms in three countries, the TIMSS 1999 Video Study investigated both mathematics and science classrooms in seven countries with six goals:

- To investigate mathematics and science teaching practices in U.S. classrooms.
- To compare U.S. teaching practices with those found in high-achieving countries.
- To discover new ideas about teaching mathematics and science.
- To develop new teaching research methods and tools for teacher[s’] professional development.
- To create a digital library of images of teaching to inform U.S. educational policy.
- To stimulate and focus discussion of teaching practices among educators, policy markers, and the public. (Jacobs et al., 2003, p. 180)

The dissertation will mention the TIMSS 1999 Video Study in more detail in Chapters 4 and 5 of this dissertation.

3.4.2. Methodology and procedure of the TIMSS Video Study

Based on Stigler et al. (1999), this dissertation can divide the TIMSS 1995 Video Study into 5 stages:

- ***The first stage***: *selecting a random sample*. The samples of the TIMSS 1995 Video Study were the sub-samples of the TIMSS 1995 assessment sample in Germany, Japan, and the United States. The final samples included 100 classrooms in Germany, 81 classrooms in the United States, and 50 classrooms in Japan (p. 9). “The sampling time in the school year” was also selected in this stage and the “goal was to spread the videotaping out evenly over the school year”. (p. 12)

- ***The second stage:*** *collecting the data*. The TIMSS 1995 Video Study “primarily collected two kinds of data: videotapes and questionnaires, and supplementary materials (e.g., copies of textbook pages or worksheets)” (p. 14). Only “one completed mathematics lesson – as defined by the teacher - was videotaped in each classroom” on a convenient date for the teacher, and after videotaping, “each teacher was given a questionnaire and an envelope in which to return it” (p. 14).

❖ ***The third stage:*** *“constructing the multimedia database”* (p. 21). The videotapes were digitized, compressed, and stored on CD-ROM, and then were transcribed and translated into English (pp. 21-22).

❖ ***The fourth stage:*** *“developing codes” and coding* (p. 23). In this stage, the coding team decided what to code, developed coding procedures, and implemented the codes using software (pp. 23-33).

❖ ***The last stage:*** statistically analyzing and reporting the results of the coding (pp. 33-39).

Unlike the TIMSS 1995 Video Study which used only one camera to videotape mathematics lessons, the TIMSS 1999 Video Study used two cameras to videotape one math lesson and one science lesson in at least 100 randomly selected schools in each country (except Japan with 50 mathematics lessons videotaped by one camera) (Jacobs et al., 2003, pp. 29-30; Stigler et al., 1999, pp. v, 15). The TIMSS 1999 Video Study also collected the teacher and student questionnaires, the worksheets, and the textbook pages used in the videotaped lessons (Jacobs et al., 2003, p. 46).

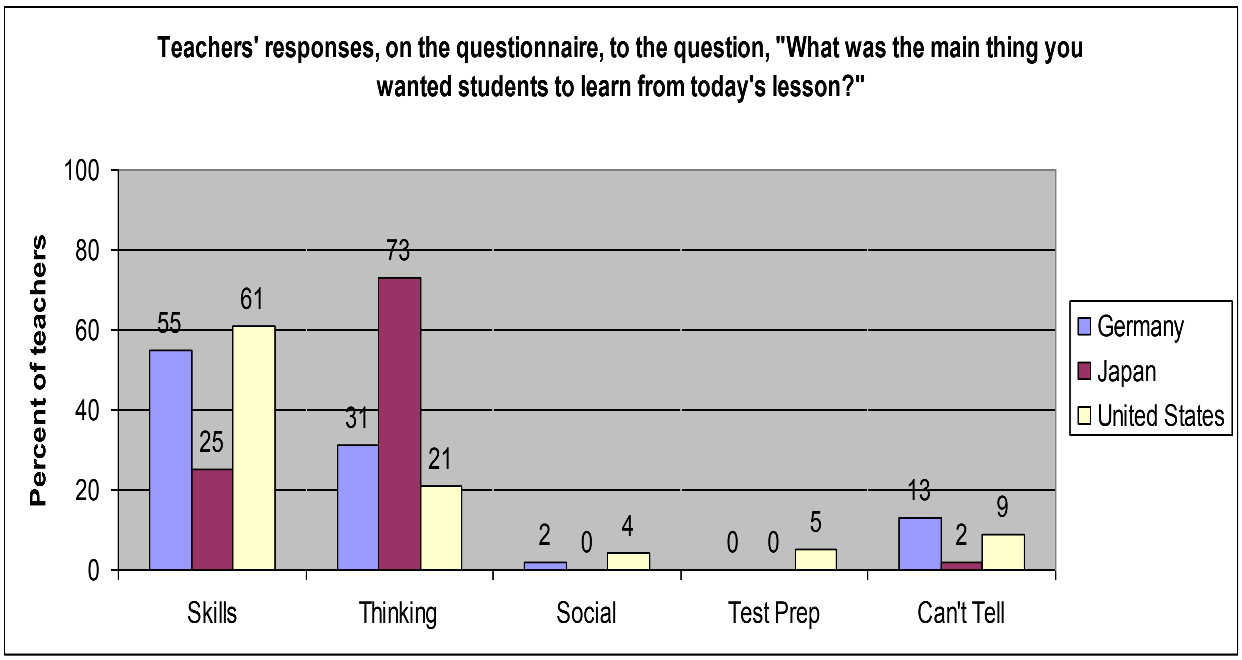
The methodology and procedure of the TIMSS 1999 Video Study will be mentioned in the next chapter of this dissertation.

3.4.3. Some findings of the TIMSS Video Study

The TIMSS 1995 Video Study investigated the "mathematical content of lessons", the "organization of instruction", "processes of instruction", and "teachers and reform," all of which were presented in Stigler et al. (1999, pp. 41-133). This section presents some of these findings.

As for the mathematical content of lessons, when Stigler et al. (1999) asked teachers "what main thing they wanted students to learn from the lesson", they "found significant differences" (p. 45) which are displayed in Figure 3.2 below.

Figure 3.2. Teachers' responses on the questionnaire to the question, "What was the main thing you wanted students to learn from today's lesson?"



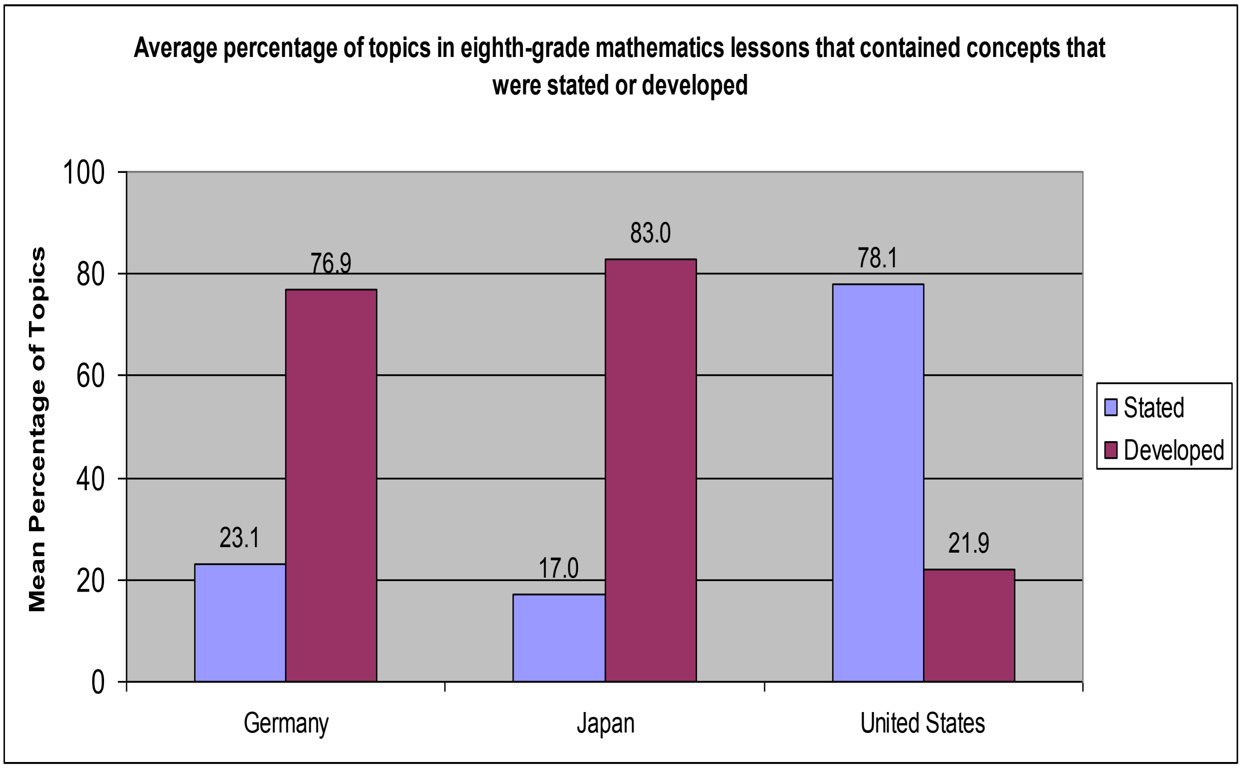
* Percentages may not sum to 100 due to rounding
* Source: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Videotape Classroom Study, 1994-1995.

Source: Adapted from Stigler et al. (1999, p. 46)

From Figure 3.2, we can see that a majority of Japanese teachers wanted their students to learn how to think from the mathematics lesson while at least 55% of their colleagues in Germany and the United States wanted the students to improve their skills.

The TIMSS 1995 Video Study also investigated whether the concepts were developed or just stated in the videotaped lessons. The results of coding this aspect can be seen in Figure 3.3 below.

Figure 3.3. Average percentage of topics in eighth-grade mathematics lessons that contained concepts that were stated or developed



Source: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Videotape Classroom Study, 1994-1995.

Source: Stigler et al. (1999, p. 52)

From Figure 3.3 we can see that the mathematical concepts were just stated in most topics of lessons in the United States while the mathematics concepts were developed in most topics of lessons in Germany and Japan.

The TIMSS 1995 Video Study also rated the quality of the mathematical content of each videotaped lesson. Based on international standards, the level of content in eighth-grade mathematics lessons in Germany, Japan, and the United States were rated in Table 3.1 and Figure 3.4 below.

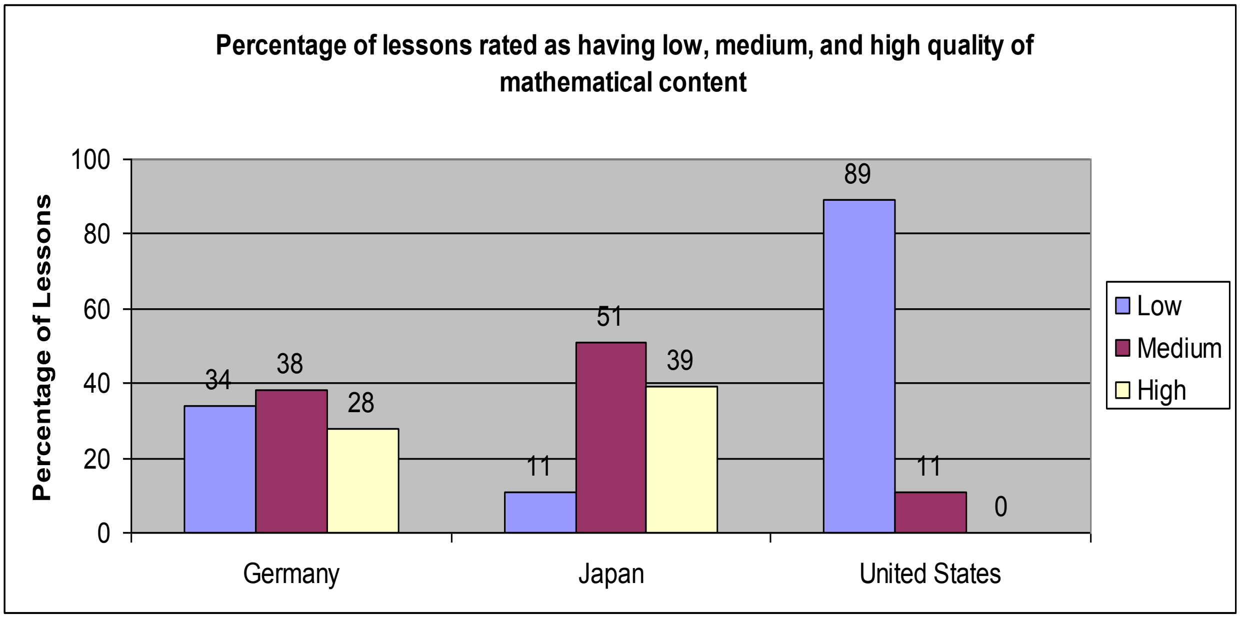
Table 3.1. Average grade level of content by international standards

	Mean
Germany	8.7
Japan	9.1
United States	7.4

* Source: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Videotape Classroom Study, 1994-1995.

Source: Stigler et al. (1999, p. 44)

Figure 3.4. Percentage of lessons rated as having low, medium, and high quality of mathematical content



* Source: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Videotape Classroom Study, 1994-1995.

Source: Stigler et al. (1999, p. 70)

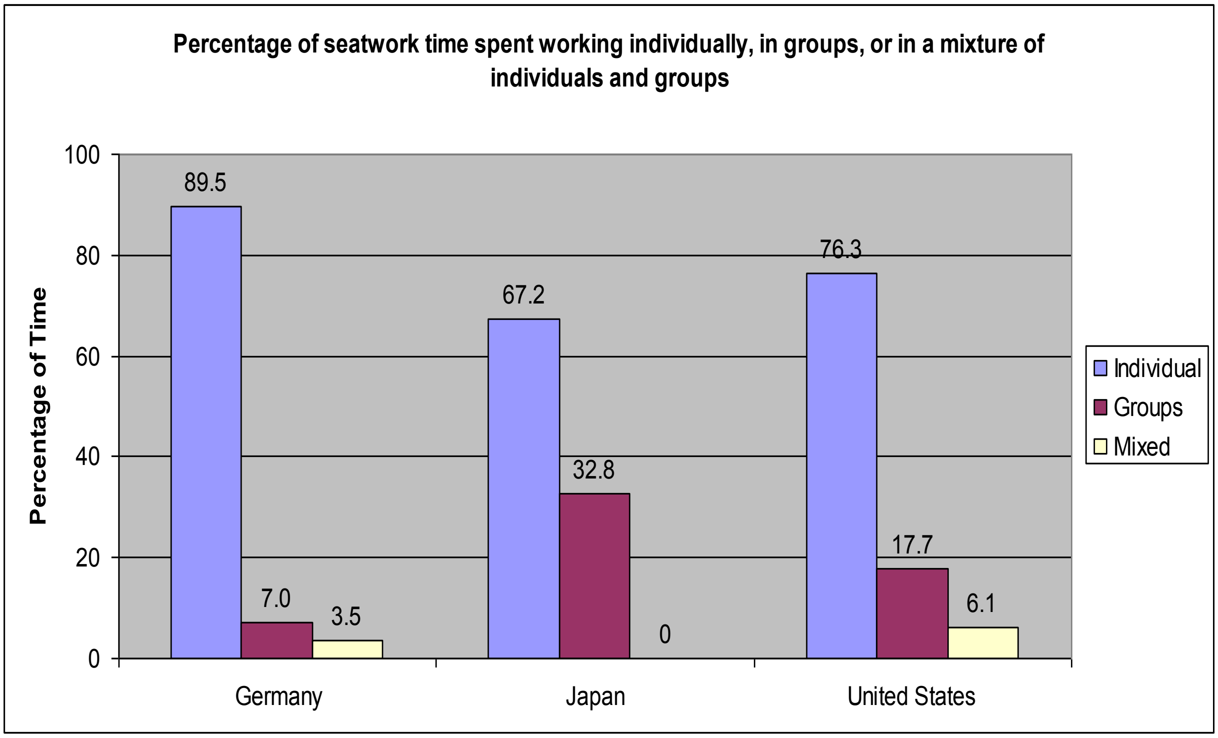
From Table 3.1 and Figure 3.4 above, we can see that the level of mathematical content in German and Japanese lessons was much higher than the level of mathematical content in the U.S. lessons. Based on international standards, the average grade level of content in German and Japanese lessons was about at the ninth-grade level, while the average grade level of content in the U.S. lessons was about at the seventh-grade level.

A majority of the U.S. lessons had low quality mathematics content. In particular, the mathematics lessons having a high quality of mathematics content were rarely found in the U.S. lessons, while they were found in 28% and 39% of German and Japanese lessons, respectively.

About the *organization of instruction*, one of the aspects to which the TIMSS 1995 Video Study paid attention was "individual seatwork" versus "group seatwork".

German teachers spent more time on individual seatwork segments than Japanese teachers did. Conversely, German teachers spent much less time on group seatwork segments than their colleagues in Japan and the United States. A mixture of individuals and groups could be found in German and U.S. lessons, but was rarely found in Japanese lessons (see Figure 3.5 below).

Figure 3.5. Percentage of seatwork time spent working individually, in groups, or in a mixture of individuals and groups



* Percentages may not sum to 100 due to rounding
* Source: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Videotape Classroom Study, 1994-1995.

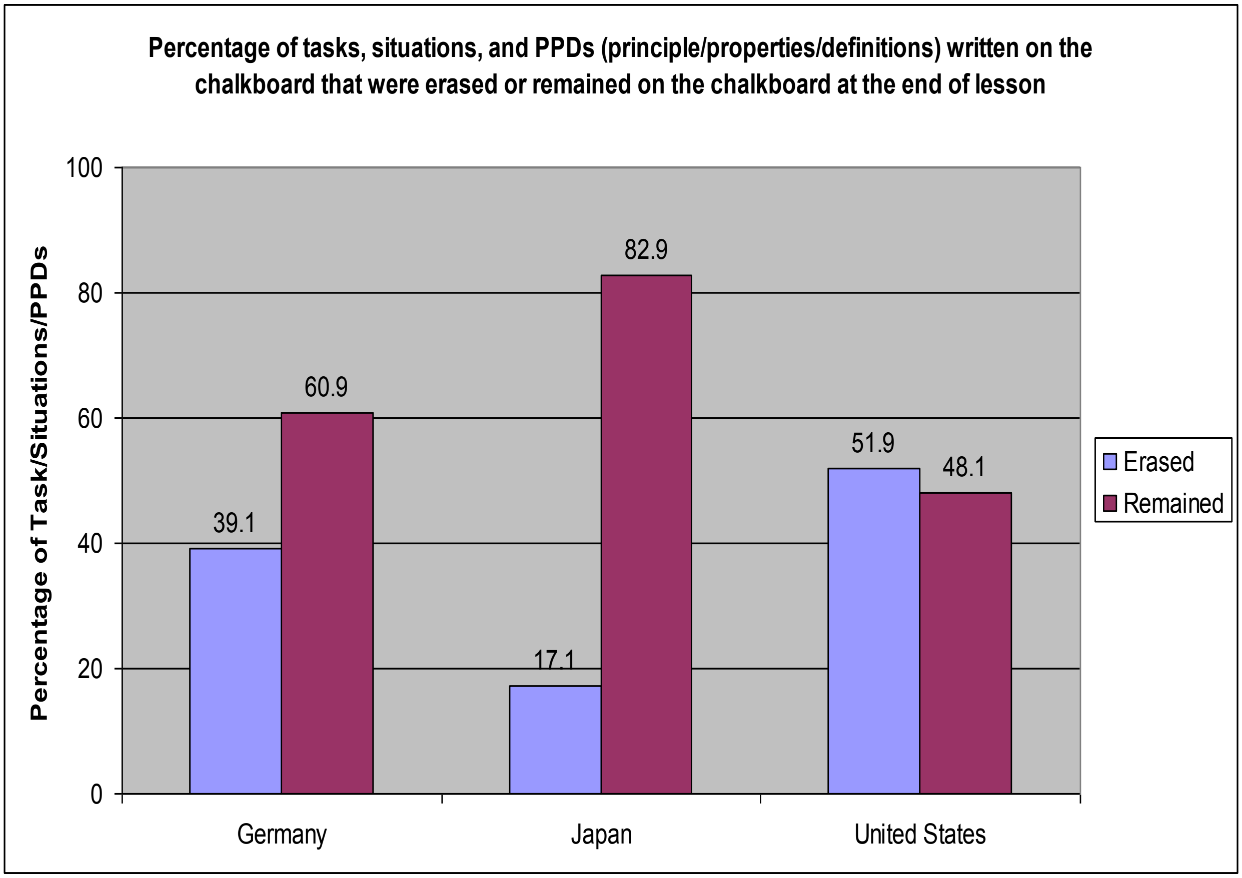
Source: Stigler et al. (1999, p. 78)

In particular, the TIMSS 1995 Video Study also investigated the way teachers in different countries used the chalkboard. The results of the TIMSS 1995 Video Study revealed that Japanese teachers tended to keep more information on the chalkboard than did German and U.S. teachers (see Figure 3.6 below). (Stigler et al., 1999, p. 95)

Stigler et al. (1999) asserted that:

> In Japan, the chalkboard is used in a highly structured way: Teachers appear to begin the lesson with a plan for what the chalkboard will look like at the end of the lesson, and by the end of the lesson we see a structured record or residue of the mathematics covered during the lesson. In the United States, in contrast, the use of the chalkboard appears more haphazard. Teachers write wherever there is free space and erase frequently to make room for what they want to put up next. (p. 93)

Figure 3.6. Percentage of tasks, situations, and PPDs (principles/ properties/ definitions) written on the chalkboard that were erased or remained on the chalkboard at the end of the lesson



* Source: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Videotape Classroom Study, 1994-1995.

Source: Stigler et al. (1999, p. 95)

Vietnamese mathematics teachers usually divide the chalkboard into two, three, or more parts by drawing vertical lines. They spend one or two parts on the left to write and keep the important mathematical contents of the lesson that students should remember. And they use the other parts on the right to write other mathematics content which can later be erased.

The other findings of the TIMSS 1995 Video Study can be found in Stigler et al. (1999). The findings of the TIMSS 1999 Video Study will be used to compare with the results of the TIMSS 2007 Video Study in Indonesia and a video study which was conducted in 2012 in Vietnam to provide the data for this dissertation. This comparison will be presented in Chapter 5 of this dissertation.

The introduction of the TIMSS 1999 Video Study and related documents can be found at http://timssvideo.com (accessed May 02, 2012). From this website, we can find many useful references that help us to conduct a private video study, such as a "data collection manual", "math coding manual", "transcription manual", "teacher questionnaire", "student questionnaire", and other reports and publications. We can also watch at least 4 full videotaped mathematics lessons in seven countries (Australia, Czech Republic, Hong Kong, Japan, Netherlands, Switzerland, and United States) from http://timssvideo.com (accessed May 02, 2012).

3.5. Some aspects that researchers have already investigated in the TIMSS Video Study and other video studies

After the success of the TIMSS 1995 Video Study, many other video studies investigating education were conducted. We can see the overview of large-scale video studies from 1995 to 2009 in Table 3.2 below.

Through these video studies, researchers investigated the following aspects:

❖ Comparing Mathematics teaching in Germany, Japan, and the United States (TIMSS 1995 Video Study) regarding: "mathematical content of lessons", "the organization of instruction", "processes of instruction", and "teachers and reform" (Stigler et al., 1999).

❖ Comparing Mathematics teaching across seven countries (TIMSS 1999 Video Study) regarding: the "context of the lessons", "the structure of lessons", "the mathematical content of lessons", "instructional practices - how mathematics was worked on", and "similarities and differences in eighth-grade mathematics teaching across seven countries" (Hiebert et al., 2003).

❖ Comparing Science teaching in Australia, the Czech Republic, Japan, the Netherlands, and the United States (TIMSS 1999 Video Study) regarding*:* "instructional organization (teacher actions)", "science content", and "student actions" (Roth et al., 2006, p.6).

❖ Comparing Physics teaching and learning between two countries (Combined second phase of the IPN Video Study in Germany and the Bern Video Study funded by the Swiss National Science Foundation (NSF) at the University of Bern in Switzerland 2003-2004) regarding*:* "surface structure" and "in-depth structure-quality aspects" (Dalehefte et al., 2009, pp. 84, 85, 88).

❖ Comparing perspectives on teaching different school subjects in the Czech Republic (CPV Video Study): the CPV Video Study compared "classroom organization" in four different school subjects (physics, geography, English, and physics education). In this study, the classroom organization was divided into three categories: "teacher-centered (lecture by teacher, dictation, teacher-class discussion)"; "student-centered (individual work, pair work, group work, more modes of classroom organization at the same time)"; and "off-topic (transition, other)" (Najvar et al., 2009, pp. 112-117).

Table 3.2. Overview of video studies from 1995 to 2009

	Goal	Countries	Sample	Data collection	Data analysis
TIMSS 1995	to provide a rich source of information regarding what goes on inside eighth-grade mathematics classes in Germany, Japan, and the U.S.	USA, Japan, Germany	231 lessons Mathematics	1 teacher camera	Mathematical content of lessons, Organization of instruction, Processes of instruction
TIMSS 1999	to provide national-level pictures of teaching, to investigate and describe teaching practices in eighth-grade mathematics and science in a variety of countries	Australia, Czech Republic, Hong Kong, the Netherlands, Switzerland, USA, Japan	638 lessons of mathematics 439 lessons of science Mathematics, Science	1 teacher camera 1 whole-class camera	Structure of lesson, mathematical content of the lessons, Instructional practices, Similarities and differences across seven countries
IPN Video Study	to describe patterns of teaching and learning in physics instruction to investigate effects of teaching on students' learning processes and outcomes	Germany	100 lessons Physics	1 teacher camera 1 whole-class camera	Organization of classroom activities, Goal clarity and coherence, Learning-orientation, Dealing with mistakes and conceptual change, scientific inquiry and the role of experiment

continued on next page

	Goal	Countries	Sample	Data collection	Data analysis
LPS [Learner's Perspective Study]	to analyze teaching and learning	Australia, China, Czech Republic, Philippines, Hong Kong, Israel, Japan, South Africa, South Korea, Germany, Singapore, Sweden	at least 30 lessons in every country; i.e. more than 390 lessons Mathematics	1 teacher camera 1 whole-class camera 1 camera aimed at selected pupils	Verbal interaction, Mathematical norms, Repetition, Role of Seatwork, Motivational strategies, Learning tasks…
Pythagoras	to investigate the impact of mathematics instruction on students' cognitive and motivational outcomes	Germany, Switzerland	19 Swiss and 20 German classes Mathematics	1 teacher camera 1 whole-class camera	Teaching patterns, Student-perceived learning quality, Cognitive activation, mathematical achievement
DESI [Deutsch Englisch Schülerleistungen International]	to describe everyday lessons, to analyse verbal communication within classrooms	Germany	105 classes English as a second language	1 teacher camera 1 whole-class camera	Aspects of instructional quality, Dealing with mistakes, efficiency of classroom management, Mediating cultural studies topics
CPV Video Study	to document and describe everyday teaching, to carry out cross-curricular comparisons of teaching and learning	Czech Republic	249 lessons Physics, Geography, English, Physical education	1 teacher camera 1 whole-class camera	Opportunities to learn, Modes of classroom organization, Phases of the lesson, Didactic tools and media, Opportunities to talk

Source: Janík, Seidel, and Najvar (2009, pp. 9-10)

❖ *“Investigating effects of teaching and learning in Swiss and German Mathematics classrooms” (The Pythagoras Study)* (Klieme, Pauli, and Reusser, 2009).

❖ *“Investigating effects of physics teaching on student learning in the context of the IPN Video study”* (Seidel, Prenzel, Schwindt, Rimmele, Kobarg, and Dalehefte, 2009, pp. 161-180).

❖ *“Exploring different ways of using video in teacher education” (CPV video web)* (Janík, Janíková, Knecht, Kubiatko, Najvar, Najvarová, and Šebestová, 2009, pp. 207-224).

❖ *Using video “to diagnose teacher competence” (LUV- Learning from classroom videos, and Observe – Assessing student teachers’ competence in observing classroom situations project)* (Seidel, Prenzel, Schwindt, Stürmer, Blomberg, and Kobarg, 2009, pp. 243-258).

3.6. Summary

Video study is considered to be a research method in mathematics education that comes with many advantages. This research method overcomes some limitations of the conventional methods, such as questionnaires or direct observation. In this chapter, the TIMSS Video Study and other video studies in education were presented briefly along with their main findings.

Society always changes, so education systems need to change to keep pace with the change of society. We cannot change education systems without looking inside the classrooms. The video study gives researchers powerful opportunities to look deeply inside the classrooms where teaching and learning take place. Based on the TIMSS Video Study, a video study was conducted in Vietnam to provide the data for this dissertation. The findings of this video study will be presented in the next chapter.

CHAPTER 4

USING VIDEO STUDY TO INVESTIGATE EIGHTH-GRADE MATHEMATICS TEACHING AND LEARNING IN VIETNAM

This chapter will present the purpose, methodology and results of the video study which was conducted in Vietnam in 2012. The methodology and procedure of the Vietnam video study were based mainly on the methodology and procedure of the TIMSS Video Study to allow a comparison between the results of these two studies.

Because the TIMSS Video Study investigated the eighth-grade classroom, this dissertation also investigated this grade level in Vietnam. By studying lower secondary school mathematics textbooks in Brandenburg, Germany, the present study found that the education system in Germany is somewhat different from the education system in Vietnam. It found that lower secondary education in Brandenburg includes four grade levels from the seventh to tenth grades. The lower secondary level in Vietnam, however, includes four grade levels from the sixth to ninth grades.

The general purpose of the video study in Vietnam was to investigate Vietnamese eighth-grade mathematics classrooms. So, before presenting the purpose of the Vietnamese video study, the dissertation presents a brief overview of the Vietnamese education system to identify what would be considered the eighth grade level.

4.1. Vietnamese education system and the purpose of video study in Vietnam

4.1.1. Vietnamese education system

This section was written based on the Vietnamese education law (No. 38/2005/QH11 of June 14, 2005) which amended and supplemented some articles in 2009 and later years.

According to Articles 4 and 44 of the Vietnamese education law *(No. 38/2005/QH11 of June 14, 2005),* the Vietnamese education system includes "formal education" and "continuing education," which "helps people pursue in-service, continuous and lifelong learning" (The National Assembly, 2005).

Articles 4, 25, 26, and 32 of the Vietnamese education law *(No. 38/2005/QH11 of June 14, 2005)* stipulated that the "educational levels and training degrees" of Vietnamese education system include:

❖ ***"Preschool education"***: *"crèches"* (for children from 3 months to 3 years old) and *"kindergartens"* (for children from 3 to 6 years old)

❖ ***"General education"***: *"primary education"* (for students from 6 to 11 years old), *"lower secondary education"* (for students from 11 to 15 years old), and *"upper secondary education"* (for students from 15 to 18 years old)

❖ ***"Professional education"***: *"professional secondary education"* (3 to 4 school years for learners who have lower secondary education diplomas; 1 to 2 school years for learners who have upper secondary education diplomas), and *"vocational training"* (less than 1 year for vocational preliminary programs and 1 to 3 years for vocational secondary and college programs)

❖ ***"Undergraduate and postgraduate education"*** (hereinafter referred to as higher education): *college, university, master* and *doctoral degrees.* (The National Assembly, 2005)

Also according to Article 11 of the Vietnamese education law, *(No. 38/2005/QH11 of June 14, 2005),* primary education and lower secondary education are *compulsory education levels* in Vietnam that "all [Vietnamese] citizens within the defined age groups [from 6 years to 15 years old] have the obligation to learn in order to obtain the level of universalized education" (The National Assembly, 2005).

For more details about *general education*, Article 26 of the Vietnamese education law *(No. 38/2005/QH11 of June 14, 2005)* stipulates that Vietnamese general education includes:

❖ *Primary education*: for students from the first grade to the fifth grade (5 school years); the age of students to start learning the first grade is six.

❖ *Lower secondary education*: for students from the sixth grade to the ninth grade (4 school years); students must complete the primary education program before entering the sixth grade at the age of eleven.

❖ *Upper secondary education*: for students from the tenth grade to the twelfth grade (3 school years); students must have a lower secondary education diploma before entering the tenth grade at the age of fifteen. (The National Assembly, 2005)

The *"*institutions of general education*"* in Vietnam consist of: "primary schools", "lower secondary schools", "upper secondary schools", "multi-level general education schools", and "centers for general techniques and vocational orientation" (Article 30 of Vietnamese education law 2005 in the National Assembly, 2005).

Also according to Article 31 of Vietnamese education law 2005,

1. Pupils who complete primary education and meet the requirements set by the Minister of Education and Training shall be certified in their school records by the principals of their primary schools that they have completed primary education.
2. Pupils who complete lower secondary education and meet the requirements set by the Minister of Education and Training shall be awarded lower secondary education

diplomas by the Heads of the Education and Training Offices of rural or urban districts, provincial towns or cities (hereinafter referred collectively to as district level).

3. Pupils who complete upper secondary education and meet the requirements set by the Minister of Education and Training shall be eligible to take an examination and those who pass the examination will be awarded upper secondary education diplomas by the directors of the Education and Training Services of the provinces or centrally-run cities (hereinafter referred collectively to as provincial level). (The National Assembly, 2005)

Schools in the Vietnamese educational system are organized into 3 forms:

1. Public schools, which are established, invested with material foundations, and provided with regular expenditure funding by the State;
2. People-founded schools, which are established, invested with material foundations, and provided with operation funding by local communities;
3. Private schools, which are established, invested with material foundations, and provided with operation funding by social organizations, socio-professional organizations, economic organizations, or individuals with non-state budget capital. (Article 48 of Vietnamese education law 2005 in the National Assembly, 2005)

The video study in this dissertation investigated 27 eighth-grade mathematics classrooms in 22 lower secondary schools in Vietnam. Most of these 22 lower secondary schools are public schools. The age of students who study in the eighth grade is usually thirteen at the beginning of the grade level.

4.1.2. The purpose of video study in Vietnam

The general purpose of this video study was to investigate mathematics teaching in Vietnam. Teaching in general and mathematics teaching in particular are complex activities. Stigler and Hiebert (1999) asserted that "teaching is a cultural activity" (p. 85). "Cultural activities are common everyday routines that have evolved, in ways that are consistent with underlying assumptions and beliefs, to deal with recurring tasks." (Hiebert and Stigler, 2000, pp. 7-8)

From the results of the TIMSS 1995 Video Study, Stigler and Hiebert (1998a) claimed that "teaching, like other cultural activities, is learned through informal participation over long periods of time. It is something one learns to do by growing up in a culture rather than by formal study" (pp. 1-2). Because "teaching is a cultural activity," the system of teaching "must be understood in relation to the cultural beliefs and assumptions that surround them." (Stigler and Hiebert, 1999, pp. 85, 88)

Schein (1997) differentiated three "levels of culture": the level of "artifacts" ("visible organizational structures and processes…that one can see, [hear], and feel"); the level of "espoused values" ("strategies, goals, philosophies" that "members of culture use as a way of depicting the culture to themselves and others"); and the level of "basic underlying assumptions" ("unconscious, taken-for-granted beliefs, perceptions, thoughts, and feelings" that are defined "as the essence of culture") (pp. 16-17). As a cultural activity, mathematics teaching can likewise be differentiated into three levels: artifacts, espoused values, and basic underlying assumptions (see more in Chapter 1 of this dissertation).

We can interpret the *artifacts level* of mathematics teaching through direct observation of what happens inside the classroom. We can interpret the *espoused values level* of mathematics teaching through teacher-student questionnaires. But we are hardly able to interpret the *basic underlying assumptions level* of teaching through these methods of research.

Trumbul, Rothstein-Fisch, and Greenfield (2000) assert that "culture is like the air we breathe, permeating all we do. And the hardest culture to examine is often our own, because it shapes our actions in ways that seem second nature." (p. 2)

Most Vietnamese mathematics teachers in schools usually start teaching new contents by dividing the chalkboard into two or more parts by drawing vertical lines (see Image 4.1 below). They do this repeatedly every lesson so that they cannot remember when they did this for the first time, where they learned to do this, or even why they do this and whether or not it is a good thing to do. They do this unconsciously, as if simply breathing air. All Vietnamese students, Vietnamese teachers, even all people in Vietnam expect to see mathematics teachers draw lines to divide the chalkboard. It is normal in Vietnam. Sometimes the students do not notice whether the teachers do this or not. The students seem blind to this action although the teachers actually do it. Dividing the chalkboard eventually becomes an invisible action. It is taken for granted in mathematics teaching in the Vietnamese culture.

Image 4.1. Most Vietnamese mathematics teachers divide the chalkboard into two or more parts by drawing vertical lines

* Image was captured from the video of lesson 12.NA.CL

Another example of things that gradually become invisible comes from my own personal experience. When I came to live in Golm in Potsdam, Germany, for the first time, I was very annoyed about the loud noise I heard when the trains passed nearby. My room was very near the train station, so when the trains went through I could not hear the music I was playing. I would wake up with a start when the trains went through at night. For me, at that time, the loud noise of the trains was at the 'artifacts level' that I could hear.

After three weeks or a month, I knew the schedule of the trains. I knew the precise time when the trains would pass by. The noise was repeated at the same times everyday. I accepted the noise as an aspect of my natural surroundings. At that time, the loud noise of the trains was at the 'espoused values level' that I accepted.

After three months or more, the noise was still repeated everyday. But I did not pay attention to it any more. When the trains went through, I could still hear clearly the music in my room, and I could sleep well all night. The noise became gradually "invisible" or unconscious. At that time, the noise was in the 'basic underlying assumptions level' that I took for granted. It is very interesting that when newcomers to the building asked me why I could sleep well at night when the train went through. I answered that "it is normal for me."

Schein (1997) said that

> The power of culture comes about through the fact that the assumptions are shared and therefore mutually reinforced. In these instances probably only a third party or some cross-cultural education could help to find common ground whereby both parties could bring their implicit assumptions to the surface. (p. 25)

Relating this to mathematics teaching, people in a particular country hardly bring their assumptions in mathematics teaching to the surface without looking outside their own culture. We need a cross-cultural study about mathematics teaching to help people in some countries look deeply inside their basic underlying assumptions in mathematics teaching.

The TIMSS Video study in 1995 and 1999 brought the opportunity to interpret the basic underlying assumptions level in mathematics teaching in seven countries. There are many advantages of using video study, which were described in Chapter 3 of this dissertation, such as that "video facilitates integration of qualitative and quantitative information" (Hiebert et al., 2003, p. 6); or "international video studies offer the possibility to see beyond one's own four walls and to learn from other teaching cultures" (Dalehefte et al., 2009, p. 98). Video study will help us to understand not only the artifacts level of mathematics teaching but also some aspects of the basic underlying assumption level of mathematics teaching.

The TIMSS 1995 and 1999 video studies were successful in finding the "images of teaching" (see Stigler and Hiebert, 1999, pp. 25-72), the "patterns of teaching" (see Stigler and Hiebert, 1999, pp. 76-83), and the "cultural scripts for teaching" in three countries (see Stigler and Hiebert, 1998b, pp. 7-8; 1999, pp. 85-96), and the "eighth-grade mathematics lesson signature" in seven countries (see Hiebert et al. 2003, pp. 123-151).

Therefore, based on the TIMSS Video Studies, a video study was carried out in Vietnam to provide the data for this dissertation, with the initial purpose of finding the Vietnamese images, patterns, and scripts of teaching, and the Vietnamese eighth-grade mathematics lesson signature.

With this initial purpose, 100 eighth-grade mathematics lessons were intended to be videotaped in 100 randomly selected schools in 23 randomly selected provinces and cities in Vietnam. But because of limited time, only 27 lessons were videotaped.

As mentioned, one of the advantages of video study is that video "allows new analyses at a later time," with the new questions "entirely different than those addressed when the video recordings were collected" (Hiebert et al. 2003, p. 5).

This is true in the video study on which this dissertation is based. After watching and coding the videos some new questions arose, such as, what was different between what Vietnamese teachers know about teaching mathematics effectively and what they actually teach in the classroom? Or, what percentage of the lesson time were Vietnamese students actively involved in the lessons?

With those new questions, the finally aims of this video study were

❖ To describe the images, scripts, and patterns of mathematics teaching in Vietnam

❖ To identify the Vietnamese eighth-grade mathematics lesson 'signature'

❖ To compare Vietnamese mathematics teaching practice with other countries' practices and to identify similar or different lesson features across countries

❖ To compare the mathematics teaching methods that Vietnamese teachers know to what they actually use

❖ To find out the percentage of the lesson time that Vietnamese students were actively involved in the lessons.

The lessons were videotaped in Vietnam from early February 2012 to late April 2012. After that, the videos were brought to Germany for viewing and coding from May 2012 to April 2013. More details can be found in the next section.

4.2. Methodology and procedure

This video study can be divided into 4 stages:

❖ ***Plans for data collection:*** studying the materials from the TIMSS Video Study, and randomly choosing Vietnamese schools in which to videotape the lessons. This stage was carried out at Potsdam University, Germany, from early 2011 to January 2012.

❖ ***Data collection:*** videotaping 27 mathematics lessons and collecting the additional materials such as questionnaires, copies of worksheets or textbooks, and so on. This stage was carried out in Hanoi capital, Thanh Hoa province, and Nghe An province in Vietnam from February to April 2012.

❖ ***Data coding:*** viewing and coding 27 videos. This stage was carried out at Potsdam University, Germany from May 2012 to April 2013.

❖ ***Data analysis:*** analyzing the data from the results of the video coding and combining these results with results from other teaching research to identify the important conclusions about eighth-grade mathematics teaching and learning in Vietnam. This stage was carried out in Potsdam University, Germany from May 2013 to 2014.

4.2.1. Make plans for data collection

This video study was based on the TIMSS 1995 and 1999 Video Studies, so we carefully studied the documents about these studies. Of course we could not conduct this video study in exactly the same way as the TIMSS Video Study. We changed some aspects to make it suitable for our situation.

We intended to collect two kinds of data similarly to the TIMSS Video Study: *videotapes* and *questionnaires*. We also intended to collect additional material such as *copies of textbook pages* or *worksheets* (see Stigler et al., 1999, p. 14). The teacher and student questionnaires were translated from English into Vietnamese (see Jacobs et al., 2003, pp. 225-251; and Appendix B of this dissertation).

Based on the TIMSS 1999 Video study, we intended to videotape 100 randomly selected eighth-grade mathematics lessons in 100 randomly selected schools in Vietnam (see Jacobs et al. 2003, p. 180). We knew that in a short time (only three months), we could not videotape all 100 of the lessons, so we decided to videotape as many lessons as possible. We would then continue to videotape other lessons later. As mentioned in Chapter 3 of this dissertation, one of the advantages of video study is that “video stores data in a form that allows new analyses at a later time” (Hiebert et al. 2003, p. 5). The TIMSS 1999 Video Study also used the videos from the TIMSS 1995 Video Study in Japan. So we could combine the videos recorded for this dissertation with other videos to be videotaped in the future to conduct a larger scale study later on.

Videotaping in 63 provinces in Vietnam is a very difficult job. It demands an extraordinary amount of time and resources that a private study cannot afford. So, we reduced the number of provinces by using a technique called "proportionate to population size" or PPS sampling (Sullivan, May, and Maberly, 2000, pp. 21-26; World Bank, 2010, p. 27; and Appendix A of this dissertation) to randomly select 25 clusters of students in lower secondary education levels from 63 provinces in Vietnam (Table 4.1). The population size was the number of students in lower secondary education as of 31 December 2010 by province (General Statistics Office, 2011, pp. 641-642).

Table 4.1. Selection of provinces in Vietnam using the PPS method

Provinces		**Number of Students (*)**	**Cumulative Students**	**Cluster**		**x+nk (**)**	**Corresponding Clusters**
Whole country		**4945178**					
Red River Delta							
1	Hà Nội	339170	339170	1	2	40135	1
2	Vĩnh Phúc	56496	395666			237942	2
3	Bắc Ninh	63672	459338	3		435749	3
4	Quảng Ninh	66774	526112			633556	4
5	Hải Dương	95205	621317			831363	5
6	Hải Phòng	90806	712123	4		1029170	6
7	Hưng Yên	63568	775691			1226977	7
8	Thái Bình	96778	872469	5		1424784	8
9	Hà Nam	45852	918321			1622591	9
10	Nam Định	113928	1032249	6		1820398	10
11	Ninh Bình	49055	1081304			2018205	11
Northern Midlands and Mountain Areas						2216012	12
12	Hà Giang	47375	1128679			2413819	13
13	Cao Bằng	30277	1158956			2611626	14
14	Bắc Kạn	16911	1175867			2809433	15
15	Tuyên Quang	42857	1218724			3007240	16
16	Lào Cai	44074	1262798	7		3205047	17
17	Yên Bái	44781	1307579			3402854	18
18	Thái Nguyên	61465	1369044			3600661	19
19	Lạng Sơn	46760	1415804			3798468	20
20	Bắc Giang	96081	1511885	8		3996275	21
21	Phú Thọ	70783	1582668			4194082	22
22	Điện Biên	36808	1619476			4391889	23
23	Lai Châu	25532	1645008	9		4589696	24
24	Sơn La	74183	1719191			4787503	25
25	Hòa Bình	44202	1763393				
North Central and Central Coastal Areas							
26	Thanh Hóa	197878	1961271	10			
27	Nghệ An	195292	2156563	11			
28	Hà Tĩnh	90687	2247250	12			

29	Quảng Bình	58538	2305788				
30	Quảng Trị	46610	2352398				
31	Thừa Thiên-Huế	79431	2431829	13			
32	Đà Nẵng	48764	2480593				
33	Quảng Nam	100535	2581128				
34	Quảng Ngãi	81498	2662626	14			
35	Bình Định	104364	2766990				
36	Phú Yên	57156	2824146	15			
37	Khánh Hòa	71845	2895991				
38	Ninh Thuận	36575	2932566				
39	Bình Thuận	79236	3011802	16			
Central Highlands							
40	Kon Tum	34534	3046336				
41	Gia Lai	87093	3133429				
42	Đắk Lắk	139854	3273283	17			
43	Đắk Nông	37663	3310946				
44	Lâm Đồng	87717	3398663				
Southeast							
45	Bình Phước	54914	3453577	18			
46	Tây Ninh	56872	3510449				
47	Bình Dương	50707	3561156				
48	Đồng Nai	146117	3707273	19			
49	Bà Rịa-Vũng Tàu	61076	3768349				
50	TP. Hồ Chí Minh	311096	4079445	20	21		
Mekong River Delta							
51	Long An	80853	4160298				
52	Tiền Giang	92429	4252727	22			
53	Bến Tre	68656	4321383				
54	Trà Vinh	48344	4369727				
55	Vĩnh Long	54451	4424178	23			
56	Đồng Tháp	87903	4512081				
57	An Giang	102852	4614933	24			
58	Kiên Giang	85708	4700641				
59	Cần Thơ	53678	4754319				
60	Hậu Giang	37004	4791323	25			
61	Sóc Trăng	60476	4851799				
62	Bạc Liêu	37572	4889371				
63	Cà Mau	55807	4945178				

(*) Number of Vietnamese students in lower secondary education as of 31 December 2010 by province (Source: General Statistics Office, 2011, pp. 641-642)

(**) Important numbers:

- Intentional number of clusters: 25
- Sampling interval k = Total of students/25 = 197807
- Random number x = round(k*rand(),0) = 40135 (using the functions: *round()* and *rand()* in Microsoft Excel)

The twenty-five clusters of students selected belonged to 23 provinces and cities (both Hanoi Capital and Ho Chi Minh City had 2 clusters). We intended to videotape 4 lessons in each cluster. But we found out from the General Statistics Office (2011) that the number of classrooms of lower secondary education was very different among the 23 selected provinces and cities (pp. 629-630). For example, the number of classrooms in Thanh Hoa was 6304, while the number of classrooms in Lai Chau was 967. If we videotaped 4 lessons in 4 classrooms in each province, we might get biased results. So, based on the numbers of classrooms of lower secondary education in each selected province, we decided on the numbers of classrooms in each selected province that would be videotaped (see Table 4.2 below).

Table 4.2. Number of classrooms should be videotaped in each selected province

Province		**Number of classrooms (*)**	**Number of videotaped classrooms (**)**
1	Hà Nội	9093	12
2	Bắc Ninh	1872	2
3	Hải Phòng	2574	3
4	Thái Bình	2934	4
5	Nam Định	3092	4
6	Lào Cai	1504	2
7	Bắc Giang	3160	4
8	Lai Châu	967	1
9	Thanh Hóa	6304	8
10	Nghệ An	5907	8
11	Hà Tĩnh	2758	4
12	Thừa Thiên-Huế	2365	3
13	Quảng Ngãi	2355	3
14	Phú Yên	1715	2
15	Bình Thuận	2381	3
16	Đắk Lắk	3795	5
17	Bình Phước	1651	2
18	Đồng Nai	3904	5
19	TP. Hồ Chí Minh	11899	15
20	Tiền Giang	2424	3
21	Vĩnh Long	1628	2
22	An Giang	3047	4
23	Hậu Giang	1096	1
	Total	78425	100

(*) Number of Vietnamese classrooms of lower secondary education as of 30 September 2010 by province (Source: General Statistics Office, 2011, pp. 629-630)
(**) Number of videotaped classrooms = 100*Number of classrooms of each province/Total classrooms

Lastly, because we intended to videotape only one lesson in one classroom at each school, we used a technique called the "systematic selection" method (see Sullivan, May, and Maberly, 2000, pp. 23-26) to select the lower secondary schools that we would videotape. From the experiences drawn from the TIMSS Video Study, there may be some schools that do not want to participate in our study, or some that are very difficult to reach; the number of schools in this selection was larger than the number of classrooms in previous samples. For example, we intended to videotape 12 lessons in Hanoi capital and 8 lessons in Thanh Hoa province, so we randomly selected 16 lower secondary schools in Hanoi, and 12 lower secondary schools in Thanh Hoa. If a selected school did not want to participate in our study, we replaced it with the next selected school on the list of randomly selected schools.

We based the school selection on the list of lower secondary schools from the websites of education offices in each province. There are many lower secondary schools in each province, such as about 600 schools in Hanoi, 576 schools in Thanh Hoa, and 470 schools in Nghe An, and sometimes the lower secondary schools in each province maybe be separated or merged, so that the list from the websites was only relatively accurate. But we thought the most important thing was that we went to the randomly selected schools and videotaped the mathematics lessons.

4.2.2. Data collection procedure

First, we contacted schools on the list of randomly selected schools for their agreement to participate in our study. It was not easy to obtain those agreements because of the confidentiality issue which was presented in Chapter 3 of this dissertation. Most principals and teachers were reluctant to allow us to videotape the lesson in their schools. We decided to contact some other schools which were not originally on the list to get as many videos of lessons as possible.

Finally, we received agreements from 17 schools which were on the list of randomly selected schools, and 5 schools which were not in the list. Out of these 22 schools, there were 12 schools in Thanh Hoa, 8 schools in Nghe An, and 2 schools in Hanoi.

Next, we asked for the schedule of mathematics lessons in each school which agreed to participate in our study. Then we chose to videotape 27 lessons in an order that was convenient for us to travel to along our route from school to school. There were 19 schools in which we videotaped only one lesson, 2 schools in which we videotaped 2 lessons, and 1 school in which we videotaped 4 lessons.

We used only one camera to videotape the lesson as in the TIMSS 1995 Video Study, but we used the data collection procedures which were used in the TIMSS 1999 Video Study:

- ❖ Before going to the school: Charge batteries…, Check equipment…, Check directions to school…, Pack questionnaires…

- ❖ Arriving at school: Arrive one hour early…, Meet first with school officials…

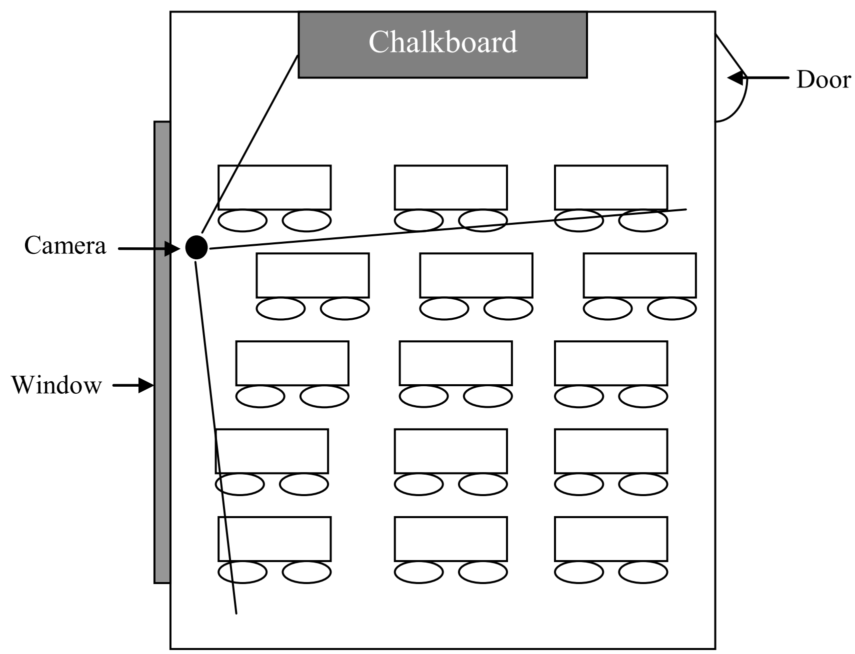
- ❖ Once in the classroom: Ask the teacher about the lesson…, Choose camera positions…

- ❖ After taping the lesson: Give the questionnaire packet to the teacher…, Pack up (Jacobs et al., 2003, pp. 182-185, 215-224).

The instruction for videotaping the lessons can be seen in Jacobs et al. (2003, pp. 186-200). This instruction is very important because it shows what we should videotape in the classroom, where we should put the camera, and how we should videotape in different situations in the classroom.

The structures of the 27 classrooms videotaped in Vietnam are almost the same: a window opposite the door (or windows on both sides of the room), chalkboard at the front, movable student desks facing the front (see Figure 4.1).

Figure 4.1 Camera position



Source: Adapted from Jacobs et al. (2003, p. 191)

In this situation, we placed the camera "by the window, 1/3 of the way from the front", and kept the camera "on the tripod as long as we could document what the teacher and students were doing" (see Jacobs et al., 2003, p. 190). If there were windows on two sides of the room, we closed "the blind of the window" that was in camera view "to avoid a backlighting situation" (see Jacobs et al., 2003, p. 192).

The questionnaires were based on the questionnaires of the TIMSS Video Study and were translated from English into Vietnamese (see Jacobs et al., 2003, pp. 225-251; and Appendix B in this dissertation).

4.2.3. Data coding

After videotaping the 27 lessons, we brought them to Germany for viewing and coding. This stage was carried out at Potsdam University, Germany from May 2012 to April 2013.

The videos were labeled as follows: 1.TH.TG, 2.TH.HL, 3.TH.HH, 4.TH.TT, 5.TH.NS1, 6.TH.NS2, 7.TH.QX, 8.TH.TS, 9.TH.TH, 10.NA.ND, 11.NA.HN, 12.NA.CL, 13.NA.NL, 14.NA.V, 15.NA.YT, 16.NA.DV, 17.NA.TC, 18.SS.BS, 19.SS.QT1, 20.SS.QT2, 21.SS.TS, 22.SS.ToS, 23.HN.PT, 24.HN.CG1, 25.HN.CG2, 26.HN.CG3, 27.HN.CG4.

There were two types of codes: coverage codes and occurrence codes.

> Coverage codes are used to code a lesson, or a defined portion of a lesson, in its entirety. All coverage codes have at least 2 mutually exclusive and exhaustive options. Only one of these options can be applied to any defined period of time. The option will always have an in-point and an out-point.
>
> Occurrence codes are codes that are marked anytime they occur (i.e., their definition is met) within a lesson. An occurrence code may be found several times within one lesson, or it may never occur within a particular lesson. We want to know: 1) how many times the code occurred within a particular lesson, and 2) where the code occurred within a particular lesson. (Jacobs et al., 2003, p. 397)

Based on the TIMSS 1999 Video Study, we watched 27 videos over and over again to code those videos through passes. There were 7 passes which were coded in the TIMSS 1999 Video Study:

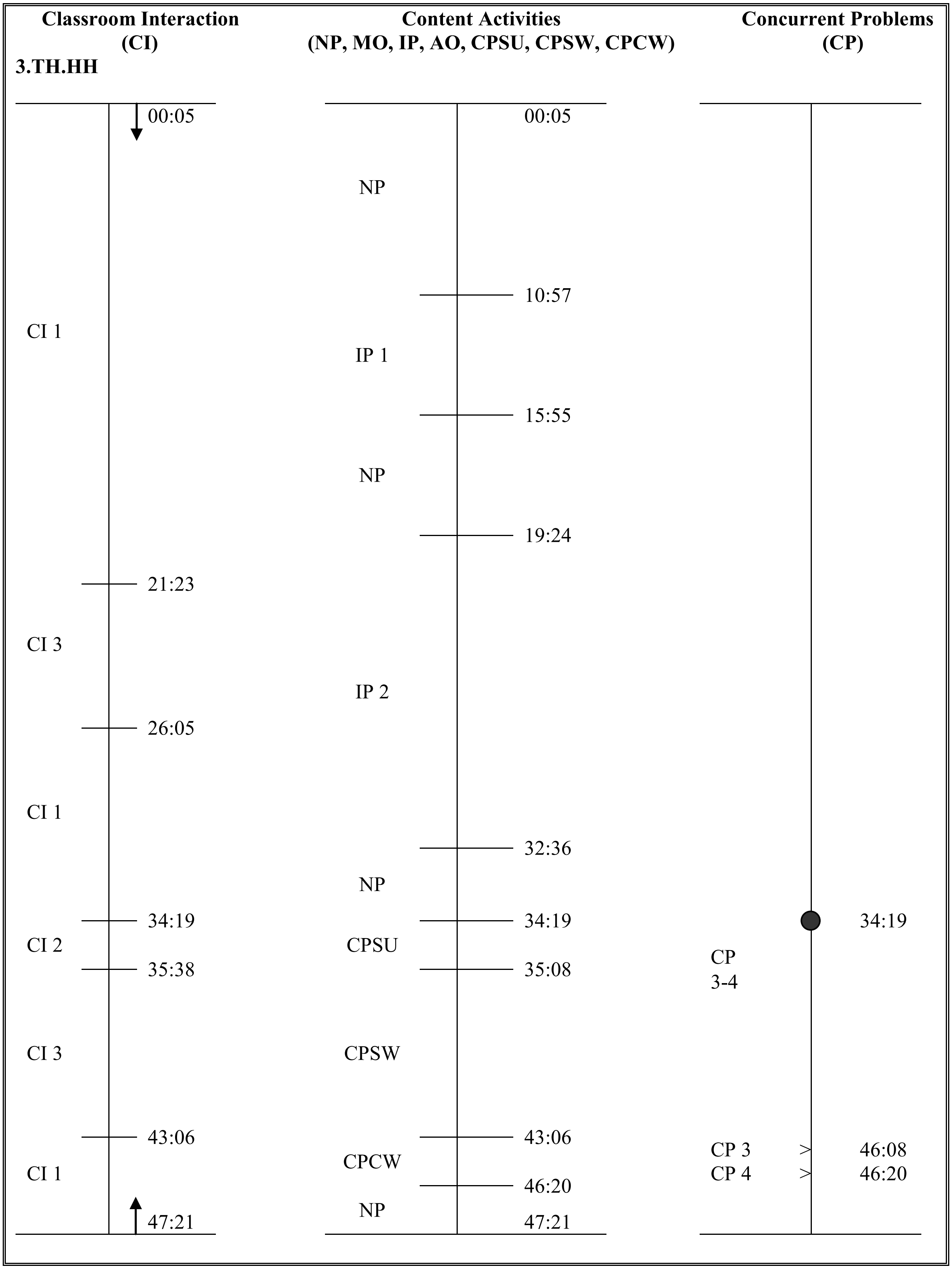
- ❖ Pass 1: Beginning and end of the lesson + Classroom Interaction
- ❖ Pass 2: Content Activity Codes
- ❖ Pass 3: Concurrent Problems
- ❖ Pass 4: Content Occurrence Codes
- ❖ Pass 5: Problem-Level Codes
- ❖ Pass 6: Codes about Resources
- ❖ Pass 7: Purpose Code (Jacobs et al., 2003, pp. 399-482)

However, with the initial aims of this video study, the dissertation just coded 6 passes out of the 7 passes above (we omitted pass 5). The results of coding of these passes can be seen in Appendices C, D, E, F, G, H, I, and K of this dissertation.

When coding the videos, we made transcriptions as suggested by Jacobs et al. (2003, p. 404). For example, the transcription of coding the lesson 3.TH.HH is presented in Figure 4.2 below. Each vertical line was divided into small segments. Each segment presented the times of the beginning and end of each code.

In this transcription, the first vertical line was used to display the 'classroom interaction' codes. The second vertical line displayed the 'content activities' codes. And the last one was used to display the 'concurrent problems' codes.

Figure 4.2. The transcription of coding lesson 3.TH.HH



The first vertical line displayed the classroom interaction codes. There are five types of classroom interaction. They are “public interaction (CI 1)”; “public information provided by teacher, optional for student use (CI 2)”; “public information provided by student, optional for student use (CI 3)”; “mixed private and public work, not optional (CI 4)”; and “private work (CI 5)” (Jacobs et al., 2003, pp. 401-403). The definitions of these classroom interactions will be presented later.

We can see from the first vertical line that lesson 3.TH.HH started with ‘public interaction’ (CI 1) from 00:05 to 21:23 of the lesson. Then the lesson continued with ‘public information provided by student, optional for student use’ (CI 3) from 21:23 to 26:05 and so on. The lesson finished with ‘public interaction’ (CI 1) from 43:06 to 47:21. The second vertical line can be understood similarly to the first one.

The third vertical line displayed the ‘concurrent problems’ codes. The black circle marked the beginning of the ‘concurrent problems’ segment. The symbol (>) marked the end of each problem in the ‘concurrent problems’. In lesson 3.TH.HH above, the ‘concurrent problems’ segment was started at 34:19 in the video. Problem number 3 was finished at 46:08, and problem number 4 was finished 12 seconds later. In this case, it did not mean that problem number 4 was just solved in 12 seconds. These problems were solved concurrently at students’ seats or on the chalkboard. One problem could be solved first but ended last.

Twenty-seven transcriptions of 27 videotaped lessons can be found in Appendix C of this dissertation.

4.2.4. Data analysis

After coding, we used Microsoft Excel to analyze the coding data, and combined these results with results of other teaching research to bring out the important conclusions about eighth-grade mathematics teaching in Vietnam. For example, after coding the ‘classroom interaction’ of lesson 3.TH.HH, the data was presented in Excel as per Table 4.3 below:

Table 4.3. Using Microsoft Excel to save the coding data

3. TH.HH								
	Beginning	End	Time		Sum total			
CI 1	0:00:05	0:21:23	0:21:18					
CI 3	0:21:23	0:26:05	0:04:42	CI 1	CI 2	CI 3	CI 4	CI 5
CI 1	0:26:05	0:34:19	0:08:14	0:33:47	0:01:19	0:12:10	0:00:00	0:00:00
CI 2	0:34:19	0:35:38	0:01:19					
CI 3	0:35:38	0:43:06	0:07:28					
CI 1	0:43:06	0:47:21	0:04:15					
			0:47:16					

From the data, we used the functions of Excel to calculate the percentage of lesson time devoted to each type of classroom interaction and other information. Then, we used the functions in Excel to calculate the mean, median, standard deviation, and range of the coding data of the 27 videotaped lessons (see Table 4.4 below). And lastly, we created charts to illustrate the coding data (see Figure 4.3 in this chapter).

Table 4.4. Using Microsoft Excel to analyze the coding data

Lesson	CI 1	CI 2	CI 3	CI 5	Nr of shifts
1. TH.TG	91	3	3	3	5
2. TH.HL	46	21	27	5	15
3. TH.HH	71	3	26	0	5
4. TH.TT	66	14	11	9	10
5. TH.NS1	76	8	13	4	7
6. TH.NS2	34	33	33	0	9
7. TH.QX	56	15	28	0	17
8. TH.TS	75	14	7	4	10
9. TH.TH	84	3	13	0	8
10. NA.ND	90	3	7	0	5
11. NA.HN	83	6	9	2	8
12. NA.CL	76	0	24	0	8
13. NA.NL	70	7	23	0	8
14. NA.V	67	2	19	12	20
15. NA.YT	97	0	3	0	2
16. NA.DV	75	7	6	12	6
17. NA.TC	89	11	0	0	4
18. SS.BS	87	0	13	0	2
19. SS.QT1	75	5	20	0	8
20. SS.QT2	80	0	17	3	8
21. SS.TS	46	7	47	0	10
22. SS.ToS	86	0	14	0	6
23. HN.PT	89	0	11	0	6
24. HN.CG1	54	16	28	2	9
25. HN.CG2	60	10	22	7	6
26. HN.CG3	54	1	45	0	7
27. HN.CG4	35	7	58	0	9
Average	71	7	20	2	8
Median	75	5	14	0	8
Std.Deviation	17	8	14	4	4
Range	34-97	0-33	0-58	0-12	2-20

The details of the coding results can be found in the following sections of this chapter and also in Appendices D, E, F, G, H, I, K, and L of this dissertation.

4.3. The coding results

4.3.1. Time of the lesson (LES)

"The code time of the lesson is to be coded" with "the in-point" (the beginning of the lesson) and "the out-point" (the end of the lesson) in which "the **beginning of lesson** is marked by first 'public talk' of the teacher that requires all students' attention", and "the **end of lesson** is marked by the last public talk of the teacher that requires all students' attention" (Jacobs et al., 2003, pp. 399-400).

According to Hiebert et al. (2003), "the length of a mathematics lesson provides the most basic element of lesson organization…. So, the amount of time devoted to formal study of mathematics is a good starting point for describing classroom lessons" (p. 36). The information on the time of the 27 videotaped lessons in Vietnam can be seen in Table 4.5 below.

Table 4.5. The statistical time data for the videotaped mathematics lessons in Vietnam (in minutes)

Mean	Median	Std.Dev	Minimum	Maximum
46	46	4	36	56

On average, the Vietnamese eighth-grade mathematics lessons videotaped lasted for 46 minutes. The shortest videotaped lesson was lesson 23.HN.PT lasting for 35 minutes 50 seconds. The longest videotaped lesson was lesson 9.TH.TH lasting for 55 minutes and 46 seconds.

The stipulated time for each teaching period in Vietnam is 45 minutes. In fact, the teachers may teach longer or shorter depending on the context of the lesson.

4.3.2. Pattern of Public/Private Classroom Interaction (CI)

According to Jacobs et al. (2003),

> Pattern of Public/Private Classroom Interaction (CI) is a coverage code. That is all points in the lesson must be coded as one of following five, mutually exclusive categories. Mark a change in public/private interaction regardless of any change in any other dimension. (p. 400)

Hiebert et al. (2003) defined the "five types of classroom interaction" as follows:

- ***Public interaction*** [CI 1]: Public presentation by the teacher or one or more students intended for all students…
- ***Private Interaction*** [CI 5]: All students work at their seats, either individually, in pairs, or in small groups, while the teacher often circulates around the room and interacts privately with individual students…

- ***Optional, student presents information*** [CI 3]: A student presents information publicly in written form, sometimes accompanied by verbal interaction between the student and the teacher or other students about the written work; other students may attend to this information or work on an assignment privately…
- ***Optional, teacher presents information*** [CI 2]: The teacher presents information publicly, in either verbal or written form, and students may attend to this or work on an assignment privately.
- ***Mixed private and public work*** [CI 4]: The teacher divides the class into groups – some students are assigned to work privately on problems, while others work publicly with the teacher. (pp. 53-54)

Some notes from Jacobs et al. (2003) when coding the pattern of public/private classroom interaction:

❖ "Code a shift in CI patterns only if another pattern lasts for *more than one minute*. However at the beginning and the end of a lesson there is no minimum time requirement." (pp. 400-401)

❖ In CI 1, all students must participate in or listen to the public presentation (not optional) (p. 401). In CI 2, "the teacher must *clearly signal* that students' attention is *optional*." (p. 402)

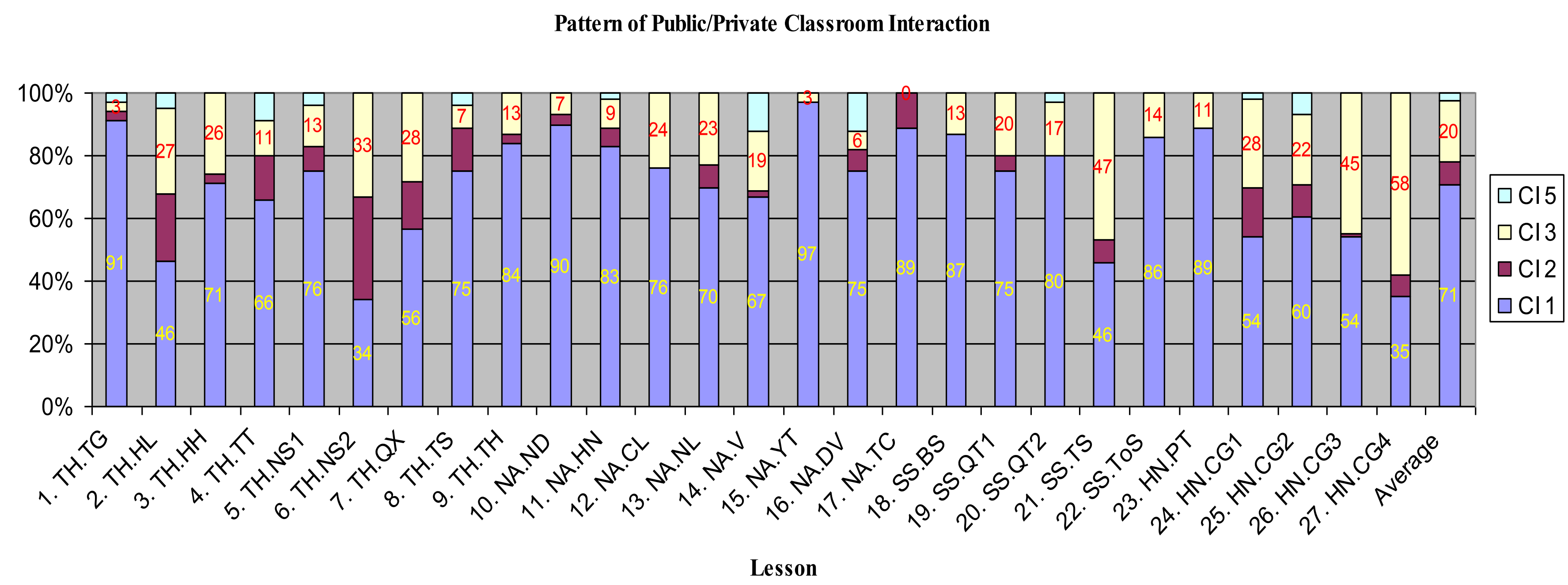
❖ In CI 3, a student or some students present information publicly in written form at the chalkboard, and if they finish presenting, the CI 3 segment also ends (p. 402). If some students are working behind the chalkboard and other students cannot see what they are doing, code this segment as CI 5. (p. 402)

❖ The pattern CI 4 is rare. (p. 403)

Brophy (1999) asserted that "students learn best within cohesive and caring learning communities" in which the teacher/student and student/student interactions happen (p. 8). Therefore, we should know about the pattern of public/private classroom interaction in Vietnam. The results of coding this aspect can be seen in Figure 4.3 below. From Figure 4.3, we can see that Vietnamese teachers devoted a majority of the lesson time to 'public interaction' (CI 1). On average, Vietnamese teachers devoted 71 percent of the lesson time to public interaction (CI 1), 7 percent to 'optional, teacher presents information' (CI 2), 20 percent to 'optional, student presents information' (CI 3), and 2 percent to 'private interaction' (CI 5). 'Mixed private and public work' (CI 4) was not found in the lessons videotaped.

From watching the videotaped lessons, it can be concluded that the percentage of lesson time devoted for each pattern of classroom interaction not only depends on the individual teacher but also depends on the purpose of lesson. If the purpose of the lesson is mainly to review old content then the teachers devote more time to CI 3 and CI 5. If the purpose of the lesson includes introducing new content then the teachers devote more time to CI 1 and CI 2.

Figure 4.3. Time percentages for patterns of public/private classroom interaction, by lesson



* Lessons in which the teachers devoted at least 90 percent of lesson time to *public interaction (CI 1)*: 1.TH.TG (91%), 10.NA.ND (90%), and 15.NA.YT (97%).

* Lessons in which the teachers devoted less than or equal to 35 percent of lesson time to *public interaction (CI 1)*: 6.TH.NS2 (34%) and 27.HN.CG4 (35%).

* Lessons in which the teachers devoted a greater percentage of lesson time to *optional, teacher presents information (CI 2)* than the other lessons: 2.TH.HL (21%), 6.TH.NS2 (33%).

* Lessons in which the teachers devoted at least 45 percent of lesson time to *optional, student presents information (CI 3)*: 21.SS.TS (47%), 26.HN.CG3 (45%), and 27.HN.CG4 (58%).

* Lessons in which the teachers devoted a greater percentage of lesson time to *private interaction (CI 5)* than the other lessons: 14.NA.V (12%) and 16.NA.DV (12%)

* On average, the percentage of lesson time devoted to each *classroom interaction:* CI 1 (71%), CI 2 (7%), CI 3 (20%), and CI 5 (2%)

Figure 4.3 above showed that out of the 27 videotaped lessons in Vietnam, there were 3 lessons in which the teachers devoted at least 90 percent of the lesson time to public interaction (CI 1). Those lessons were 1.TH.TG (91%), 10.NA.ND (90%), and 15.NA.YT (97%), while most of the teachers devoted less than 12% of the lesson time to private interaction (CI 5). In particular, after assigning the problems to the classroom, Vietnamese teachers usually invited one or more students to go to the chalkboard to solve those problems. So we can see CI 3 segments more often than CI 5 segments.

On average, the percentage of the lesson time devoted to each classroom interaction was: CI 1 (71%), CI 2 (7%), CI 3 (20%), and CI 5 (2%).

Hiebert et al. (2003) noted that

> One way to examine the organization of eighth-grade mathematics lessons is to look at the number of purpose segments they contain. Similarly, varying the type of interaction provides another way for the teacher to structure the lesson and to emphasize different kinds of experiences. By shifting between interaction types, the teacher can modify the environment and ask students to work on mathematics in different ways. (p. 56)

Figure 4.4 below displays the times that teachers changed interaction types during the lesson.

Combining the results from Figure 4.3 and Figure 4.4, the information about the pattern of public/private classroom interaction in the videotaped lessons is presented in Table 4.6 below.

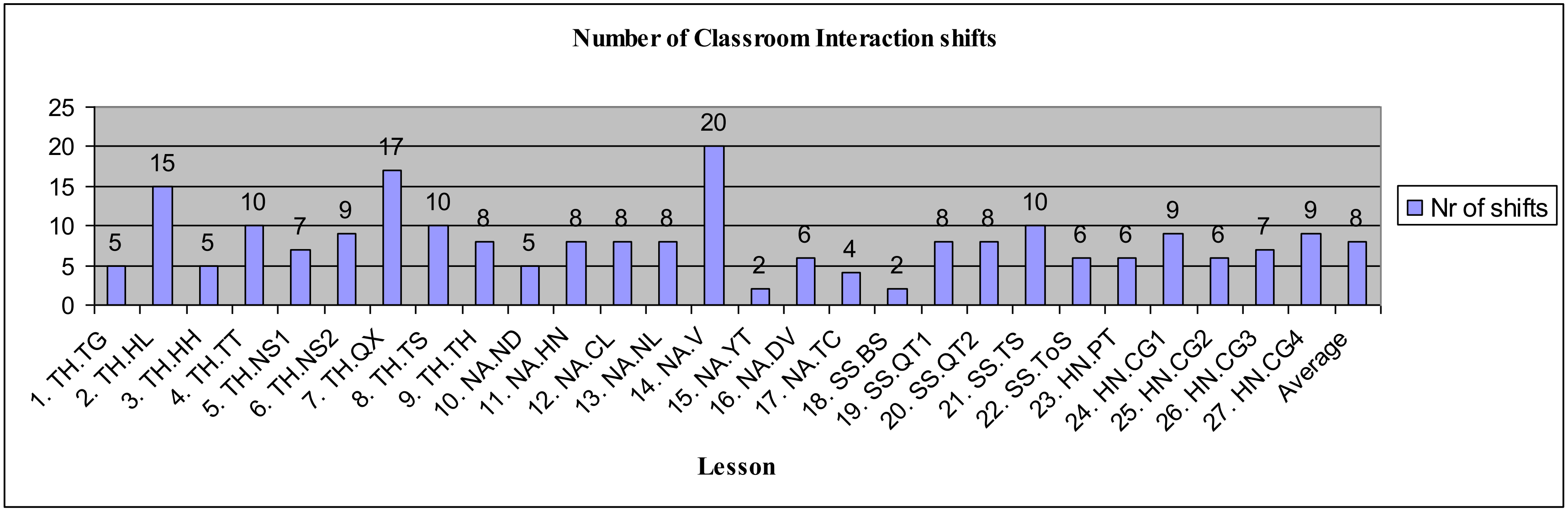
Table 4.6. Pattern of public/private classroom interaction of videotaped lessons in Vietnam (in percent, N = 27)

Pattern	Mean	Median	Range	Std. Dev
CI 1	71	75	34-97	17
CI 2	7	5	0-33	8
CI 3	20	14	0-58	14
CI 4	0	0	0	0
CI 5	2	0	0-12	4
Nr. shifts (*)	8	8	2-20	4

(*) Nr. shifts are in number

The average number of classroom interaction shifts is 8. From Figure 4.4, it can be seen that the number of classroom interaction shifts in most lessons is around 8 (from 6 to 10). On average, each segment of interaction lasted about 6 minutes (see Table 4.5 in this chapter).

Figure 4.4. Number of classroom interaction shifts, by lesson



* The lessons in which teachers shifted at least 15 times between the types of *classroom interaction*: 2.TH.HL (15 times), 7.TH.QX (17 times), and 14.NA.V (20 times)

* The lessons in which teachers shifted only 2 times between the types of *classroom interaction*: 15.NA.YT and 18.SS.BS. In these lessons, the teachers shifted from CI 1 to CI 3 and from CI 3 to CI 1.

* The average of number of *classroom interaction shifts* is 8. From Figure 4.4, it can be seen that the number of *classroom interaction shifts* in most lessons is around 8 (from 6 to 10). On average, each segment of interaction lasted about 6 minutes (see Table 4.5 in this chapter).

From Table 4.6, we can see that Vietnamese teachers devoted a majority of the lesson time to CI 1, while they spent only 2 percent of the lesson time for CI 5. When assigning problems to the class, Vietnamese teachers often invited one or more students to solve those problems at the chalkboard and other students to solve the same problems at their seats at the same time. We coded these segments as CI 3. On average, 20 percent of the lesson time was devoted to CI 3.

In this table, 'Nr. Shifts' are the number of classroom interaction shifts per lesson. Its range is from 2 to 20 shifts. The videos with the minimum of shifts were 15.NA.YT and 18.SS.BS. The teachers in these videos started lessons with CI 1, then shifted to CI 3, and finally to CI 1. The video with the maximum of shifts was 14.NA.V, in which the teacher shifted 20 times between CI 1, CI 2, CI 3, and CI 5.

It can be seen from the videotaped lessons that if the teacher shifts a lot of times, then students may not learn mathematics initiatively because each type of classroom interaction happens very quickly. For example, in lesson 14.NA.V, the teacher shifted 20 times in 45 minutes and 03 seconds. On average, each interaction segment lasts about 2 minutes. Actually, from the results of coding this lesson, there were 4 segments of CI 5 which lasted less than 1 minute and 45 seconds. These segments happened very quickly such that some students did not have enough time to solve the difficult problem at their seats.

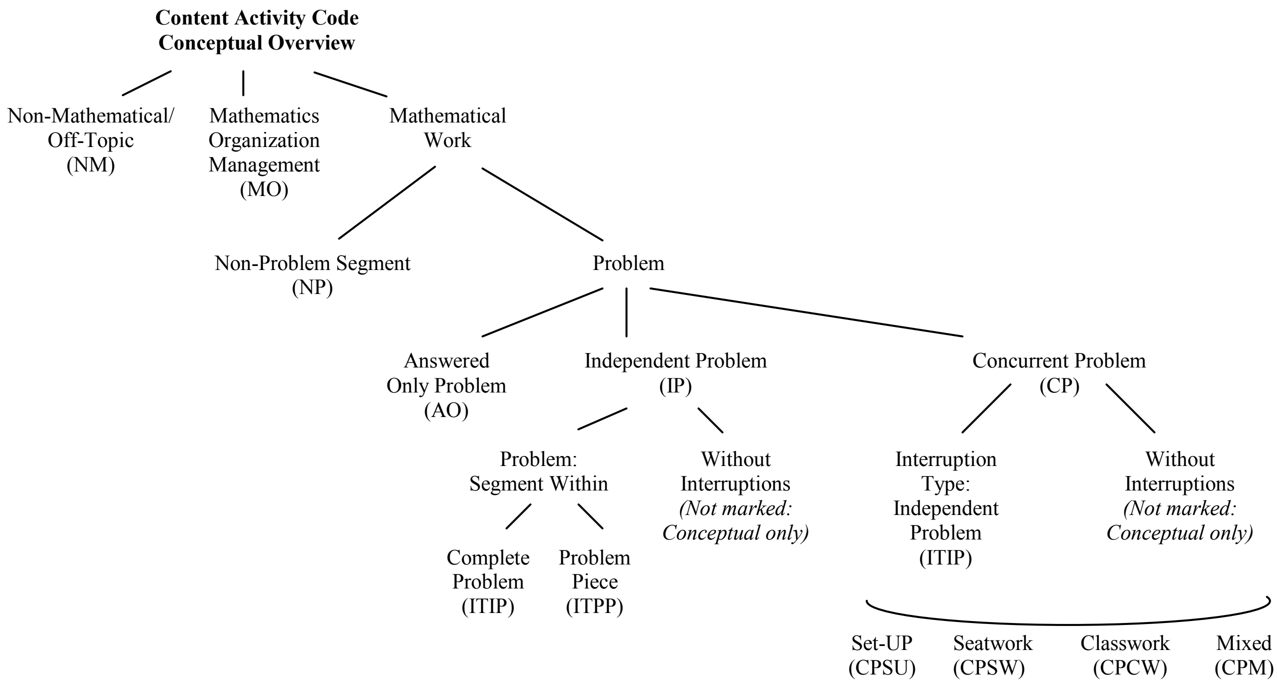
4.3.3. Content Activity Codes

Content activity code is a *coverage code*. According to Jacobs et al. (2003), there are 13 content activity categories:

- Non-Mathematical/Off-Topic (NM)
- Mathematics Organization/Managements (MO)
- Independent Problem (IP)
- Answered Only Problem (AO)
- Concurrent Problem Set-Up (CPSU)
- Concurrent Problem Seat Work (CPSW)
- Concurrent Problem Class Work (CPCW)
- Concurrent Problem Mixed Activity (CPM)
- Interruption Type: Independent Problem (ITIP)
- Interruption Type: Problem Piece (ITPP)
- Non-Problem (NP)
- Break (BK)
- Technical Problem (TP). (p. 406)

Let us see the definitions of these 13 content activity categories. Because the *mathematical work* segment was divided into smaller segments, namely a *non-problem* segment and a *problem* segment which was also divided into *answered only problem*, *independent problem*, and *concurrent problem* segments (see Diagram 4.1 below), so *mathematical work* and *problem* were not on the list of 13 content activity categories for coding. However, we should know their definitions as well as some other aspects related to content activity.

Diagram 4.1. Content Activity Codes



Source: Jacob et al. (2003, p. 407)

The definitions of content activity codes are presented as follows:

❖ *Non-Mathematical/Off-Topic (NM):*

Non-Mathematical/Off-Topic Segments (NM) contain no mathematical content. They offer no opportunities for students to learn mathematics. Non-mathematics segments must last ***at least 30 seconds*** in order to be coded as such.

Examples:

- Announcements by the teacher about school activities (e.g., field trips, vacation days)
- Interruptions by someone outside of the class requesting the teacher's attention…
- Disciplinary actions by the teacher in response to students' misbehavior. (Jacobs et al., 2003, pp. 407-408)

❖ *Mathematics Organization/Management (MO):*

Mathematics Organization/Management Segments (MO) include references to mathematics (e.g., math tools, resources, homework, tests), but do *not* contain mathematical content. As soon as any content is presented or the teacher begins to assign problems, it will Not be coded as MO.

MO segments must last at ***least 30 seconds*** in order to be coded as such.

Examples of segments to be coded as MO:

- General organizational description of a future test or a quiz…
- The teacher and/or students passing out a worksheet that is not the next activity. (Jacobs et al., 2003, p. 408).

- *Mathematical work*:

  Time spent on mathematical content presented either through a mathematical problem or outside the context of a problem, e.g., talking or reading about mathematical ideas, solving mathematical problems, practicing mathematical procedures, or memorizing mathematical definitions and rules. (Hiebert et al., 2003, p. 38)

- *Non-Problem (NP):*

  Non-Problem segments (NP) contain mathematical information. They do not contain problems, but may reference problems. NP segments must last ***at least 20 seconds***. If a segment seems to fit the definition but is ***less than 20 seconds***, code it as part of the segment before or after – whichever is most relevant…

  Examples of Non-Problem segments:

  - Assignment of homework
  - Historical background…
  - Presentation of new information (concepts or resources)
  - Real life connection/application. (Jacobs et al., 2003, p. 426)

- *General definition of a Problem:*

  Problems were defined as events that contained a statement asking for some unknown information that could be determined by applying a mathematical operation. Problems varied greatly in length and complexity, ranging from routine exercise to challenging problems. Although problems could be relatively undemanding, they needed to require some degree of thought by eighth-grade students. Simple questions asking for immediately accessible information did not count as problems. Mathematical operations of the following kinds were common:

  - Adding, subtracting, multiplying, and dividing whole numbers, decimals, fractions, percents, and algebraic expressions;
  - Solving equations;
  - Measuring lines, areas, volumes, angles;
  - Plotting or reading graphs; and
  - Applying formulas to solve real-life problems. (Hiebert et al., 2003, p. 41)

- *Answered Only Problems (AO):*

  Answered Only (AO) problems are problems completed before the present lesson (and *not worked on* during the present lesson). Answers are shared either verbally or in written form. AO problems have No public discussion of a solution strategy, and No private working on time

  Examples:

  - The teacher gives answers to homework verbally, on the chalkboard, or on a handout.
  - The teacher gives answers to a test/quiz verbally, on the chalkboard, or on a handout.
  - The teacher provides solution strategies in written form only (there is no discussion) (e.g., the teacher provides a hand-out with the steps students should have used to solve the equation). (Jacobs et al., 2003, p. 417)

- *Independent Problems (IP):*

Independent Problems (IPs) are problems on which the teacher expects students to spend time during the present lesson. They are worked on by themselves. The exact time the whole class spends working on the particular problem is known.

IPs may be worked on entirely publicly or they may contain a private working on phase. (Jacobs et al., 2003, p. 418)

- *Concurrent Problems (CP):*

Concurrent Problems (CPs) are those problems that share some private working on time (CI 2, CI 3, CI 4, or CI 5). During that private time it is not known on which problems students are working. Thus, the exact time spent working on each of the CPs is unknown. (Jacobs et al., 2003, pp. 418-419)

- *Concurrent Problem Set-Up (CPSU):*

CP Set-Up (CPSU) is a segment during which the teacher assigns multiple problems. To qualify as a CPSU segment, during the activity that immediately follows students must work on the assigned problems. If any other activity (e.g., checking homework, reviewing from a previous lesson) occurs between the initial assignment of CPs and the working-on segment, then the initial assignment of the problem is **NOT** coded as a CPSU phase. In this case the CPSU phase would be the reassignment of problems immediately preceding the working-on segment. (Jacobs et al., 2003, p. 419)

- *Concurrent Problem Seatwork (CPSW):*

CP Seatwork (CPSW) is the segment when students actively work on concurrent problems (CPs) at their seats (privately). They may work individually, in pairs, or in small groups.

The **in-point** of the CPSW Segment is when all students start working privately at their seats…

The **out-point** of the CPSW Segment is marked either 1) immediately before students publicly share the work they completed privately…, or 2) if there is no public sharing of private work and another segment begins. (Jacobs et al., 2003, pp. 421-422)

- *Concurrent Problem Classwork (CPCW):*

CP Classwork (CPCW) is the segment when the teacher/students actively work on or discuss Concurrent Problems (CPs) as a whole class (publicly).

[The] **in-point** of the CPCW Segment is when students begin to publicly share work they completed at their seats.

The **out-point** of the CPCW Segment is when the TR [Target Result] of the last problem of the group has been stated or the related discussion to that problem or the entire set of problems has finished and a new segment begins. (Jacobs et al., 2003, p. 423)

❖ *Concurrent Problem Mixed Activity (Seatwork & Classwork) (CPM):*

The teacher explicitly divides the class into groups, and assigns them different activities. One group works privately at their seats, while at the same time another group works publicly with the teacher.

Note:

This situation is rare. It generally overlaps with one of the mixed Classroom Interaction (CI) patterns. (Jacobs et al., 2003, pp. 423-424)

❖ *Interruption of Type Independent Problem (ITIP):*

A new Independent Problem (IP) may be started and solved before another IP is completed. We code both problems as IPs, and number each one consecutively. However, this means that a period of time will be covered by two activity segments. Therefore, we will also code this period of time (covered by the 2 IPs) as ITIP – Interruption of Type Independent Problem….

An Individual Problem (IP) can interrupt a CP Phase (usually the CPSU or CPCW phase). However, this means that a period of time will be covered by two activity segments. Therefore we will also code this period of time (cover by the CP Phase and IP codes) as ITIP – Interruption of Type Independent Problem. (Jacobs et al., 2003, p. 424)

❖ *Interruption of Type Problem Piece (ITPP):*

Sometimes the class works publicly on one Independent Problem (IP) up to a certain point without finishing it. The class then starts working publicly on another Individual Problem (IP) which also remains unfinished. The class then goes back to finish the first problem and then completes the second. The problems are broken up into different pieces.

We code both problems as IPs, and number each one consecutively. However, this means that a period of time will be covered by two activity segments. Therefore, we will also code this period of time (covered by the 2 IP codes) as ITPP – Interruption of Type Problem Piece. (Jacobs et al., 2003, p. 425)

❖ *Official Break in Lesson (BK):*

Time during the lesson (or in-between double lessons) that the teacher has designated as a Break (BK) for students. The in-point of the BK is when the teacher publicly announces that students may take a break. The out-point of the BK is when the interaction clearly shifts back into a mathematics lesson. (Jacobs et al., 2003, p. 427)

❖ *Technical Problems with the Video (TP):*

You may come across a video that has a Technical Problem (TP). For instance, the video may start late or lack audio. These difficulties may prevent you from making a confident coding decision. In these cases, use Technical Problem (TP) as a content activity category to mark the difficult section. The **in-point** of a TP segment is where the coding difficulty begins. The **out-point** is where you have sufficient information to make a coding decision. (Jacobs et al., 2003, p. 427)

Hiebert et al. (2003) asserted that:

> Although lesson length provides the boundaries of possible instruction time, the measure of most interest is the time actually spent working on mathematics. Because lesson time can be spent on other things, such as chatting about a musical concert the students attended the night before, it is important to mark the segments of the lesson devoted to mathematical work. (p. 38)

The results of coding content activity in the Vietnam video study are presented hereafter.

In the 27 videotaped lessons, the *break (BK)* and *technical problem (TP)* segments were not found. The *non-mathematical work (NM)* segment was found only in lesson 20.SS.QT2 within 30 seconds. It can be stated that the teachers in all 27 videotaped lessons devoted most of the lesson time to *mathematical work* segments (see Figure 4.5)

The statistical data of the time used for mathematical work, mathematical organization, and non-mathematical work can be seen in Table 4.7 below.

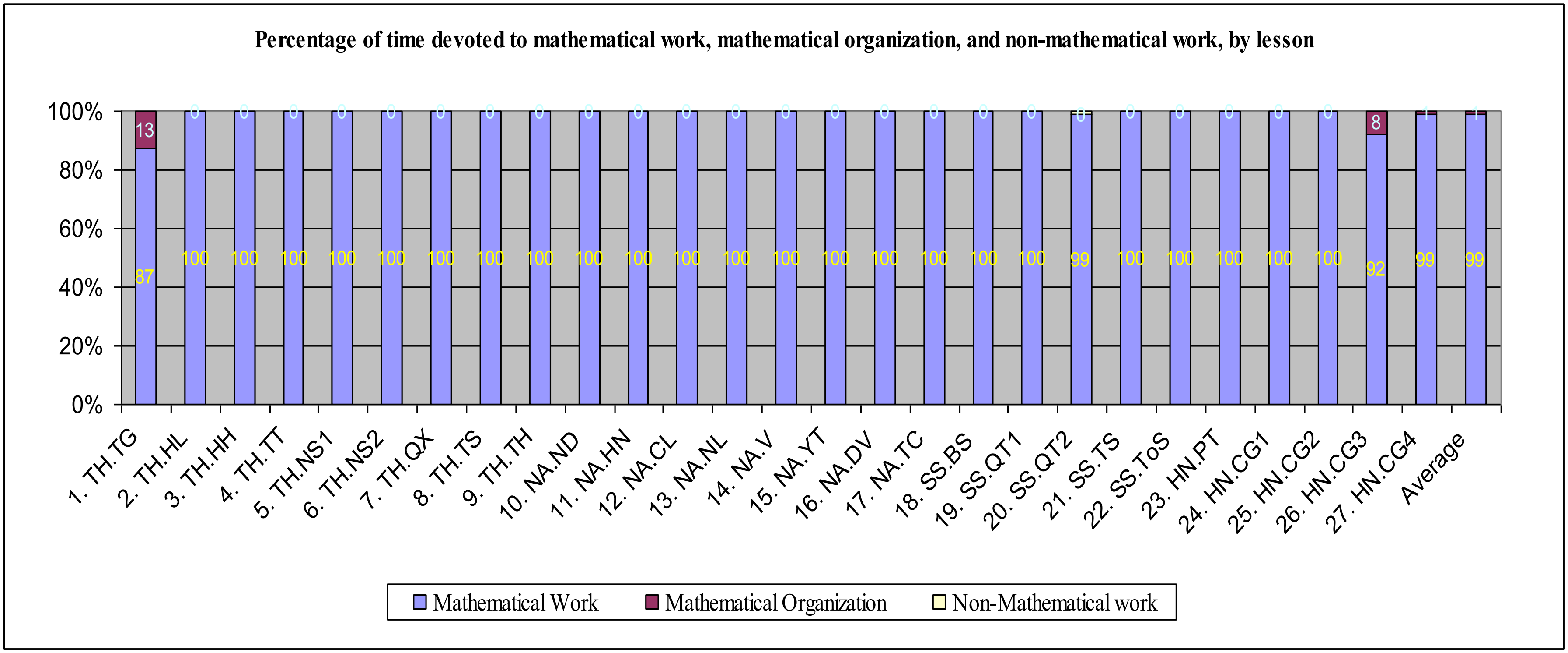
Table 4.7. Time used for mathematical work, mathematical organization and non-mathematical work in Vietnam (in minutes)

Structure	% of time	Mean	Median	Std. Dev	Minimum	Maximum
Mathematical work	99%	45.9	45.8	4.5	35.8	55.8
Non-mathematical work	0%	0	0	0.1	0	0.5
Mathematical organization	1%	0.4	0	1.2	0	5.5

We can see from Table 4.7 that, on average, Vietnamese teachers devoted 99% of the lessons time to mathematical work. It is normal that when the lessons were videotaped, the teacher in the videotaped lesson would just focus on mathematical work and organization. In the practice of teaching in Vietnam, teachers may spend a little time on non-mathematical work to help students relax after difficult problems.

The percentage of time the teachers devoted to non-mathematical work, mathematical organization, and mathematical work segments can be found in Figure 4.5 below. It is not difficult to find out that there was only one lesson in which a teacher spent 30 seconds on non-mathematical work (lesson 20.SS.QT2). There were 3 lessons in which teachers spent time on mathematical organization: 1.TH.TG, 26.HN.CG3, and 27.HN.CG4. There were 23 remaining lessons in which the teachers spent the whole lesson time on mathematical work segments.

Figure 4.5. Percentage of time devoted to mathematical work, mathematical organization, and non-mathematical work, by lesson



* The lessons in which teachers devoted lesson time to *mathematical organization*: 1.TH.TG (13%), 26.HN.CG3 (8%), and 27.HN.CG4 (1%).
* The lesson in which teacher devoted lesson time to *non-mathematical work*: 20.SS.QT2 (1%).
* On average, the teachers devoted lesson time to each type of segment: *mathematical work* (99%), *mathematical organization* (1%)

The mathematical work segment was divided into 'problem' and 'non-problem' segments. The definitions of these segments were presented above. The mathematical work time of videotaped lessons in Vietnam was divided into 'problem' and 'non-problem' segments as in Figure 4.6 and Table 4.8 below.

Table 4.8. *Mathematical work* time of videotaped lessons divided into *Problem* and *Non-Problem* segments in Vietnam (in minutes)

Structure	% of time	Mean	Median	Std. Dev.	Minimum	Maximum
Non-problem	32%	14.7	13.8	11.1	0.0	45.0
Problem	68%	31.2	32.6	10.4	3.3	45.8

We can see from Figure 4.6 and Table 4.8 that most teachers in videotaped lessons devoted more time to solving problems. On average, the time devoted to solving problems is 31.2 minutes (68% of lesson time) and time devoted to non-problem segments is 14.7 minutes (32% of lesson time).

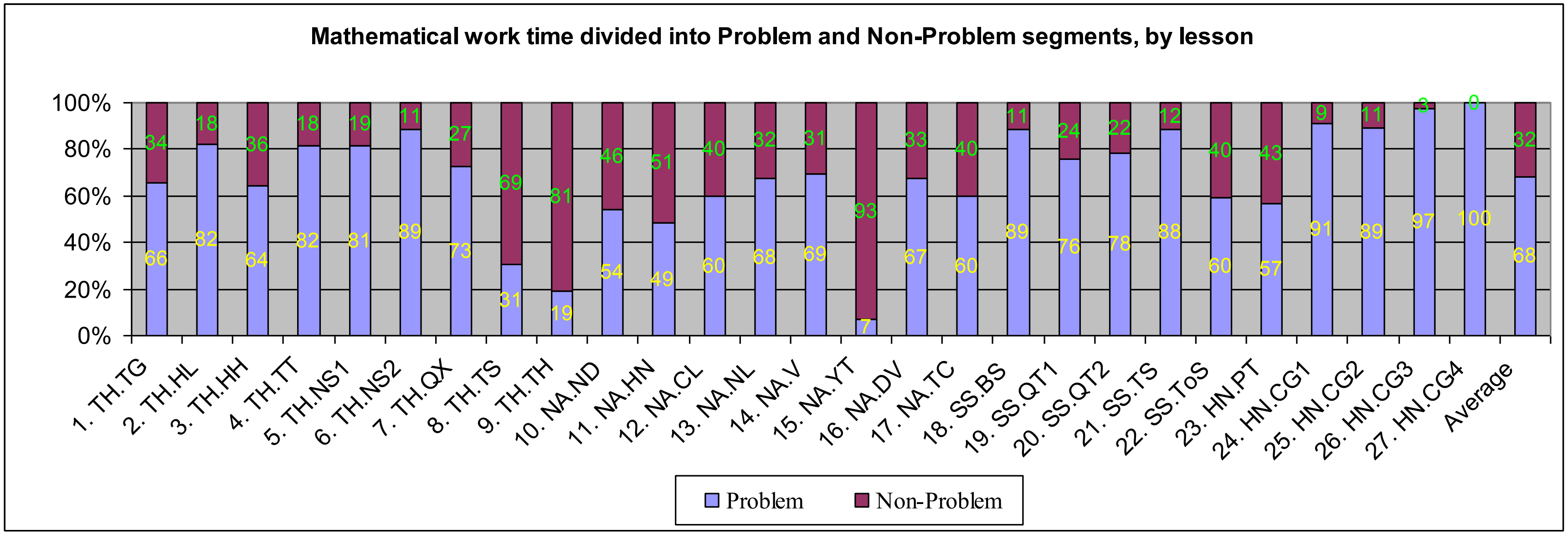
As distinguished, there are three different types of mathematical problems: *Independent problems (IP), Concurrent problems (CP),* and *Answered-only problems (AO).*

> It was important to distinguish among the problem types because they can provide different experiences for students. For example, working on a single problem with the whole class can be a different experience from working on a set of problems individually or in small groups, which can be different still from hearing answers to problems completed as homework. More than that, separating out the independent problems, for which it was possible to mark beginning and ending times, allowed further analyses of the nature of these problems. (Hiebert et al., 2003, p. 43)

We can see from Figure 4.7 that most teachers in videotaped lessons devoted most mathematical problem time to independent problems. On average, the time devoted to independent problems is 22.1 minutes (71%), the time devoted to concurrent problems is 8.8 minutes (28%), and the time devoted to answered-only problems is 0.3 minutes (1%).

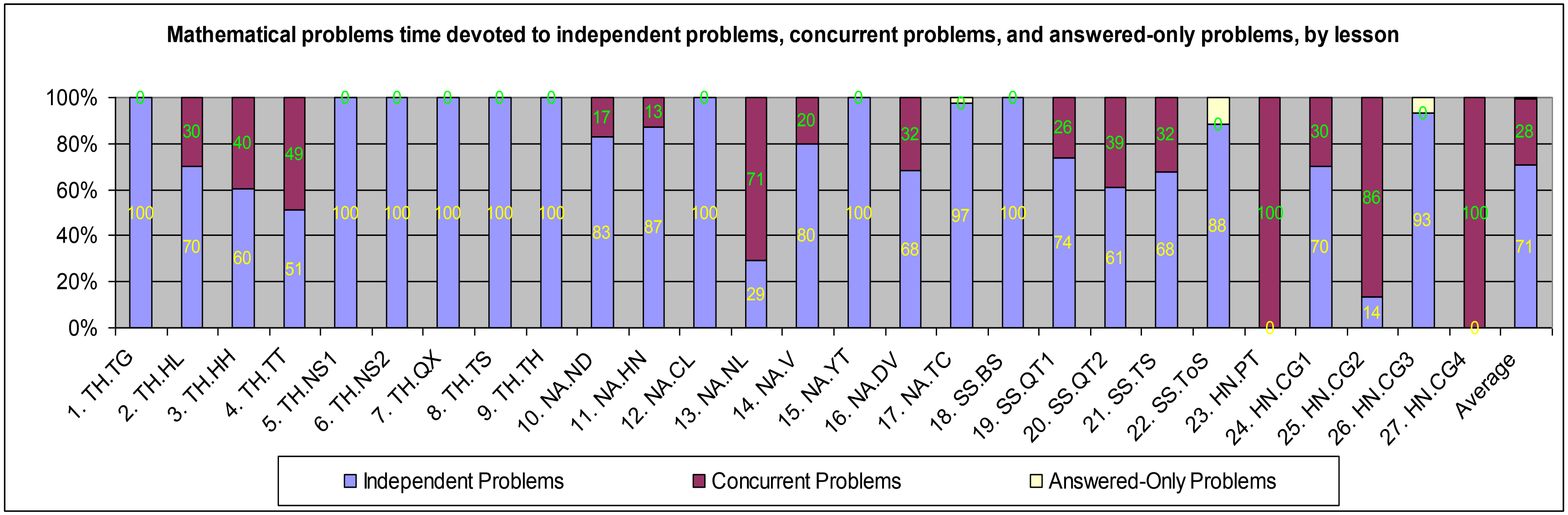
Sometimes, with the same set of problems, different teachers may use them as independent problems if they assign these problems one after another to students. Or, they may use them as concurrent problems if they assign these problems simultaneously to the students. We will discuss this in the next chapters.

Figure 4.6. Mathematical work time divided into Problem and Non-Problem segments, by lesson



* The lessons in which teachers devoted at least 90% of *mathematical work* time to *problem* segments: 24.HN.CG1 (91%), 26.HN.CG3 (97%), and 27.HN.CG4 (100%).
* The lesson in which teacher devoted less than 10% of *mathematical work* time to *problem* segments: 15.NA.YT (7%).
* The lessons in which teachers devoted more than 80% of *mathematical work* time to *non-Problem* segments: 9.TH.TH (81%), 15.NA.YT (93%).
* The lessons in which teachers devoted less than 10% of *mathematical work* time to *non-problem* segments: 24.HN.CG1 (9%), 26.HN.CG3 (3%), and 27.HN.CG4 (0%).
* On average, the percentage of *mathematical work* time devoted to *problem* segments was 68% while the percentage of *mathematical work* time devoted to *non-problem* segments was 32%.

Figure 4.7. Mathematical problems time devoted to independent problems, concurrent problems, and answered-only problems, by lesson



* The *mathematical problems* time devoted to *answered-only problems* of some lessons: 17.NA.TC (3%), 22.SS.ToS (12%), 26.HN.CG3 (7%), and Average (1%).
* There were 9 lessons in which teachers only used *independent problems* (100%).
* The lessons in which teachers devoted more *mathematical problems* time to *concurrent problems*: 13.NA.NL (71%), 23.HN.PT (100%), 25.HN.CG2 (86%), and 27.HN.CG4 (100%)
* On average, Vietnamese teachers devoted more *mathematical problems* time to *independent problems* segments (71%). They devoted 28% of *mathematical problems* time to *concurrent problems*. While they devoted only 1% of *mathematical problems* time to *answered-only problems*.

We want to know, on average, how many problems were solved in the lesson and how long one problem took to solve.

This is very difficult to answer because "the concurrent problems were assigned as a group of problems to be worked on privately", and these concurrent problems might be solved during class or solved outside of class as homework, so we might not know exactly how many concurrent problems were solved and how long a problem among the concurrent problems was solved (Hiebert et al., 2003, p. 43).

So, independent problems were used to interpret the average time used to solve one problem. The number of independent problems solved and average length of time per problem in videotaped lessons can be seen in Figure 4.8 and Table 4.9 below.

Table 4.9. Number of independent problems solved in the lesson and average length of time per problem in Vietnam (in minutes)

	Mean	Median	Std. Dev.	Minimum	Maximum
Nr. of IP	4	4	2.2	0	9
Length	5.9	5.9	4.3	2.3	22.7

There were two lessons (11.NA.HN and 14.NA.V) in which 9 independent problems were assigned and there were two lessons (23.HN.PT and 27.HN.CG4) in which teachers did not assign any independent problems (see Figure 4.8). The minimum length of time devoted to one problem was 2.3 minutes and the maximum length of time devoted to one problem was 22.7 minutes (see Figure 4.8).

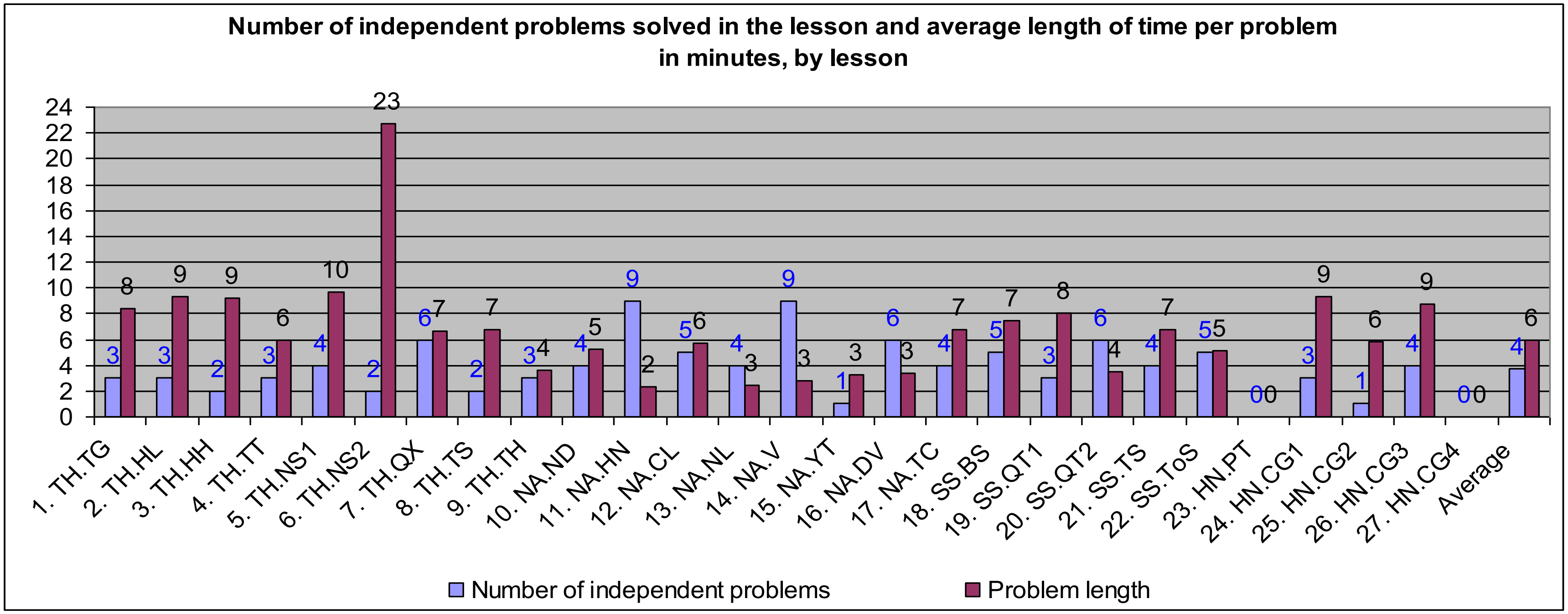
On average, there were 4 problems solved in each lesson in Vietnam and the time spent to solve one problem was 5.9 minutes.

From watching the videotaped lessons, it could be seen that the teachers devoted more or less time to each problem depending on many factors, such as the difficulty of the problem, the number of methods used to solve the problem, or even the confusion and mistakes of teachers and students when solving the problem (see more reasons in Hiebert et al., 2003, p. 46).

Based on information from the World Bank (2010, pp. 39-40), we want to know how many independent problems Vietnamese teachers often assigned to students in each lesson.

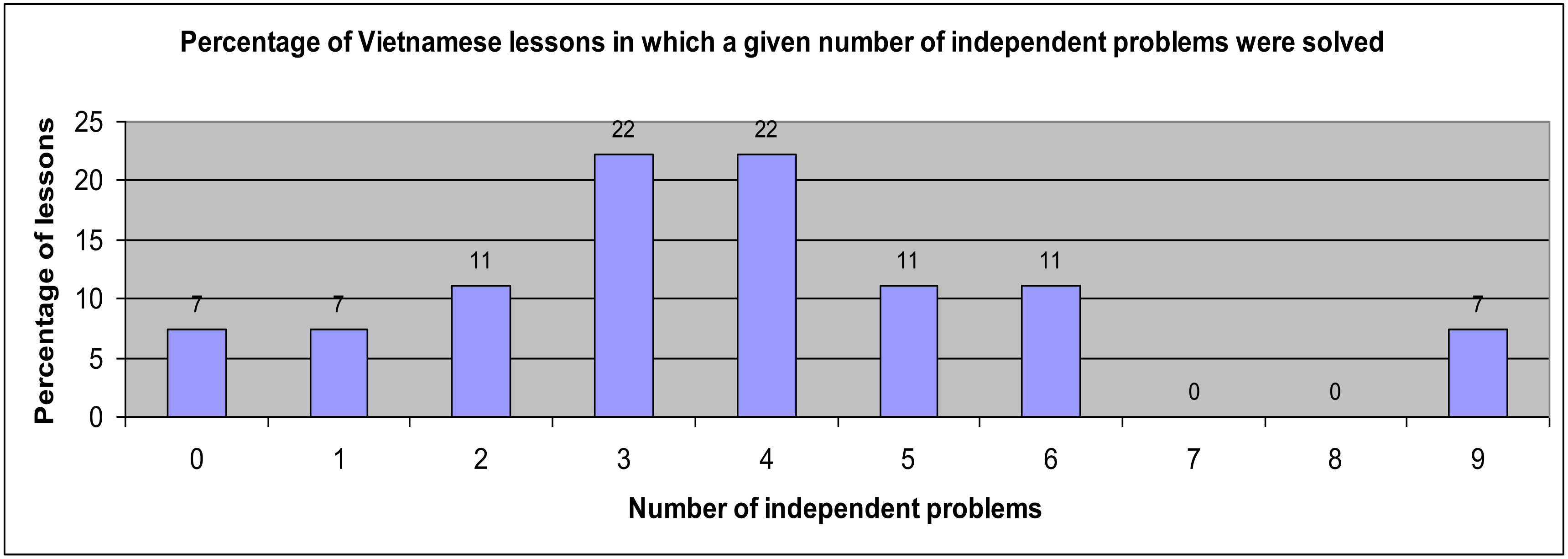
The answer, which was found from the videotaped lessons, is 3 or 4. Figure 4.9 below shows that out of 27 videotaped lessons, there were 6 lessons (22%) in which 3 independent problems were solved. There were also 6 lessons (22%) in which 4 independent problems solved. It means that a majority of teachers often assigned 3 or 4 independent problems in each lesson.

Figure 4.8. Number of independent problems solved in the lesson and average length of time per problem (in minutes), by lesson



* The length of time was rounded.
* The lessons in which 9 *independent problems* were solved: 11.NA.HN and 14.NA.V.
* The lessons in which there were not any *independent problems*: 23.HN.PT and 27.HN.CG4.
* The average length of time devoted to one problem was from 2 minutes and16 seconds (11.NA.HN) to 22 minutes and 40 seconds (6.TH.NS2).
* On average, there were 4 *independent proble*ms solved in the lesson and the average length of time devoted to each problem was 5 minutes and 54 seconds.

Figure 4.9. Percentage of Vietnamese lessons in which a given number of independent problems were solved



* The number of *independent problems* solved in each lesson was from 0 to 9 problems.
* There were 7 percent of videotaped lessons (2 lessons) in which no *independent problem* was solved: 23.HN.PT and 27.HN.CG4.
* There were 7 percent of videotaped lessons (2 lessons) in which 1 *independent problem* was solved: 16.NA.YT and 25.HN.CG2.
* There were 11 percent of videotaped lessons (3 lessons) in which 2, 5, or 6 *independent problems* were solved (see Figure 4.8).
* There were 22 percent of videotaped lessons (6 lessons) in which 3 or 4 *independent problems* were solved (see Figure 4.8).
* There were 7 percent of videotaped lessons (2 lessons) in which 9 *independent problems* were solved (see Figure 4.8).
* There was not any videotaped lesson in which 7 or 8 *independent problems* were solved (see Figure 4.8).

4.3.4. Content Occurrence Codes

Some types of segments might or might not occur in a specific videotaped lesson, such as "assignment of homework (AH)", "goal statement (GS)", "historical background (HB)", "outside interruptions (OI)", "summary of lesson (SL)", "non-mathematics within problems (NMWP)", "real life connection/application – non problem (RLNP)", and these types of segments were coded as "content occurrence codes" (Jacobs et al., 2003, pp. 440-443). Jacobs et al. (2003) notes that if two content occurrence segments of the same type occur consecutively, they are coded together as a single occurrence "if the break between them is ***less than 2 minutes***" (p. 440)

Some definitions of these occurrence codes are presented below.

- *Assignment of Homework (AH):*

  > The teacher assigns homework for the students to complete after the lesson ends. Mark the in-point when the teacher *announces* that a particular assignment is homework. This means that the task itself may not be stated by the teacher. For instance, if the teacher writes an assignment on the blackboard during CPSW, doesn't refer to it until CPCW, and then simply says, "Your homework for tonight is on the board," you'll mark the AH at the teacher's announcement. (Jacobs et al., 2003, p. 440)

- *Goal Statement (GS):*

  > Explicit verbal or written statements made by the teacher about the specific mathematics topic that will be covered in today's lesson. The topic must be the mathematics that students will learn in the entire lesson, or in a large part (that is, more than a third) of the lesson. (Jacobs et al., 2003, p. 441)

- *Historical Background (HB):* "The teacher and/or the students connect mathematical content to its historical background (e.g., Pythagoras as the originator of a mathematical theorem)." (Jacobs et al., 2003, p. 441)

- *Outside Interruptions (OI):*

  > An outside interruption is any incident that disrupts classroom activities, such as announcements over the intercom, fire drills, a teacher remarking on a student(s) late arrival, or some individual from outside requiring the teacher's attention.
  > *Notes:*
  > - Even if an announcement over the intercom doesn't appear to disrupt the class, it should be marked as an OI.
  > - Any occurrence of an announcement over the intercom or instance of the telephone ringing should be marked, even if it occurs during CI 5 (private work) and/or it doesn't appear to disrupt the class.
  > - If a student enters the classroom late, only mark this as an OI if the teacher comments about it. (Jacobs et al., 2003, p. 442)

❖ *Summary of Lesson (SL):*

> A summary of the mathematical content of the current lesson. These statements refer to work that has been completed during the lesson, or describe the main point of the lesson. The summary should occur near the end of (the public portion of) the lesson. (Jacobs et al., 2003, p. 442)

❖ *Non-Mathematics Within Problems (NMWP):*

> A Non-Mathematics Within Problem segment is a period of time of AT LEAST 30 SECONDS that contains no mathematical content. That is, there is no opportunity for students to learn mathematics.
>
> **This code can occur only during IPs, CPSUs, CPCWs, CPM, or CPSWs (during a public announcement)**. (Jacobs et al., 2003, p. 443)

❖ *Real Life Connection/Application – Non Problem (RLNP):*

> The teacher and/or the students explicitly connect or apply mathematical content to real life/the real world/experiences beyond the classroom. For example, connecting the content to books, games, science fiction, etc.
>
> **This code can occur only during Non-Problem (NP) segments.** (Jacobs et al., 2003, p. 443)

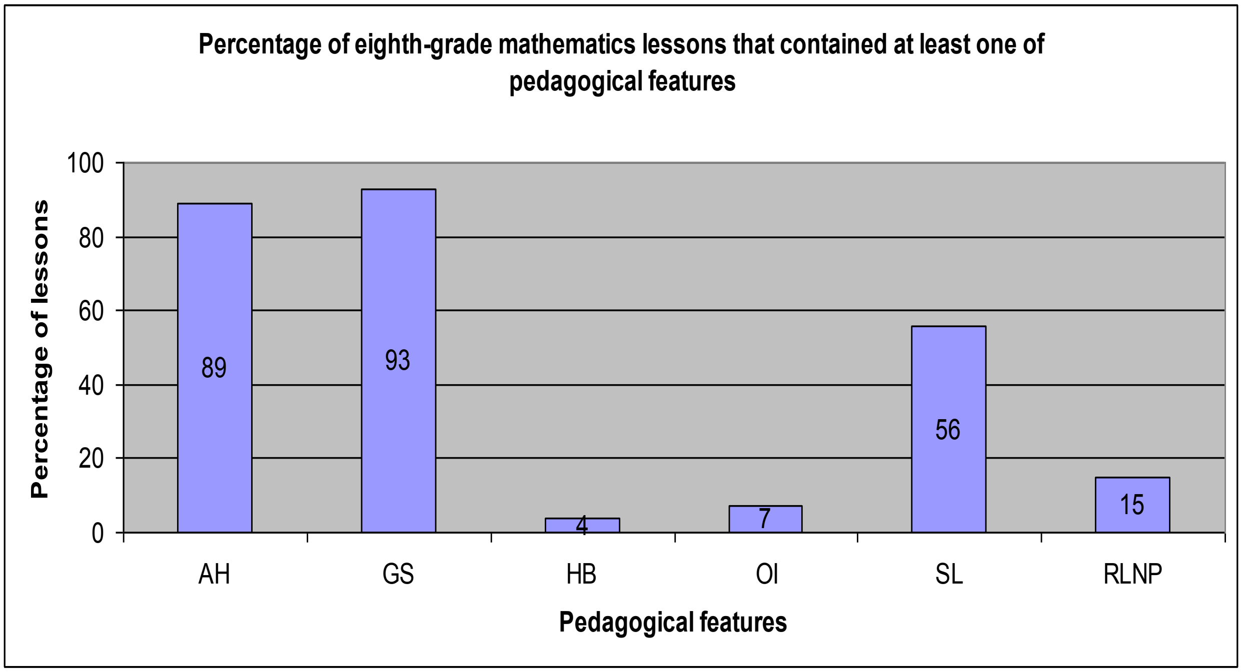
Figure 4.10 shows that in most lessons (93%) teachers described the goal of the lesson. Describing the goal of the lesson is very important. Brophy (1999) asserted that:

> Advanced organizers orient students to what they will be learning before the instruction begins. They characterize the general nature of the activity and give students a structure within which to understand and connect the specifics that will be presented by the teacher or text. Such knowledge of the nature of the activity and the structure of its content helps students to focus on the main ideas and order their thoughts effectively. Therefore, before beginning any lesson or activity, the teacher should ensure that students know what they will be learning and why it is important for them to learn it. (p. 15)

Figure 4.10 also shows that, in Vietnam, most teachers in videotaped lessons assigned the homework for students after the lesson ended, and the outside interruptions were few. The mathematical content was rarely connected to its historical background or to real life.

These content occurrence codes were considered to be “the pedagogical features that influence lesson clarity and flow” by Hiebert et al. (2003, p. 59)

Figure 4.10. Percentage of eighth-grade mathematics lessons that contained at least one of pedagogical features



* *Assignment of Homework (AH):* 89% of videotaped lessons in which the teachers assigned homework for students after lessons ended.
* *Goal Statement (GS):* 93% of videotaped lessons in which the teachers stated the goal of lessons.
* *Historical Background (HB):* Only 4% of videotaped lessons in which mathematical content was connected to its historical background.
* *Outside Interruptions (OI):* 7% of videotaped lessons were interrupted by outside elements.
* *Summary of Lesson (SL):* 56% of videotaped lessons in which teachers summarized the lessons near the end of lessons.
* *Real Life Connection/Application – Non Problem (RLNP):* 15% videotaped lessons in which mathematical content was connected or applied to real life.

4.3.5. Resources used during the lesson

The "resources used" during the lesson may be "chalkboard (CH)", "projector (PRO)", "television or video (TV)", "textbook or worksheet (TXW)", "special mathematical material (SMM)", "real-world object (RWO)", "calculator (CALC)", or "computer (COMP)". (Jacobs et al., 2003, pp. 466-469)

❖ *Chalkboard (CH):*

Code whether a chalkboard/whiteboard is used at any time in the lesson. If the teacher refers to something that has been written on the chalkboard (e.g., notes, definitions), code this as a chalkboard use even if the information was not written during the videotaped lesson. (Jacobs et al., 2003, p. 466)

❖ *Projector (PRO):* "Code whether an overhead projector, video projector, or computer projector is used at any time in the lesson." (Jacobs et al., 2003, p. 467)

❖ *Television or Video (TV):*

> Code whether a television or video is used at any time in the lesson. This includes prerecorded or live footage, film clips, etc. This does *not* include instances where a TV is used as a computer monitor or other projection device. (Jacobs et al., 2003, p. 467)

❖ *Textbook or Worksheet (TXW):* "Code whether textbooks or worksheets (e.g., review sheets, study sheets, homework sheets) are used at any time in the lesson." (Jacobs et al., 2003, p. 467)

❖ *Special Mathematical Material (SMM):*

> Code whether there are any mathematical materials used for a mathematical purpose at any time in the lesson. These materials are usually commercially produced, however they can be pre-prepared by the teacher.
>
> For example: special paper for graphing (i.e. paper with grids of common units used for drawing graphs), graph boards, hundreds tables, geometric solids, base-ten blocks, rulers, measuring tape, compasses, protractors, and computer software that simulates constructions or models. (Jacobs et al., 2003, p. 468)

❖ *Real-World Object (RWO):*

> Code whether real-world objects (e.g., cans, beans, toothpicks, maps, common geometric puzzles, dice, newspapers, magazines, springs) are used or shown at any time in the lesson for mathematical purposes. Real-world objects are those typically found outside the classroom. (Jacobs et al., 2003, p. 468)

❖ *Calculator (CALC):* "Code whether calculators (i.e., regular calculators and graphing calculators) are used at any time in the lesson, and note whether or not they are used for graphing." (Jacobs et al., 2003, 469)

❖ *Computer (COMP):* "Code whether computers are used at any time in the lesson." (Jacobs et al., 2003, p. 469)

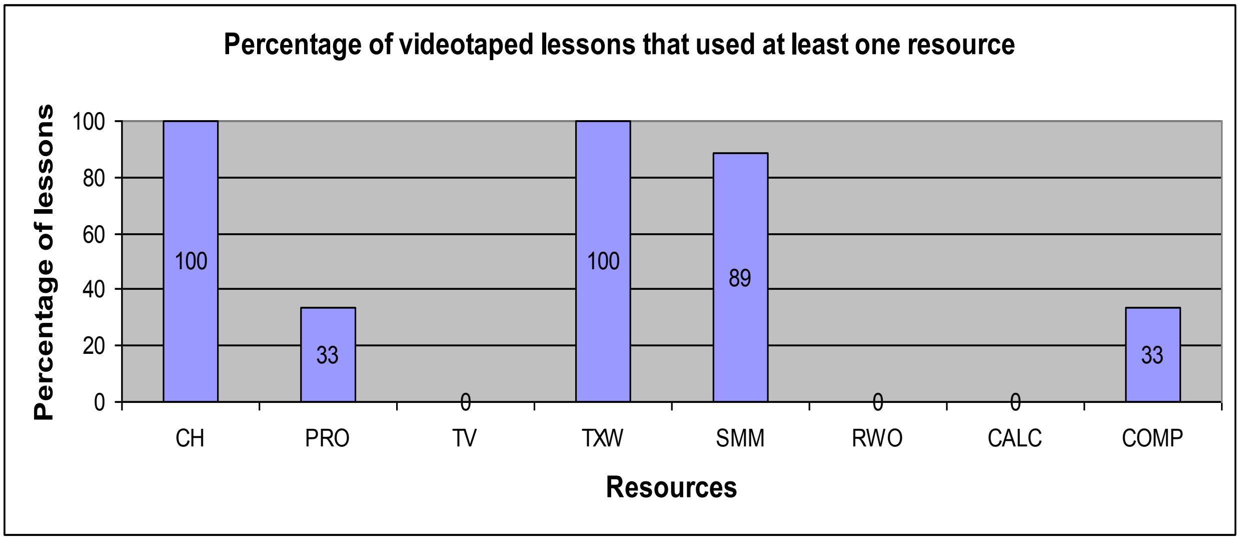
If we see these resources in videos but they were not used at any time in the lessons, we do not code these resources as used. (Hiebert, 2003, p. 113)

We can see from Figure 4.11 that all teachers used the chalkboard and textbooks or worksheets in videotaped lessons. This also happens in practical mathematics teaching in Vietnam. Most Vietnamese mathematics teachers use chalkboards and textbooks or worksheets when teaching mathematics.

Eighty-nine percent of teachers used special mathematics materials when teaching. These special mathematics materials included rulers for drawing figures, or auxiliary boards which teachers prepared at home.

From the teacher questionnaires or direct interviews, we found that Vietnamese teachers only use projectors and computers in special cases, such as when there is someone observing the lesson.

Figure 4.11. Percentage of videotaped lessons that used at least one resource



* 100% of videotaped lessons in which the teachers used the *chalkboard (CH)* and *textbooks or worksheets (TXW).*
* 33% of videotaped lessons in which *projectors (PRO)* and *computers (COMP)* were used.
* 89% of videotaped lessons in which *special mathematical materials (SMM)* were used.
* *Television or video (TV), real-world objects (RWO),* and *calculators (CALC)* were not used in videotaped lessons.

4.3.6. Purpose of different lesson segments

The purpose (P) code is a coverage code. That is, all points in the lesson must be coded as one of the following 3 mutually exclusive categories: Addressing Content Introduced in Previous Lessons (P1), Introducing New Content (P2), or Practicing/Applying Content Introduced in the Current Lesson (P3). (Jacobs et al., 2003, p. 483)

Hiebert et al. (2003) also defined these three purposes as "reviewing", "introducing new content", and "practicing new content" as follows:

- ***Reviewing***: This category, more technically called "addressing content introduced in previous lessons", focused on the review or reinforcement of content presented previously…. These segments typically involved the practice or application of a topic learned in a prior lesson, or the review of an idea or procedure learned previously. Examples included:
  - Warm-up problems and games, often presented at the beginning of a lesson;
  - Review problems intended to prepare students for the new content;
  - Teacher lectures to remind students of previously learned content;
  - Checking the answers for previously completed homework problems; and
  - Quizzes and grading exercises.

- ***Introducing new content***: This category focused on introducing content that students had not worked on in an earlier lesson…. Examples of segments of this type included:
  - Teacher expositions, demonstrations, and illustrations;
  - Teacher and student explorations through solving problems that were different, at least in part, from problems students had worked [on] previously;
  - Class discussions of new content; and
  - Reading textbooks and working through new problems privately.
- ***Practicing new content****:* This category focused on practicing or applying content introduced in the current lesson…. These segments only occurred in lessons where new content was introduced. They typically took one of two forms: the practice or application of a topic already introduced in the lesson, or the follow-up discussion of an idea or formula after the class engaged in some practice or application. Examples of segments included:
  - Working on problems to practice or apply ideas or procedures introduced in an earlier lesson;
  - Class discussions of problem methods and solutions previously presented; and
  - Teacher lectures summarizing or drawing conclusions about the new content presented earlier. (pp. 49-50)

Sometimes it was difficult to classify clearly the 'reviewing' and 'practicing new content' segments. In some situations, if 'practicing new content' segments contained the 'reviewing' segments, then these segments were coded as 'practicing new content' segments (P3) (Jacobs et al., 2003, pp. 483, 485).

The summaries of mathematical contents which were learned in the lesson "should be coded as part of the purpose segment that precedes it", such as, if the summary comes after the teacher introduces new content, code it as P2; if the summary comes after the students practice or apply new content, code it as P3 (Jacobs et al., 2003, p. 484).

The results of coding the purpose of different segments can be seen in Table 4.10 below.

Table 4.10. Time (in minutes) used for reviewing (P1), introducing new content (P2), and practicing new content (P3), by lesson

Lesson	*Reviewing*	*Introducing new content*	*Practicing new content*	Nr.shift
1. TH.TG	2.8	26.5	14.6	4
2. TH.HL	5.0	16.4	26.7	2
3. TH.HH	4.3	29.8	13.2	2
4. TH.TT	1.5	10.4	30.4	2
5. TH.NS1	0.5	26.1	20.9	2
6. TH.NS2	51.1	0.0	0.0	0
7. TH.QX	4.0	15.1	35.8	2
8. TH.TS	3.7	25.5	15.5	6
9. TH.TH	9.6	29.4	16.8	8
10. NA.ND	1.4	27.5	18.4	6
11. NA.HN	6.3	12.1	29.4	7
12. NA.CL	2.2	23.2	22.1	7
13. NA.NL	50.5	0.0	0.0	0
14. NA.V	5.3	25.3	14.5	7
15. NA.YT	4.6	13.4	27.4	6
16. NA.DV	4.5	24.2	15.8	4
17. NA.TC	27.6	18.7	0	1
18. SS.BS	4.5	25.5	12	2
19. SS.QT1	4.7	21.7	16.5	2
20. SS.QT2	7.5	24.9	12.4	4
21. SS.TS	6.8	10.9	27.6	2
22. SS.ToS	4.8	24.5	19.5	6
23. HN.PT	35.8	0.0	0.0	0
24. HN.CG1	44.1	0.0	0.0	0
25. HN.CG2	48.1	0.0	0.0	0
26. HN.CG3	41.6	0.0	0.0	0
27. HN.CG4	46.4	0.0	0.0	0

* 7 lessons were entirely *reviewing (P1):* 6.TH.NS2, 13.NA.NL, 23.HN.PT, 24.HN.CG1, 25.HN.CG2, 26.HN.CG3, and 27.HN.CG4.

From Table 4.10, we can see that there were 7 lessons which were entirely review. Out of all the videotaped lessons, 100% of lessons contained at least one segment of reviewing (P1), 74% of lessons had at least one segment of introducing the new content (P2), and 70% of lessons had at least one segment of practicing new content (P3) (see Table 4.11 below).

Table 4.11. The statistical time data (in minutes) used for reviewing, introducing new content, and practicing new content in Vietnam and the number of shifts between purpose segments.

Mathematical Activities	Mean	Median	Std. Dev.	Minimum	Maximum	N
Reviewing	15.9	5.0	18.6	0.5	51.1	27
Introducing new content	16.0	18.7	11.0	0.0	29.8	20
Practicing new content	14.4	15.5	11.2	0.0	35.8	19
Nr. Shifts	3	2	2.7	0	8	

* On average, Vietnamese teachers devoted about 16 minutes to review, also 16 minutes to introduce the new content and about 14 minutes to practice new content.
* The teachers could devote only 30 seconds to review (5.TH.NS1) or the whole lesson to review (see Table 4.10).
* There was not any lesson that was entirely *introducing new content* or *practicing new content*.
* There were 100% of lessons with at least one segment of *reviewing* (N = 27), 74% of lessons with at least one segment of *introducing the new content* (N = 20), and 70% of lessons with at least one segment of *practicing new content* (N = 19).
* On average, Vietnamese teachers shifted 3 times between the purpose segments.

It was observed from the videotaped lessons that, except for lessons dedicated entirely to review, the teachers usually reviewed at the beginning of the lessons (about 1 to 10 minutes) and after that the teachers alternately introduced new content and practiced new content (see Appendix G).

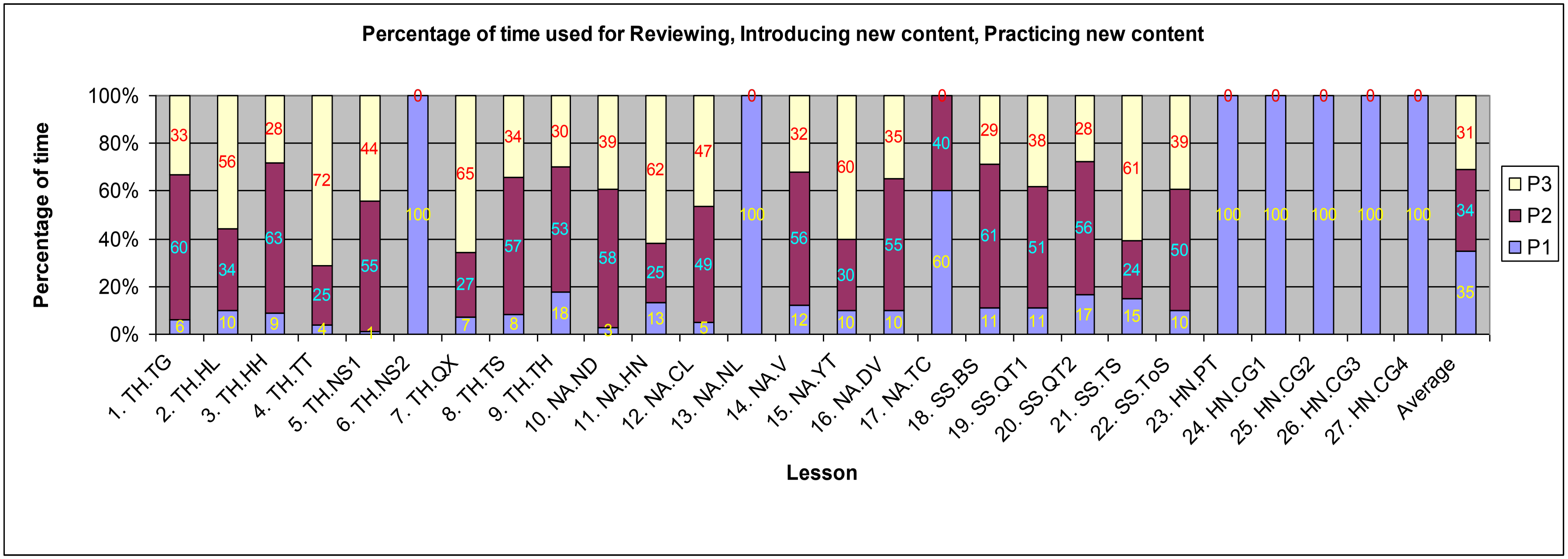
Hiebert et al. (2003) said that:

> The number, length, and sequence of purpose segments provide one way of organizing lessons for accomplishing different goals. One measure of this lesson organization is simply the number of purpose segments. Different learning experiences might be afforded by lessons that have relatively short purpose segments and jump back and forth between segments of different purposes than by lessons that spend a longer time on a particular purpose before shifting to another. (p. 52)

It can be seen from Table 4.10 and 4.11 that the average of number of shifts of purpose segments of the videotaped lessons was 3. The lessons in which the teachers did not shift the purpose were 6.TH.NS2, 13.NA.NL, 23.HN.PT, 24.HN.CG1, 25.HN.CG2, 26.HN.CG3, and 27.HN.CG4 (entirely review). The lesson in which the teachers shifted the most was 9.TH.TH, with 8 shifts.

For more information about the coding of segment purposes, see Figure 4.12 below and Appendix G of this dissertation.

Figure 4. 12. Percentage of time used for reviewing, introducing new content, and practicing new content



* 7 lessons were entirely *reviewing (P1):* 6.TH.NS2, 23.HN.PT, 24.HN.CG1, 25.HN.CG2, 26.HN.CG3, and 27.HN.CG4.
* The lessons in which teachers devoted less than 5% of lesson time to *reviewing*: 4.TH.TT (4%), 5.TH.NS1 (1%), and 10.NA.ND (3%).
* Except for the entirely *reviewing* lessons, percentage of lesson time devoted to *introducing new content (P2)* in the remaining lessons ranged from 24% (21.SS.TS) to 63% (3.TT.HH).
* Except for the entirely *reviewing* lessons, there was only one lesson (17.NA.TC) in which the teacher did not devote time to *practicing new content (P3)*. In other lessons, teachers devoted from 28% to 72% of lesson time to *practicing new content*.
* On average, the teachers seemed to devote the same time to *reviewing* (35%), *introducing new content* (34%), and *practicing new content* (31%)

4.3.7. Percentage of lesson time teacher and students participated in lessons

The TIMSS Video Study investigated all the "opportunities to talk" in the classrooms (Hiebert et al., 2003, p. 107). Because of limited time, the *opportunities to talk* in Vietnamese classrooms will be investigated later.

Based on information from the World Bank (2010, p. 43), we want to know the percentage of time teachers and students participated in the lesson.

As mention earlier, there are "five types of classroom interactions," which are "public interaction" (CI 1); "private interaction" (CI 5); "optional, student presents information" (CI 3); "optional, teacher presents information" (CI 2); and "mixed private and public work" (CI 4) (Hiebert et al., 2003, pp. 53-54).

In the Vietnamese lessons, there was no mixed private and public work (CI 4*).* In CI 5, private interaction, all students work at their seats. So we coded CI 5 as a "students-only" activity (see World Bank, 2010, p. 43). This was also the case with CI 3. One or more students present information publicly in written form, and other students may attend to this information or work on an assignment privately; we also coded CI 3 as a student-only activity.

Based on the categorization of the World Bank (2010), we divided the CI 1, and CI 2 segments into three categories:

❖ "Teacher-only": teacher lectured, explained and so on, students just listened, took notes

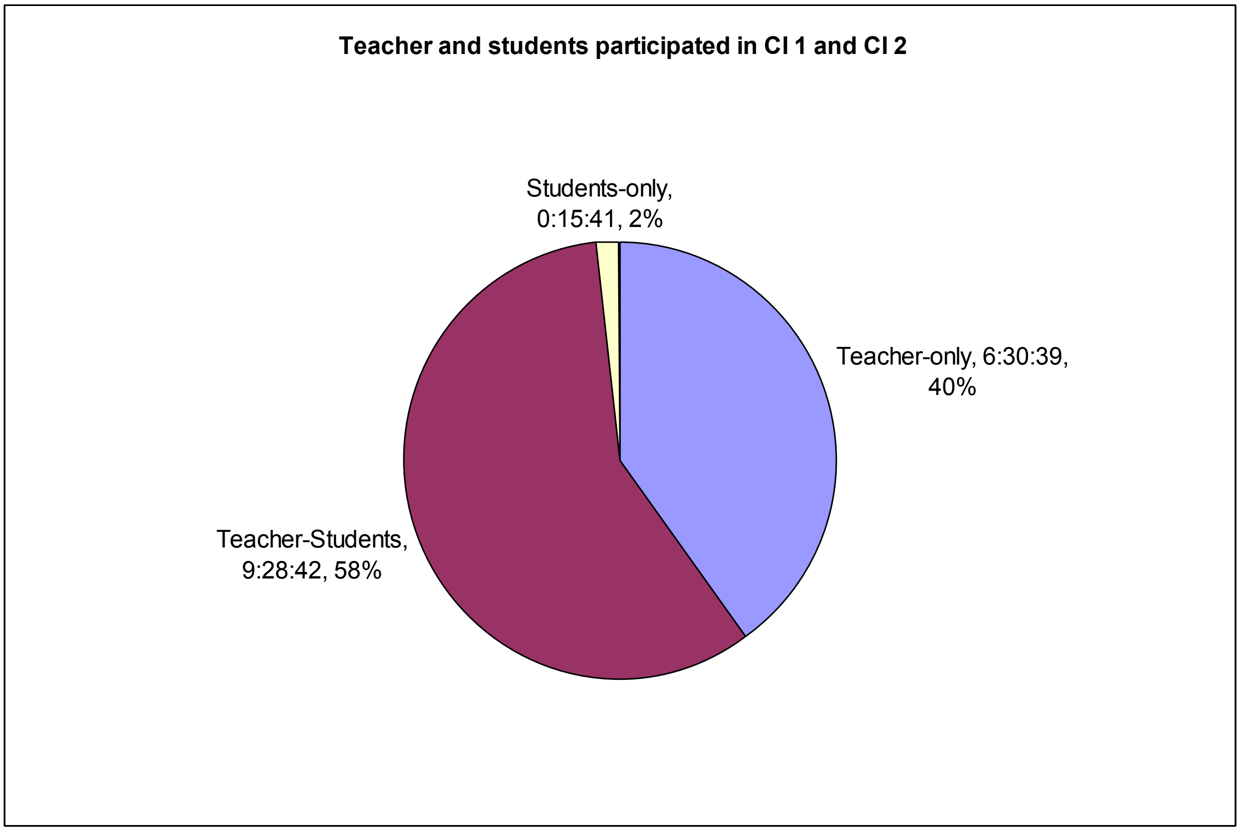
❖ "Student-only": students read the textbook, solved problems and so on, the teacher listened, walked around to help individual student if necessary

❖ "Teacher-students": teacher and students participated in question-and-answer to solve the problem; or one student read the problem key for the teacher to write on the chalkboard and so on. (p. 43)

The result can be seen in Figure 4.13 (see more detail in Appendix K of this dissertation).

The sum of CI 1 time and CI 2 time in the 27 videotaped lessons was 16 hours 15 minutes and 2 seconds. From Figure 4.13, we can see that, in CI 1 and CI 2 segments, the teachers lectured about 6 hours 30 minutes and 39 seconds (6:30:39), making up 40% of the total time. The teachers and students participated in question-and-answer for about 9 hours 28 minutes and 42 seconds, making up 58% of total time. And the students presented publicly for about 15 minutes 41 seconds, making up 2% of the total time.

Figure 4.13. Teacher and students participated in CI 1 and CI 2



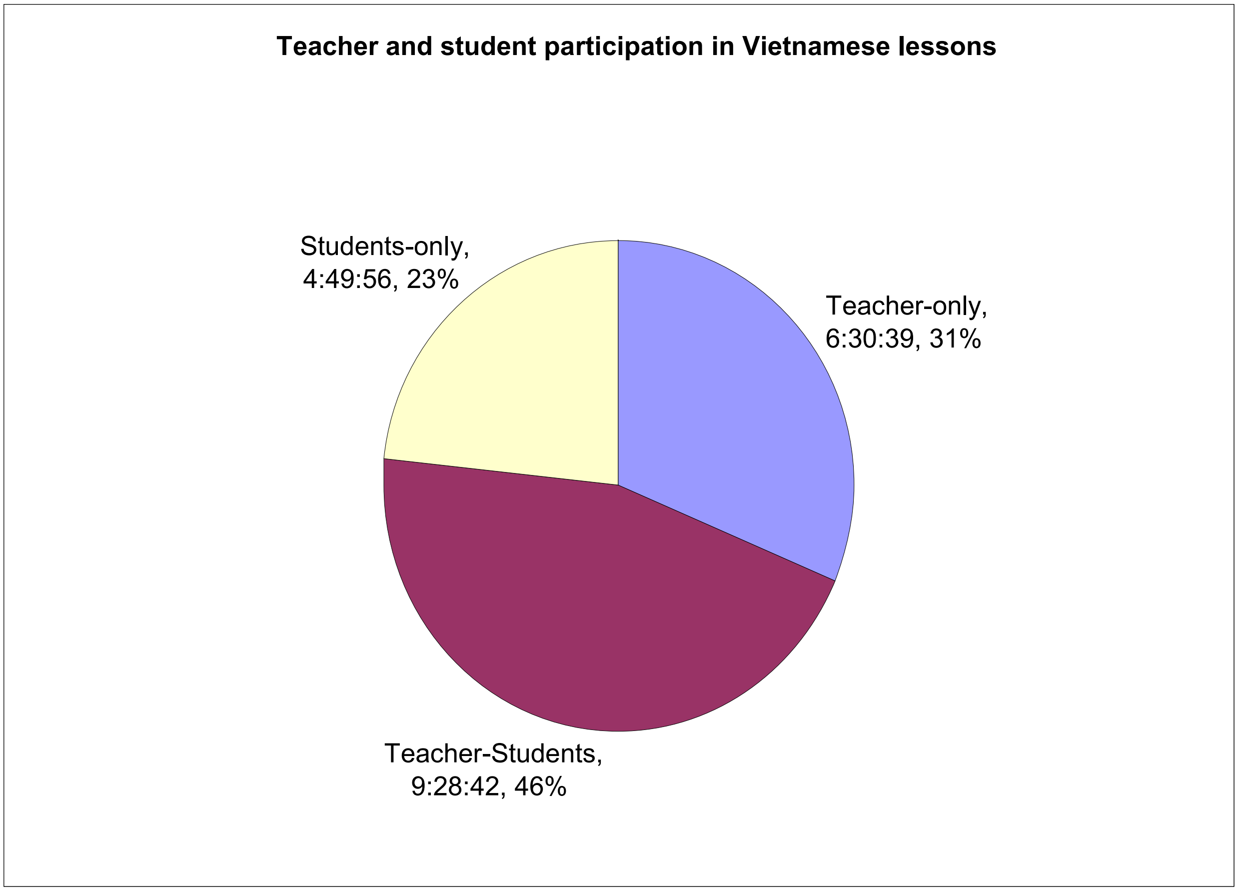
* The sum of CI 1 segment time and CI 2 segment time: 16:15:02 (16 hours 15 minutes and 02 seconds)
* The time of *teacher-only* segments: 6:30:39 (6 hours 30 minutes and 39 seconds), making up 40% of total time
* The time of *teacher-students* segments: 9:28:42 (9 hours 28 minutes and 42 seconds), making up 58% of total time
* The time of *student-only* segments: 0:15:41 (15 minutes 41 seconds), making up 2% of total time

After that, this result was combined with the time of CI 3 and CI 5, from which we obtained the information about the percentage of time teachers and students were involved in the lesson in Figure 4.14 below.

From Figure 4.14, we can see that the time the teacher devoted to lecturing is 6 hours 30 minutes and 39 seconds out of a total 20 hours 49 minutes and 17 seconds of the 27 videotaped lessons' time. Student-only segments made up 23% of the lesson time, and teacher-student segments made up 46% of the lesson time.

We could not divide the teacher-student segments into teacher-only segments and student-only segments, because the teacher and students usually moved through the question-and-answer session very quickly in this kind of segment. The questions or answers might last just 1 or 2 seconds. The answers might be a very simple "yes".

Figure 4.14. Teacher and student participation in Vietnamese lessons



* On average, the percentage of lesson time teachers mainly lectured: 31% (about 14 minutes 28 seconds)
* On average, the percentage of lesson time teacher and students used question-and-answer: 46% (about 21 minutes 4 seconds)
* On average, the percentage of lesson time students did mathematics by themselves: 23% (about 10 minutes 44 seconds)

We will continue to the discussion of this aspect in the next chapter.

4.3.8. Vietnamese eighth-grade mathematics lesson signature

4.3.8.1. What is the lesson signature?

> If there are features that characterize teaching in a particular country, there should be enough similarities across lessons within the country to reveal a particular pattern to the lessons in each country. If this were the case, then overlaying the features of all of the lessons within a country would reveal a pattern or, as labeled here, a "lesson signature."
>
> …lesson signatures take into account when features occurred in the course of a lesson and consider whether and how basic lesson features co-occurred. (Hiebert et al., 2003, p. 123)

"Three dimensions" used to create *lesson signatures* in the seven countries of the TIMSS Video Study were: "the purpose of the activities, the type of classroom interaction, and the nature of the content activity" (Hiebert et al., 2003, p. 123). These dimensions were also coded in this dissertation to create the Vietnamese 'lesson signature' (Figure 4.15).

To create the lesson signatures in the seven countries of the TIMSS 1999 Video Study, each lesson was divided "into 250 segments, each segment represented 0.4 percent of total lesson length" (Hiebert et al., 2003, p. 123). "The horizontal axis of each lesson signature is a time scale that represents the percentage of time that has elapsed in a given lesson, from the beginning to the end of a lesson." (Hiebert et al., 2003, p. 123)

Different from the TIMSS Video Study, we divided each Vietnamese lesson into 100 segments. Each segment represented 1 percent of the total lesson length. "The histogram increases in height" by one unit of length for every lesson "marked positively for a feature at any given moment during the lesson time" (see Hiebert et al., 2003, p. 123). For example, in the histogram of reviewing in the Vietnamese lesson signature below, at the beginning of the lesson, there were 27 lessons (100 percent of lessons) in which the teachers reviewed old content. So, in the histogram of reviewing, the height was represented by 100 units of length at this moment. There were about 30 percent of lessons in which teachers reviewed the old content in the middle of the lesson, so in the middle of the reviewing histogram, the height was represented by 30 units of length. We created all the histograms in the same form, so the unit of length in all histograms was the same.

How to interpret a lesson signature? Hiebert et al. (2003) showed that:

> Comparing the histograms of features within or across dimensions provides a sense of how those features were implemented as lesson time elapsed. Patterns may or may not be easily identified. Where patterns are readily apparent, this suggests that many lessons contain the same sequence of features. Where patterns are not readily apparent, this suggests variability within a country, either in terms of the presence of particular features or in terms of their sequencing. Furthermore, if the histograms of particular features are all relatively high at the same time in the lesson, this suggests that these features are likely to co-occur. However, in any single lesson observed in a country, this may or may not be the case. Thus, the histograms provide a general sense of what occurs as lesson

time passes rather than explicitly documenting how each lesson moved from one feature to the next. (p. 124)

4.3.8.2. The lesson signature for Vietnam

Purpose

As mentioned earlier, there are 7 lessons (26 percent of lessons) that were entirely review. Out of all the videotaped lessons, 100% contained at least one segment of reviewing, 74% at least one segment of introducing the new content, and 70% at least one segment of practicing new content (see Table 4.10, Table 4.11, and Figure 4.12).

We can see this information in Figure 4.15 of the Vietnamese lesson signature below. In this figure, the feature of reviewing is represented in the first histogram. 100 percent of the lessons started with reviewing (the height of the histogram at the beginning is 100 units of length). A majority of the lessons focused on reviewing through the first 11 percent of the lesson time (about 5 – 7 minutes). Then, the lessons focused on introducing new content for the next 20 percent of the lesson time (between 12 and 30 percent). Most lessons focused on practicing new content for at last 20 percent of the lesson time. In fact, for 30 to 80 percent of the lesson time, introducing new content and practicing new content were conducted alternately.

Classroom interaction

As mentioned before, Vietnamese teachers devoted a majority of the lesson times to public interaction (71%), while they spent only 2 percent of the lesson time on private interaction. In public interaction, the teachers mainly lectured and students listened. When assigning problems to the class, some Vietnamese teachers often invite one or more students to solve those problems at the chalkboard and other students solve those problems at their seats at the same time. We coded these segments as 'optional, student presents'. On average, 20 percent of the lesson time was devoted to 'optional, student presents' (Table 4.6).

From the lesson signature below, we can see very clearly that a majority of the lessons focused on public interaction for most of the lesson. Ninety-three percent of teachers started the lesson with public interaction. Eighty-five percent of teachers devoted lesson time to public interaction in the middle of lesson, and the same at the end of the lesson (see Appendix L in this dissertation)

From the lesson signature, we can also see that Vietnamese teachers devoted more time to 'optional, student presents' segments than private interaction. These types of interaction started with the teacher assigning problems to the students. While in private interaction, all of the students solved the problems at their seats, in 'optional, student presents', one or more students solved the problems at the chalkboard, so other students could watch. It means that maybe there were some students who did nothing in CI 3.

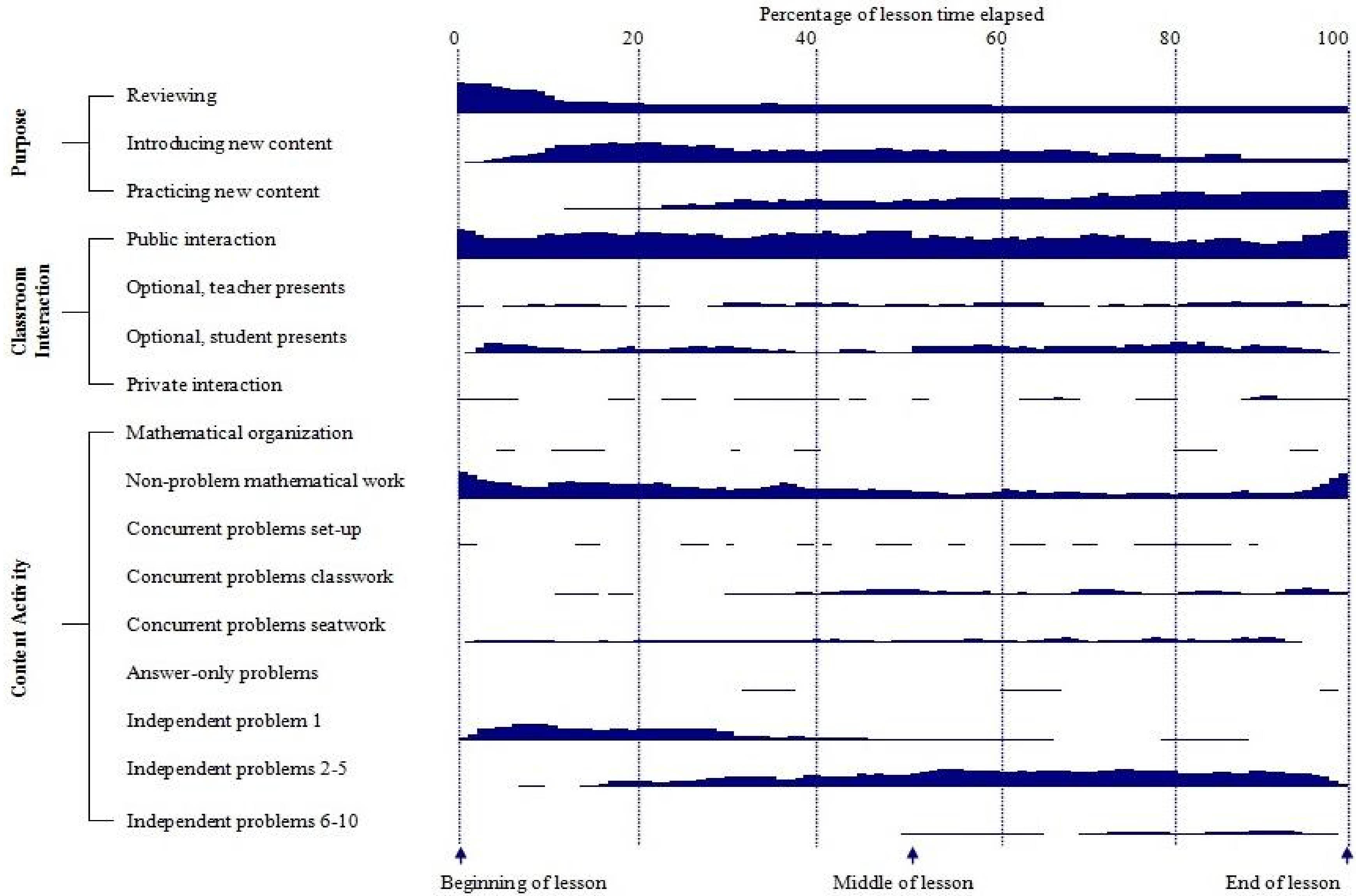
Content activities

We can see from Figure 4.6 and Table 4.8 that most videotaped lessons devoted more time to solving problems. On average, the time devoted to problem solving was 68% of the lesson time, and the time devoted to non-problem segments is 32% of the lesson time.

We can see from Figure 4.7 that most videotaped lessons devoted most mathematical work time to independent problems. On average, the time devoted to independent problems makes up 71% of mathematical work time, the time devoted to concurrent problems makes up 28%, and the time devoted to answer-only problems makes up 1% of the time.

From the lesson signature below, we can see that Vietnamese teachers prefer assigning one problem after another (independent problems) to assigning a group of problems (concurrent problems) to students.

Figure 4.15. Vietnamese eighth-grade mathematics lesson signature



4.4. Summary

This chapter presented the video study in Vietnam and its results. This video study was based on the TIMSS Video Study. We modified some aspects of the TIMSS Video Study to make it suitable for our situation. For example, two cameras were used in the TIMSS 1999 Video Study, but we used only one camera. Due to limited time, we did not code all of the features included in the TIMSS Video Study. We just coded and analyzed some aspects that we needed for our recent research. We will code and analyze other aspects later.

The most important thing that we learned from this video study was the nature of the Vietnamese eighth-grade mathematics lesson signature. With our 27 sample videos, we do not assert that the lesson signature, which we created, reflects the reality of eighth-grade mathematics teaching in Vietnam. But with personal experiences about mathematics teaching in Vietnam, we think that the lesson signature reflects relatively accurate the reality of mathematics teaching in Vietnam.

The results of the Vietnam video study will be combined with the results of the TIMSS 1999 Video Study to compare eighth-grade mathematics teaching and learning across countries. These comparisons will be presented in the next chapter of this dissertation.

CHAPTER 5

MATHEMATICS TEACHING IN DIFFERENT COUNTRIES

This chapter will combine the results of the video study in Vietnam with the TIMSS Video Studies to compare some aspects of mathematics teaching and learning across countries. Specifically, it will use the results of the TIMSS 1995 Video Study in three countries, the TIMSS 1999 Video Study in seven countries, the TIMSS 2007 Video Study in Indonesia, and the 2012 video study in Vietnam to identify the similarities and differences in eighth-grade mathematics teaching and learning across nine countries. These results can be found in Stigler and Hiebert (1999), Stigler et al. (1999), Hiebert et al. (2003), World Bank (2010), and Chapter 4 of this dissertation.

First, the dissertation briefly presents the TIMSS Video Study in Indonesia in the following section.

5.1. Introducing the TIMSS 2007 and 2011 Video Studies in Indonesia

The TIMSS Video Study in Indonesia "was based heavily on" the TIMSS 1999 Video Study that allowed a comparison of "Indonesia's results to those of the other seven countries" (World Bank, 2010, p. vi). This video study was conducted through two phases in 2007 and 2011 that examined not only mathematics teaching practices each year but also how mathematics teaching practices changed from 2007 to 2011 (Chang et al., 2014, pp. 126-127). This video study investigated 100 classes out of the 150 that participated in the TIMSS 2007 examination, and also 100 additional classes in 2011 (Chang et al., 2014, pp. 126-127, 152; World Bank, 2010, p. 9).

The purpose of the video study in Indonesia was "to examine classroom performance of teachers in order to provide evidence for the effect of the Teacher Law and the BERMUTU [Better Educational through Reformed Management and Universal Teacher Upgrading] project" (World Bank, 2010, pp. vii, 24).

The procedure for conducting the TIMSS Video Study in Indonesia was relatively similar to the procedure used in the TIMSS 1999 Video Study in the seven countries as described in previous chapters.

One example of the change in mathematics practices from 2007 to 2011 in Indonesia is offered by Chang et al. (2014), who commented that the percentage of lesson time devoted to *mathematical work* decreased statistically significantly from 89 percent in 2007 to 86 percent in 2011, while the time devoted to *mathematical organization* increased statistically significantly from 8 percent to 10 percent (p. 130) (see the definition of *mathematical work* and *mathematical organization* in Chapter 4 of this dissertation).

Also according to Chang et al. (2014), Indonesian teachers used closed problems and questions more often (about 97 percent) than open problems and questions (about 3 percent) when teaching mathematics, and this hardly changed at all from 2007 to 2011 (pp. 138-139).

More findings of the TIMSS 2007 and 2011 Video Studies in Indonesia can be found in Chang et al. (2014), World Bank (2010) and the next sections of this chapter.

In these next sections, the findings of the TIMSS 2007 Video Study in Indonesia will be compared with the findings of the TIMSS 1995 and 1999 Video Studies and the 2012 video study in Vietnam.

5.2. Eighth-grade mathematics teaching cross-country comparisons

In this section, it must be noted that the Japanese mathematics data were collected in 1995, the Indonesian mathematics data in 2007, the Vietnamese mathematics data in 2012, and other countries' mathematics data in 1999. First, this dissertation will compare the time of mathematics lessons in nine countries: Australia, Czech Republic, Hong Kong SAR, Japan, Netherlands, Switzerland, United States, Indonesia, and Vietnam.

5.2.1. Lesson times

The information about time of mathematics lessons in each country can be seen in Table 5.1 below.

Table 5.1. Mean, median, range, and standard deviation (in minutes) of time of eighth-grade mathematics lessons, by country

Country	Mean	Median	Minimum	Maximum	Std.Dv
Australia	47	45	28	90	13
Czech Republic	45	45	41	50	1
Hong Kong SAR	41	36	26	91	14
Japan [1]	50	50	45	55	2
Netherlands	45	45	35	100	7
Switzerland	46	45	39	65	3
United States	51	46	33	119	17
Indonesia [2]	70	68	39	97	14
Vietnam [3]	46	46	36	56	4

1. Japanese mathematics data were collected in 1995.
2. Indonesian mathematics data were collected in 2007.
3. Vietnamese mathematics data were collected in 2012.
4. Other countries' mathematics data were collected in 1999.

Source: Hiebert et al. (2003, p. 37), World Bank (2010, p. 36), and Table 4.5 in Chapter 4 of this dissertation

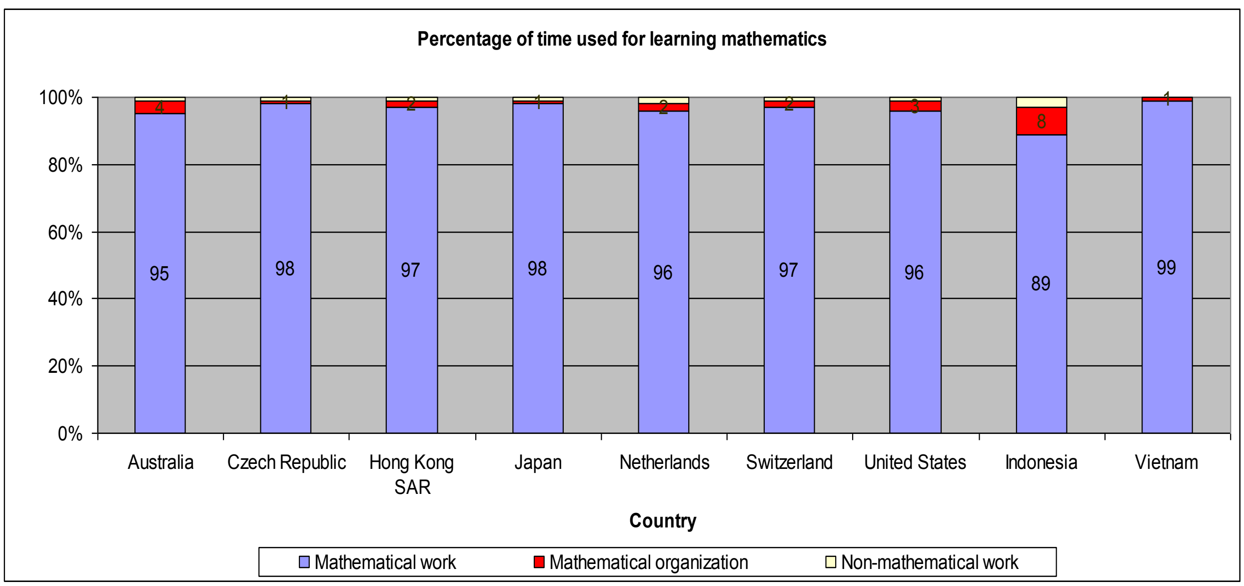
From Table 5.1 we can see that there was a large range of lesson times in a majority of countries. According to Hiebert et al. (2003) there was a "large range" in lesson times "in some countries" partly because the mathematics lessons were taught in "two traditional instructional periods" called "double lessons" in some countries (p. 37). In this case, "the median length is probably the best measure for gauging the length of a typical lesson" in each country (Hiebert et al., 2003, p. 37).

Most videotaped lessons in Vietnam lasted one traditional teaching period, so the mean length of lessons in Vietnam was 46 minutes, which approximated the mean length of lessons in the Czech Republic, Australia, the Netherlands, and Switzerland. The lessons' length in Indonesia was "significantly longer than in other countries" (World Bank, 2010, p. 36).

5.2.2. Percentage of lesson time spent studying mathematics

The comparison of the *mathematical work* time, *mathematical organization* time, and *non-mathematical work* time across countries can be seen in Figure 5.1 below.

Figure 5.1. Average percentage of eighth-grade mathematics lesson time devoted to *mathematical work*, *mathematical organization*, and *non-mathematical work*, by country



1. Japanese mathematics data were collected in 1995.
2. Indonesian mathematics data were collected in 2007.
3. Vietnamese mathematics data were collected in 2012.
4. Other countries' mathematics data were collected in 1999.
5. Except Indonesia and Vietnam, the percentage of *mathematical work* time in other countries was calculated approximately from Figure 3.2 in Hiebert et al. (2003, p. 39)

Source: Hiebert et al. (2003, p. 39); World Bank (2010, pp. 37, 38); Table 4.7 in Chapter 4 of this dissertation

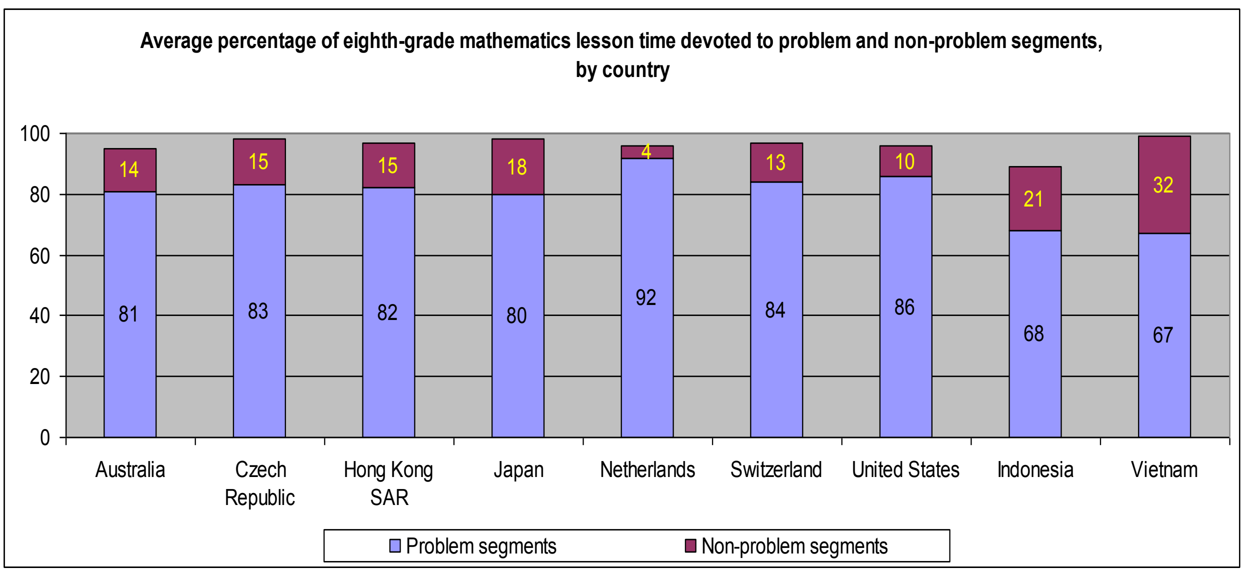
This figure was created by combining Table 4.7 in Chapter 4 of this dissertation with Figure 3.2 in Hiebert et al. (2003, p. 39) and Table 4.2 in World Bank (2010, p. 37).

From Figure 5.1, we can see that except for Indonesia, on average, the time devoted to *mathematical work* made up at least 95 percent of the lesson time. Indonesian teachers tended to devote "a much larger proportion" of lesson time to *mathematical organization* and *non-mathematical work* segments (World Bank, 2010, p. 38).

5.2.3. Time spent on problems and non-problems

The definitions of *problem* and *non-problem* segments were represented in Chapter 4 of this dissertation. From Figures 3.2 and 3.3 in Hiebert et al. (2003, pp. 39, 42), we calculated the average percentage of lesson time devoted to *problem* and *non-problem* segments in seven countries. We used Figures 4.7 and 4.8 in World Bank (2010, pp. 38, 39) to calculate the average percentage of lesson time devoted to *problem* and *non-problem* segments in Indonesia. The results of these calculations were combined with the results of the Vietnam video study to create Figure 5.2 below.

Figure 5.2. Average percentage of lesson time devoted to *problem* and *non-problem* segments, by country



1. Japanese mathematics data were collected in 1995.
2. Indonesian mathematics data were collected in 2007.
3. Vietnamese mathematics data were collected in 2012.
4. Other countries' mathematics data were collected in 1999.
5. Average percentage of lesson time devoted to *problem* segments in Indonesia was calculated approximately from Figures 4.7 and 4.8 in World Bank (2010, pp. 38, 39). Average percentage of lesson time devoted to problem segments in other countries except Vietnam was calculated approximately from Figures 3.2 and 3.3 in Hiebert et al. (2003, pp. 39, 42).

Source: Hiebert et al. (2003, pp. 39, 42); World Bank (2010, pp. 38, 39)

Comparing the results from Figure 5.2 in this chapter with the results from Table 4.8 in Chapter 4 of this dissertation, we can view this somewhat differently. In Table 4.8 in Chapter 4, the *mathematical work* time was divided into *problem* segments (68%) and *non-problem* segments (32%). However, on average, the *mathematical work* time made up only 99 percent of the lesson time (see Table 4.7 in Chapter 4, and Figure 5.1 above). So, on average, the percentage of *lesson time* devoted to *problem* segments and *non-problem* segments was 67 percent and 32 percent, rounded from 67.3 percent and 31.9 percent, respectively.

From Figure 5.2 above, we can see that Vietnamese teachers devoted more time to *non-problem* segments than did their colleagues in other countries. On the contrary, the teachers in the Netherlands devoted much less time to *non-problem* segments than did other countries' teachers.

5.2.4. Time devoted to independent, concurrent, and answered-only problems

The Indonesian TIMSS 2007 Video Study did not report on the lesson time used for *concurrent problem* and *answered-only problem* segments. So in Figure 5.3 below, we compare these features among eight countries.

Because problem segments were divided into *independent, concurrent*, and *answered-only* problem segments, from Figure 5.2 in this chapter and Figure 3.4 in Hiebert et al. (2003, p. 45) we calculated the average percentage of lesson time devoted to each type of segment in seven countries.

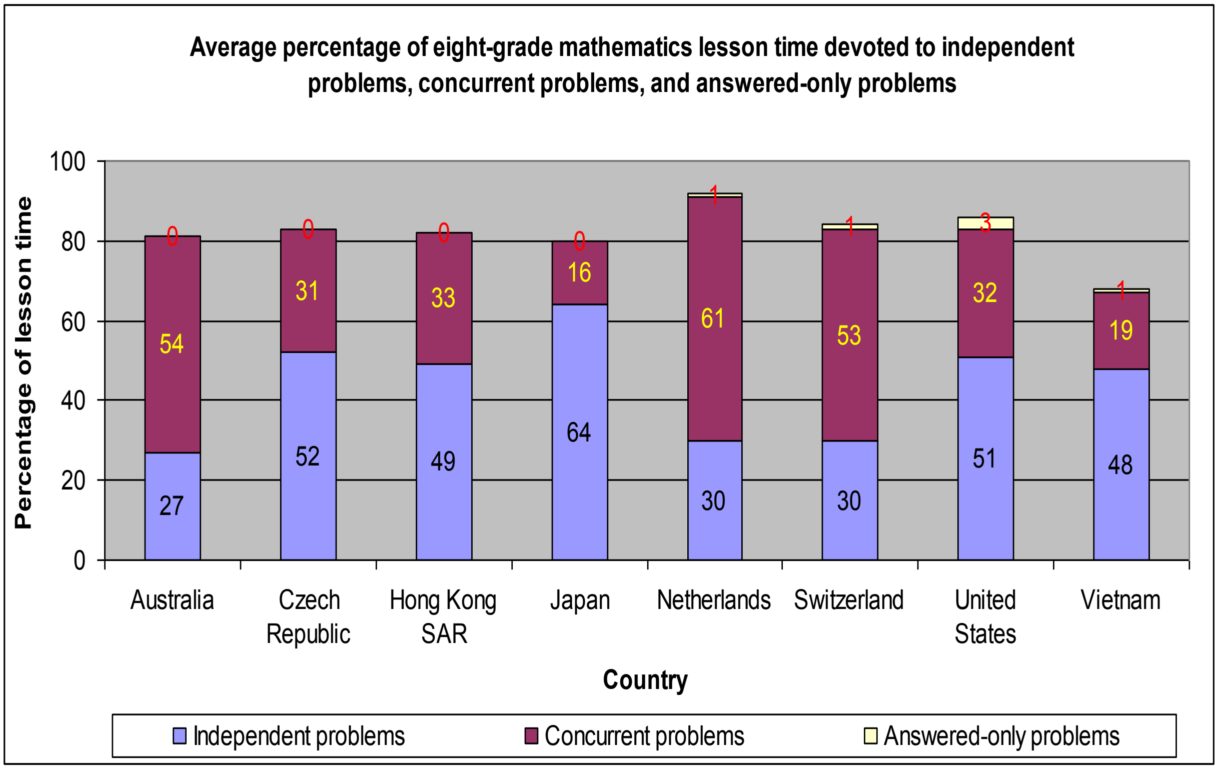
On average, the percentage of Vietnamese lesson time devoted to independent, concurrent, and answered-only problem segments were 47.8%, 19.0%, and 0.5%, respectively. These results were rounded in Figure 5.3 below.

From Figure 5.3, we can sort the eight countries into two groups. The first group includes Australia, the Netherlands, and Switzerland, in which the teachers spent more time on concurrent problem segments than independent problem segments. On the contrary, the second group includes the Czech Republic, Hong Kong SAR, Japan, the United States, and Vietnam, in which the teacher spent more time on independent problem segments than concurrent problem segments.

In our opinion, if the students in the class are on nearly the same level of mathematics comprehension, then they can solve one problem in nearly the same time. In this case, the teacher should spend more time on independent problem segments.

If the students in the class are not on the same level of mathematics, then some students can solve one problem much more quickly than others, and the teacher should spend more time on concurrent problem segments. The reason is that in the concurrent problem segments, the problems are assigned as a set of problems. Each student can solve a different number of problems in the same period of time depending on their level of understanding.

Figure 5.3. Average percentage of eighth-grade mathematics lesson time devoted to *independent problems, concurrent problems*, and *answered-only problems*, by country



1. Japanese mathematics data were collected in 1995.
2. Vietnamese mathematics data were collected in 2012.
3. Other countries' mathematics data were collected in 1999.
4. Except Vietnam, average lesson time devoted to *independent problem* segments in countries was calculated approximately from Figure 5.2 in this chapter and Figure 3.4 in Hiebert et al. (2003, p. 45).
5. The data was rounded.

Source: Hiebert et al. (2003, p. 45)

We can see from Figure 5.3 that the average percentage of Japanese lesson time devoted to independent problem segments was larger than that of other countries. In the next section, we will see that the average number of independent problems solved in Japanese lessons was only 3 problems. This means that the time devoted to one problem in Japanese lessons was much longer.

The teachers in most countries hardly ever used answered-only problems. U.S. teachers devoted 3 percent of the lesson time to answered-only problem segments, significantly higher than their colleagues in other countries.

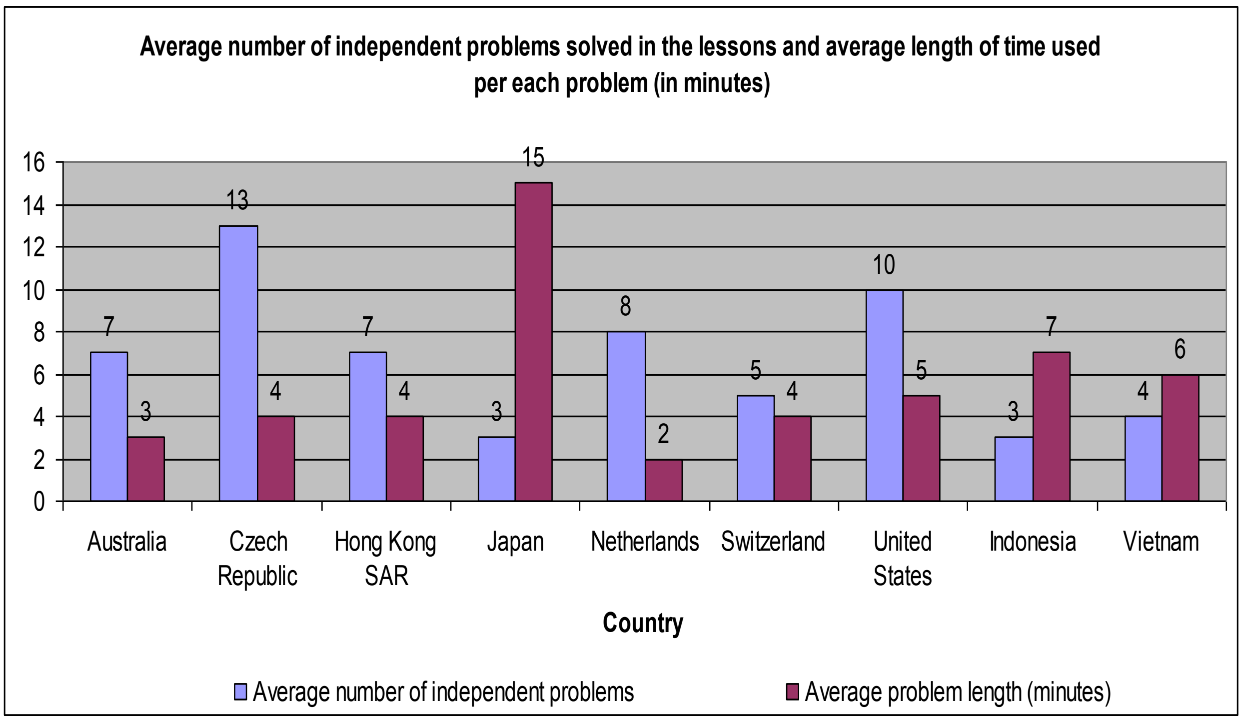
5.2.5. Average number of independent problems solved in the eighth-grade mathematics lessons and average time spent to solve each independent problem

Hiebert et al. (2003) asserted that

> It was possible to examine independent problems more carefully than concurrent problems because the exact time spent working on each problem could be calculated. This allowed an analysis of average time spent per independent problem as well as further analyses of the nature of the work that occurred during this time. (p. 46)

Figure 5.4 below was created by combining the results from Table 3.3 and Figure 3.5 in Hiebert et al. (2003, pp. 44, 46), Figure 4.10 in World Bank (2010, p. 40), and Table 4.9 in Chapter 4 of this dissertation.

Figure 5.4. Average number of *independent problems* solved in the lessons and average time per *independent problem* per lesson (in minutes)



1. Japanese mathematics data were collected in 1995.
2. Indonesian mathematics data were collected in 2007.
3. Vietnamese mathematics data were collected in 2012.
4. Other countries' mathematics data were collected in 1999.
5. The data was rounded.

Source: Hiebert et al. (2003, pp. 44, 46); World Bank (2010, p. 40); Table 4.9 in Chapter 4 of this dissertation

Hiebert et al. (2003) also asserted that the time teachers spent on independent problem segments depended on the challenge level of the problem, how long it took to discuss the problem, or how long they allowed students to solve the problem. (p. 46)

Figure 5.4 above shows that in Japan, on average, there were only 3 independent problems solved in each lesson, much less than in other countries except Indonesia, but the average time used per problem was 15 minutes, much more than in other countries. From the results of the TIMSS 1995 Video Study, Stigler and Hiebert (1999) asserted that "an appropriate motto for Japanese teaching would be 'structured problem solving.'" (p. 27)

5.2.6. The purpose of different lesson segments

> Mathematical problems, together with non-problem segments, can be used by teachers to accomplish different purposes. And different countries might define these purposes in somewhat different ways. (Hiebert et al., 2003, p. 49)

Reviewing, *introducing new content*, and *practicing new content* were defined as the three main purposes of mathematical work segments (see the definitions in Hiebert et al. (2003, pp. 49-50) or in Chapter 4 of this dissertation).

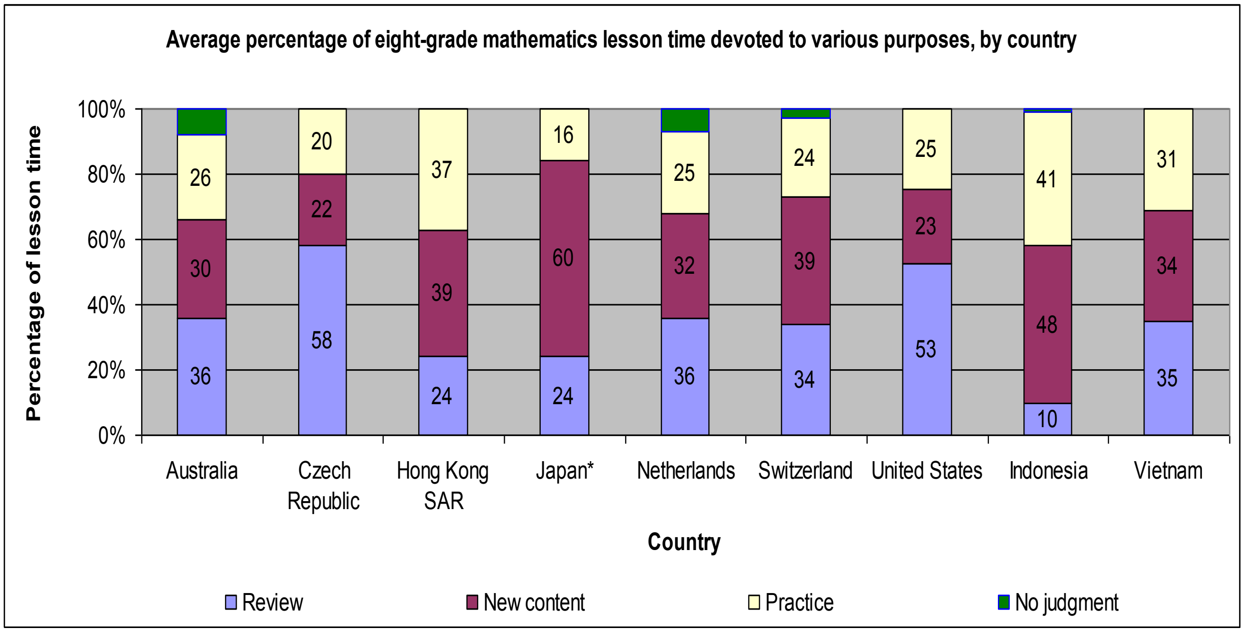
Figure 3.8 in Hiebert et al. (2003, p. 50) displayed the average percentage of lesson time devoted to these three purposes. The percentages in this figure might "not sum to 100 because of rounding," and some lesson segments could not be judged for the purposes when coding (Hiebert et al., 2003, p. 50). The values of the 'reviewing' series were not displayed in this figure. But from Figure 3.8 in Hiebert et al. (2003, p. 50) we estimated these values based on the proportion of the heights of columns to the length of the vertical axis in the chart.

The results of the calculation above were combined with the Indonesian results in Figure 4.11 in World Bank (2010, p. 42), and Figure 4.12 in Chapter 4 of this dissertation to create Figure 5.5 below about the average percentage of eighth-grade mathematics lesson time devoted to those three purposes: reviewing, introducing new content, and practicing new content.

From Figure 5.5, we can see that, on average, Vietnamese lessons devoted nearly the same amount of time to all three purposes of segments (see Table 4.11 in Chapter 4 of this dissertation). Japanese teachers spent a large proportion of lesson time on introducing new content (60% of lesson time), much higher than other colleagues in other countries. Teachers in the Czech Republic and the United States tended to devote a greater proportion of lesson time to reviewing segments (58% and 53%, respectively) than teachers in other countries.

There was a similarity in the proportion of lesson time devoted to all three purposes (even including the *no judgment* segments) between Australia and Netherlands.

Figure 5.5. Average percentage of eighth-grade mathematics lesson time devoted to various purposes, by country



1. Japanese mathematics data were collected in 1995.
2. Indonesian mathematics data were collected in 2007.
3. Vietnamese mathematics data were collected in 2012.
4. Other countries' mathematics data were collected in 1999.
5. The values of *review* series were calculated approximately based on the proportion of the height of columns to the length of the vertical axis in the chart from Figure 3.8 in Hiebert et al. (2003, p. 50)
6. Some segments in the lessons could not be judged on the three purposes, they were coded as "No judgment" in this figure.

Source: Hiebert et al. (2003, p. 50); World Bank (2010, p. 40); Figure 4.12 in Chapter 4 of this dissertation.

Hiebert et al. (2003) asserted that

> Another way to uncover the relative emphasis placed on reviewing, introducing new content, and practicing new content is to check the percentage of lessons in which an activity of each type appeared. Did some lessons, for example, contain no review, or no new content? (p. 51)

Table 5.2 below shows that 100 percent of the lessons in the Czech Republic and Vietnam included at least one review segment.

Table 5.2. Percentage of eighth-grade mathematics lessons with at least one segment of each purpose type, by country

Country	Purpose		
	Reviewing	*Introducing new content*	*Practicing new content*
	Percent		
Australia	89	71	58
Czech Republic	100	75	63
Hong Kong SAR	82	92	81
Japan	73	95	43
Netherlands	65	71	46
Switzerland	75	81	55
United States	94	72	57
Indonesia	60	64	61
Vietnam	100	74	70

1. Japanese mathematics data were collected in 1995.
2. Indonesian mathematics data were collected in 2007.
3. Vietnamese mathematics data were collected in 2012.
4. Other countries' mathematics data were collected in 1999.
5. The percentages in Indonesia and Vietnam were calculated based on the parameter N in Table 4.3 in World Bank (2010, p. 41) and Table 4.11 in Chapter 4 of this dissertation.

Source: Hiebert et al. (2003, p. 51); World Bank (2010, p. 41); Table 4.11 in Chapter 4 of this dissertation

Table 5.2 above was created by combining Table 3.4 in Hiebert et al. (2003, p. 51), Table 4.3 in World Bank (2010, p. 41), and Table 4.11 in Chapter 4 of this dissertation. In Table 4.3 in World Bank (2010, p. 41) and Table 4.11 in Chapter 4 of this dissertation, the percentage of lessons with at least one segment of each purpose type was not shown. But we used the number of lessons in which at least one segment of each purpose type was found (N) to calculate the percentage. It was very easy when we knew that there were 100 videotaped lessons in Indonesia and 27 videotaped lessons in Vietnam.

From Table 5.2 above, we can see that 95 percent of Japanese lessons contained at least one segment for introducing new content, while 36 percent of Indonesian lessons did not contain any segments introducing new content. It is very clear that if one lesson does not introduce any new content, then that lesson does not contain any segments practicing new content, either. So from Table 5.2 we also know the average percentage of lessons that were devoted entirely to reviewing. For example, the average percentage of lessons that were entirely review in Vietnam was 26 percent, while in Japan it was 5 percent.

In some lessons, teachers introduced all of the new content in the lesson before asking the students to practice that new content. In other lessons, teachers asked students to practice new content immediately after teachers introduced it. It means that in some lessons, the teachers shifted the purpose segments more often than in other lessons. The average number of shifts in purpose per lesson can be seen in Table 5.3 below.

Table 5.3. Average number of shifts in purpose per eighth-grade mathematics lesson, by country

Country	Average number of shifts in purpose
Australia	2
Czech Republic	2
Hong Kong SAR	3
Japan	1
Netherlands	1
Switzerland	2
United States	2
Vietnam	3

1. Japanese mathematics data were collected in 1995.
2. Vietnamese mathematics data were collected in 2012.
3. Other countries' mathematics data were collected in 1999.
4. Indonesia did not report on this aspect.

Source: Hiebert et al. (2003, p. 53); Table 4.11 in Chapter 4 of this dissertation

On average, teachers in all countries shifted at least once from one purpose type to another, which means that "lessons in all countries contained activities of at least two different purpose types" (Hiebert et al., 2003, p. 53). On average, teachers in Hong Kong SAR and Vietnam shifted purposes more often (3 times) than teachers in other countries. Indonesia did not report on this aspect so we just compared this aspect among eight countries.

5.2.7. Classroom interaction

After watching some "eighth-grade mathematics lessons in the TIMSS 1999 Video Study sample, the mathematics code development team" defined *five types of classroom interaction* which "were mutually exclusive and exhaustive; each segment of lesson time was classified as a single type" (Hiebert et al., 2003, pp. 53, 54). The definitions of the five types of classroom interaction were presented in Chapter 4 of this dissertation.

Table 5.4 below displays the average percentage of eighth-grade mathematics lesson time devoted to five types of classroom interaction in each country. This table was created by combining Table 3.6 in Hiebert et al. (2003, p. 54) and Table 4.6 in Chapter 4 of this dissertation.

From this table, we can see the differences between Vietnamese videotaped lessons and other countries' lessons. In the videotaped lessons, Vietnamese teachers did not devote much time to *private interaction* (only 2 percent of lesson time) while they devoted much more time to *optional, student presents information* than other countries, except the Czech Republic. Maybe this just happened in the videotaped lessons. But actually, most Vietnamese teachers display the particular habit of assigning the problems to students, they often invite one or more students to solve those problems on the chalkboard, and they ask the other students to solve the same problems at their seats. In this case, we coded these segments as *optional, students presents information* instead of *private interaction*.

Table 5.4. Average percentage of eighth-grade mathematics lesson time devoted to *public interaction*; *private interaction*; *optional, teacher presents information*; and *optional, student presents information*, by country: 1999

Country	*Public interaction*	*Private interaction*	*Optional, student presents*	*Optional, teacher presents*
	Percent			
Australia	52	48	*	*
Czech Republic	61	21	18	*
Hong Kong SAR	75	20	5	*
Japan	63	34	3	*
Netherlands	44	55	*	*
Switzerland	54	44	1	*
United States	67	32	1	*
Vietnam	71	2	20	7

* The information was not displayed in the original source
1. Japanese mathematics data were collected in 1995.
2. Vietnamese mathematics data were collected in 2012.
3. Indonesia did not report on this aspect.

Source: Hiebert et al. (2003, p. 54); Table 4.6 in Chapter 4 of this dissertation

Hiebert et al. (2003) asserted that

> varying the type of interaction provides a way for the teacher to structure the lesson and to emphasize different kinds of experiences. By shifting between interaction types, the teacher can modify the environment and ask students to work on mathematics in different ways. (p. 56)

Table 5.5 below displays the information about the average number of classroom interaction shifts per lesson in each country. We can see from this table that, on average, Japanese and Vietnamese teachers shifted types of classroom interaction more often than other countries' teachers. We also know the average lesson times in Japan (50 minutes) and Vietnam (46 minutes), so we can see that each single classroom interaction segment in Japan and Vietnam lasted, on average, about 6 minutes (see Table 3.1 in Hiebert et al. (2003, p. 37) and Table 4.5 in Chapter 4 of this dissertation).

Table 5.5. Average number of classroom interaction shifts per eighth-grade mathematics lesson, by country

Country	Average number of shifts
Australia	5
Czech Republic	7
Hong Kong SAR	5
Japan [1]	8
Netherlands	3
Switzerland	5
United States	5
Vietnam [2]	8

1. Japanese mathematics data were collected in 1995.
2. Vietnamese mathematics data were collected in 2012.
3. Other countries' mathematics data were collected in 1999.
4. Indonesia did not report on this aspect.

Source: Hiebert et al. (2003, p. 56); Table 4.6 in Chapter 4 of this dissertation

In the Netherlands, on average, the teachers made the fewest shifts, with only 3 shifts, and the length of each classroom interaction segment in the Netherlands was about 14 minutes (Hiebert et al., 2003, p. 56).

5.2.8. Some special segments in the lessons

There were some special segments in the lessons that might influence lesson clarity and flow. Hiebert et al. (2003) called them "pedagogical features" which "seem to highlight the major points of the lesson for the students or, on other hand, might interrupt the flow of the lesson." (p. 59)

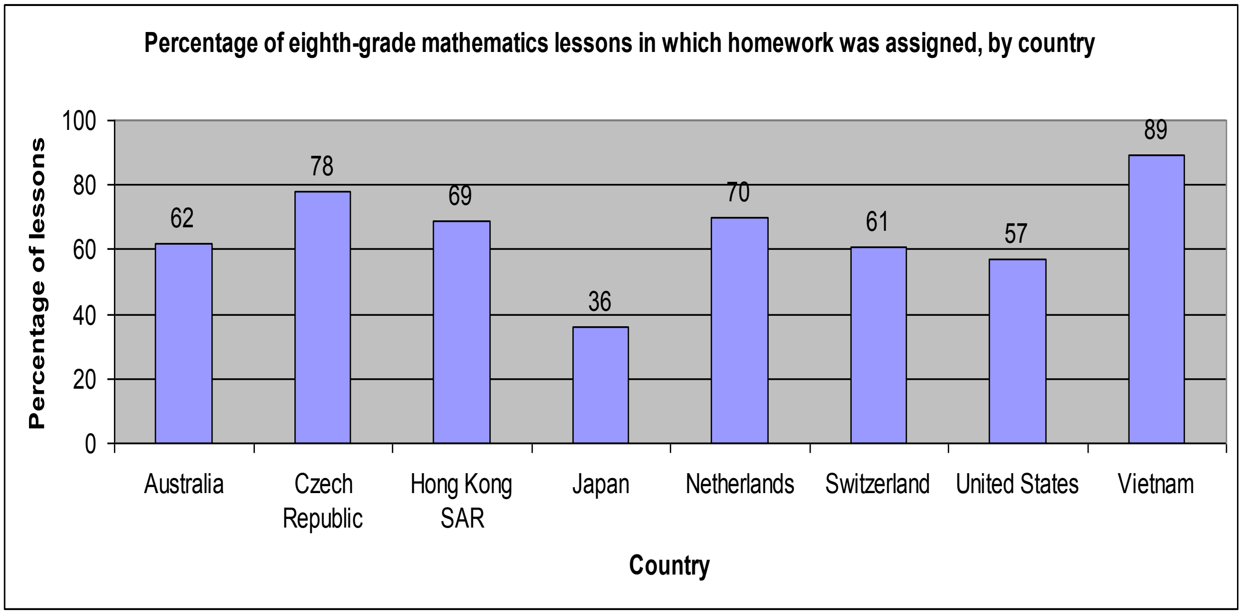
5.2.8.1 Assignment of homework

In our opinion, homework helps students reinforce the learned knowledge in the lesson and prepare the necessary knowledge for the next lesson.

Based on the proportion of the height of columns to the length of the vertical axis in the chart in Figure 3.11 in Hiebert et al. (2003, p. 57), we calculated the approximate percentage of lessons in which homework was assigned in seven countries. This calculation was combined with Figure 4.10 in Chapter 4 of this dissertation to create Figure 5.6 below.

Figure 5.6 below shows that Japanese teachers assigned homework only in 36 percent of lessons, while other countries' teachers assigned homework in at least 57 percent of lessons (see Hiebert et al., 2003, p. 57).

Figure 5.6. Percentage of eighth-grade mathematics lessons in which homework was assigned, by country



1. Japanese mathematics data were collected in 1995.
2. Vietnamese mathematics data were collected in 2012.
3. Other countries' mathematics data were collected in 1999.
4. Indonesia did not report on this aspect
5. Except Vietnam, the percentages in seven countries were calculated approximately based on the proportion of the height of columns to the length of the vertical axis in the chart in Figure 3.11 in Hiebert et al. (2003, p. 57)

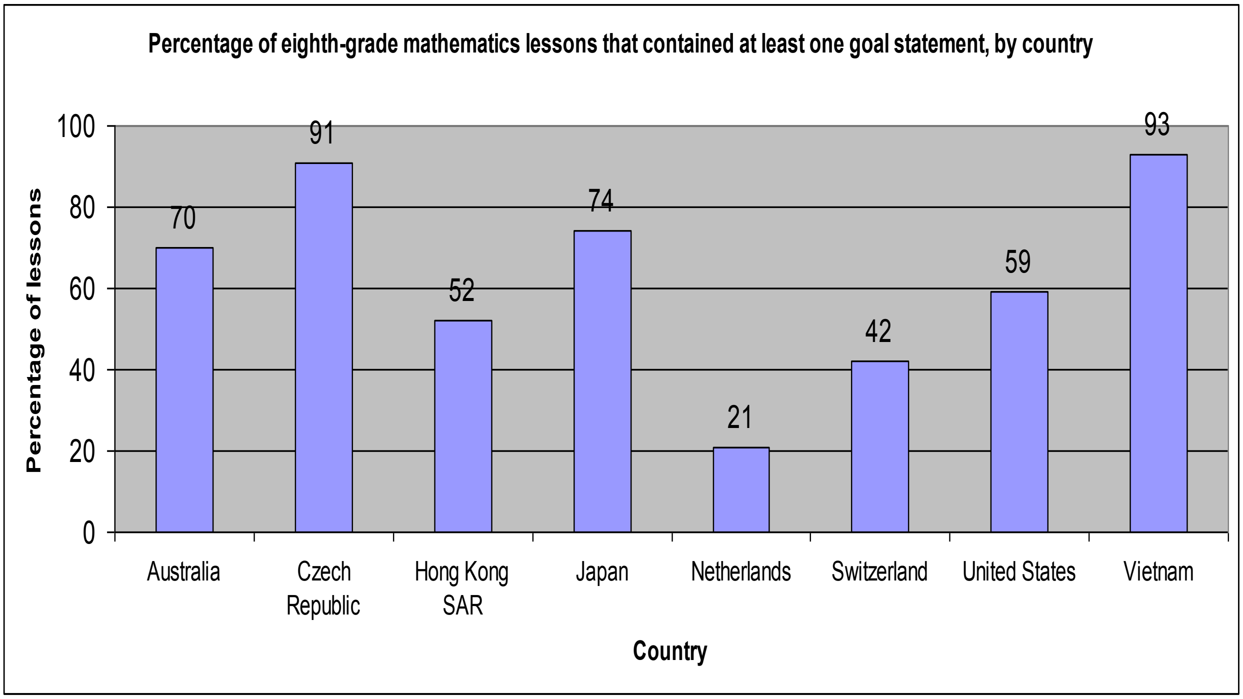
Source: Hiebert et al. (2003, p. 57); Figure 4.10 in Chapter 4 of this dissertation

Vietnamese teachers assigned homework very often (89 percent of lessons in this study, and maybe more in practical teaching). Assigning homework and checking homework often is the way to ask the students to spend more time on mathematics at home that helps students reinforce mathematical knowledge.

5.2.8.2. Goal statements

Goal statement segments were defined in Jacobs et al. (2003, p. 441) and represented in Chapter 4 of this dissertation. The percentage of lessons, in which at least one goal statement was provided, was presented in Figure 5.7 below. In this figure, the percentages in 7 countries (except Vietnam) were calculated approximately based on the proportion of the height of columns to the length of the vertical axis in the chart in Figure 3.12 in Hiebert et al. (2003, p. 60). Figure 5.7 below was created by combining the results of this calculation with Figure 4.10 in Chapter 4 of this dissertation.

Figure 5.7. Percentage of eighth-grade mathematics lessons that contained at least one *goal statement*, by country



1. Japanese mathematics data were collected in 1995.
2. Vietnamese mathematics data were collected in 2012.
3. Other countries' mathematics data were collected in 1999.
4. Indonesian data about this aspect was not found.
5. Except in Vietnam, percentages in other countries were calculated approximately based on the proportion of the height of columns to the length of the vertical axis in the chart in Figure 3.12 in Hiebert et al. (2003, p. 60).

Source: Hiebert et al. (2003, p. 60); Figure 4.10 in Chapter 4 of this dissertation

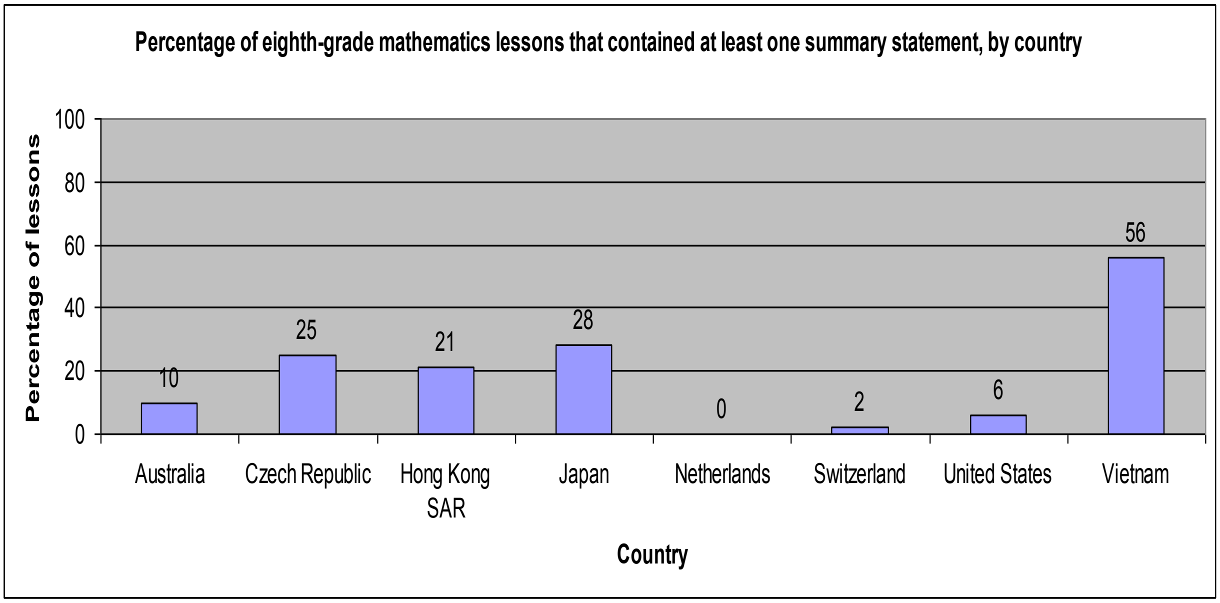
From Figure 5.7, we can see that Vietnamese teachers provided the goal statement in 93 percent of lessons, much more often than other countries' teachers, except teachers in the Czech Republic (91 percent). The goal statements were provided in only 21 percent of lessons in the Netherlands, less than in other countries.

5.2.8.3. Lesson summary statements

Hiebert et al. (2003, p. 60) asserted that a *summary statement*, "that occurred near the end of public portions of the lesson," can "help students recognize the key ideas" that were learned in the lesson.

Figure 5.8 below shows the percentage of lessons in each country that contained at least one summary statement. This figure was created by combining Figure 3.13 in Hiebert et al. (2003, p. 61) with Figure 4.10 in Chapter 4 of this dissertation.

Figure 5.8. Percentage of eighth-grade mathematics lessons that contained at least one summary statement, by country



1. Japanese mathematics data were collected in 1995.
2. Vietnamese mathematics data were collected in 2012.
3. Other countries' mathematics data were collected in 1999.
4. Except in Vietnam, percentages in other countries were calculated approximately based on the proportion of the height of columns to the length of the vertical axis in the chart in Figure 3.13 in Hiebert et al. (2003, p. 61).

Source: Hiebert et al. (2003, p. 61); Figure 4.10 in Chapter 4 of this dissertation

From Figure 5.8, we can see that Vietnamese teachers provided summary statements in 56 percent of lessons, much more often than teachers in other countries.

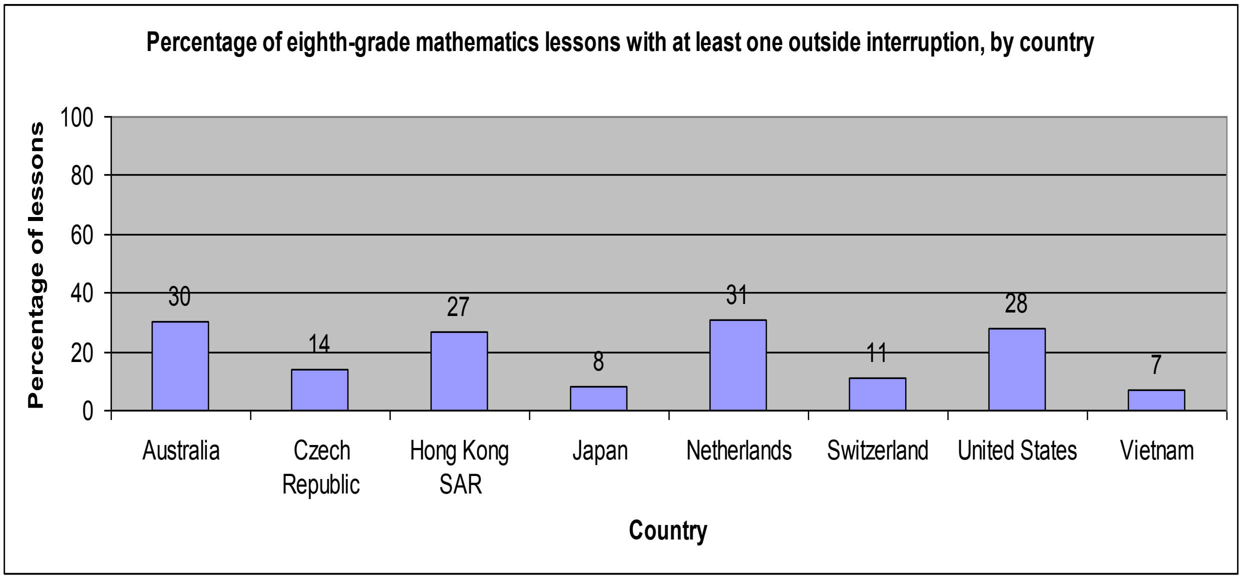
The percentage of lessons that contained at least one summary statement in Australia, Switzerland, and the United States was 10, 2, and 6 percent, respectively. At least 21 percent of lessons in the Czech Republic, Hong Kong SAR, and Japan contained the summary statements. There were "too few cases to be reported" in the Netherlands about this aspect (Hiebert et al., 2003, p. 61).

5.2.8.4. Outside interruptions

"Examples of outside interruptions include announcements over the intercom, individuals from outside the class requiring the teacher's attention, and talking to a student who has arrived late." (Hiebert et al., 2003, p. 61)

Recently, an example of outside interruptions may be the ringing of mobile phones, which happened in some of the Vietnamese lessons videotaped.

Figure 5.9. Percentage of eighth-grade mathematics lessons with at least one *outside interruption*, by country



1. Japanese mathematics data were collected in 1995.
2. Vietnamese mathematics data were collected in 2012.
3. Other countries' mathematics data were collected in 1999.
4. Except in Vietnam, percentages in other countries were calculated approximately based on the proportion of the height of columns to the length of the vertical axis in the chart in Figure 3.14 in Hiebert et al. (2003, p. 62).

Source: Hiebert et al. (2003, p. 62); Figure 4.10 in Chapter 4 of this dissertation

With 7 percent of lessons interrupted, Vietnamese lessons were interrupted much less often than the lessons in Australia, Hong Kong SAR, the Netherlands, and the United States (about 30 percent). The percentage of lessons interrupted in Japan, the Czech Republic, and Switzerland was about the same in Vietnam.

Outside interruptions were restricted as much as possible in Vietnamese lessons.

5.2.9. Images of mathematics teaching in Germany, Japan, the United States, and Vietnam

This section is based heavily on Chapters 3 and 4 in Stigler and Hiebert (1999, pp. 25-72).

After several months of watching and re-watching the videotaped lessons from the TIMSS 1995 Video Study, Stigler and Hiebert (1999) presented the "preliminary descriptions of [mathematics] teaching" in Germany, Japan, and the United States as follows:

> Teachers in Germany are in charge of the mathematics and the mathematics is quite advanced, at least procedurally. In many lessons, teachers lead students through a development of procedures for solving general classes of problems. There is concern for technique, where technique includes both the rationale that underlines the procedure and the precision with which the procedure is executed. A good motto for German teaching would be "developing advanced procedure."
>
> In Japan, teachers appear to take a less active role, allowing their students to invent their own procedures for solving problems. And these problems are quite demanding, both procedurally and conceptually. Teachers, however, carefully design and orchestrate lessons so that students are likely to use procedures that have been developed recently in class. An appropriate motto for Japanese teaching would be "structured problem solving."
>
> In the United States, content is not totally absent, as was portrayed by our colleague, but the level is less advanced and requires much less mathematical reasoning than in the other two countries. Teachers present definitions of terms and demonstrate procedures for solving specific problems. Students are then asked to memorize the definitions and practice the procedures. In the United States, the motto is "learning terms and practicing procedures." (pp. 26-27)

What is the motto for mathematics teaching in Vietnam?

In our point of view, most Vietnamese teachers teach mathematics based exactly on the textbook. Teachers present concepts, theorems, and procedures. After that, teachers and/or students will take some examples of the concepts, prove the theorems, and practice the procedures in the simple situation.

Next, teachers and/or students will use the concepts, theorems, or procedures to solve more difficult problems that require mathematics reasoning and logical, creative, and mathematical thinking.

Vietnamese teachers ask their students to memorize as exactly as possible the concepts, theorems, and procedures during the lesson as well as at home and teachers will check students' memorization in the next lessons.

The procedures mentioned here are understood in a broad sense, that a set of implicit steps used to solve a group of similar problems may be seen as a procedure.

For example, most teachers in Vietnam usually "serve as a model" when solving a new type of problem, then students imitate them to solve similar problems as follows:

Problem: Solve an equation $|2x - 4| = 5 - x$ (*)

Teacher solves this problem following implicit steps at the chalkboard:

- *If* $2x - 4 \geq 0 \Leftrightarrow x \geq 2$ *then* $|2x - 4| = 2x - 4$

So $(*) \Leftrightarrow 2x - 4 = 5 - x \Leftrightarrow 3x = 9 \Leftrightarrow x = 3$ *(satisfying the condition* $x \geq 2$*)*

- *If* $2x - 4 < 0 \Leftrightarrow x < 2$ *then* $|2x - 4| = 4 - 2x$

So $(*) \Leftrightarrow 4 - 2x = 5 - x \Leftrightarrow x = -1$ *(satisfying the condition* $x < 2$*)*

Conclusion: roots of the equation are -1 and 3.

After that, the teacher asks the students to solve a similar equation: $|5x-10| = 2+x$.

Although the teacher may not state explicitly the steps to solve this type of equation, students may imitate these steps to solve similar equations. In this case, we consider the teacher to have presented a new procedure.

From the descriptions of teaching in three countries and the practice of teaching in Vietnam, we think that mathematics teaching in Vietnam is more similar to mathematics teaching in the United States than in Germany and Japan.

In our opinion, the motto for Vietnamese mathematics teaching could be "strict instruction and reproduction".

The "portraits of eighth-grade mathematics lessons" in Germany, Japan, and the United States in 1995 were presented in Stigler and Hiebert (1999, pp. 27-46). In this section, we present the *portrait of eighth-grade mathematics lessons* in Vietnam in 2012.

The lesson described is lesson 4.TH.TT taught by Mrs. Thuong

In Vietnamese lessons, when the teacher came into the classroom, all the students stood up in unison to greet the teacher (without a bow like students in Japan). When hearing the teacher say "sit down, please", all students sat down in unison and prepared for learning.

Checking the homework and reviewing previous lessons (00:15 – 01:45)

Mrs. Thuong: Now, I will check the homework. In the last lesson, we learned about the two cases of similar triangles. So now, one of you compare or relate two cases of similar triangles with the cases of concurrent triangles which you learned in seventh-grade. Who can? Linh, please!

Linh stood up, then Mrs. Thuong and Linh questioned and answered to find the similarities and differences between two cases of similar triangles (side-side-side, side-

angle-side) and three cases of concurrent triangles (side-side-side, side-angle-side, and angle-side-angle).

Mrs. Thuong: we have three cases of concurrent triangles. Let us try to guess whether there is a third case of similar triangles. Yes or no?

Students: Yes

Mrs. Thuong: Ah, today we will learn about the third case of similar triangle and relate this case to the third case of concurrent triangles.

Introducing the new content (01:45 – 12:08)

Mrs. Thuong wrote the title of the new lesson on the chalkboard: "Lesson 47. The third case of similar triangles."

Mrs. Thuong: Before we learn about the third case of similar triangles, you all solve the following problem: "Here are triangle ABC and triangle A'B'C'. Assuming that *angle A = angle A', angle B = angle B'*, prove that triangle ABC and triangle A'B'C' are similar."

Mrs. Thuong reminded students of two cases of similar triangles, and of the procedures used to prove two triangles are similar from the last lesson. Then, Mrs. Thuong and students questioned and answered to solve the problems. After the problem was solved, Mrs. Thuong and students questioned and answered again to understand the theorem deeply.

Mrs. Thuong: We proved two triangles are similar. What is the initial supposition in this problem? Who knows? Nga, please!

Nga (stood up and answered)*: angle A = angle A' and angle B = angle B'*.

Mrs. Thuong: That is right! We just need *A = A' and B = B'* and then we proved what?

Nga: Triangle ABC and triangle A'B'C' are similar.

Mrs. Thuong: That is right! So, from this problem, which conclusion can you generalize?

Nga: If *two angles of one triangle are equal to two angles of other triangle,* then those triangles are similar.

Mrs. Thuong: That is right! Sit down, please!

Mrs. Thuong: From this problem, we can conclude that *if two angles of one triangle are equal to two angles of other triangle respectively* then those two triangles are similar. This is also the theorem of the third case of similar triangles. I call this case "angle-angle".

Mrs. Thuong: One student please state again the theorem in the textbook. **My**, please!

My (stood up and read the theorem from the textbook): *If two angles of one triangle are equal to two angles of another triangle,* then those two triangles are similar.

Mrs. Thuong: That is right! Another student please repeat the theorem. **Dung**, please!

Dung (stood up and read the theorem from the textbook): *If two angles of one triangle are equal to two angles of another triangle,* then those two triangles are similar.

Mrs. Thuong: Sit down, please! Has everyone memorized this?

Students: Yes!

Mrs. Thuong: Please study this theorem in the textbook. You do not need to write the theorem in the notebook. Now, write the supposition and conclusion of this theorem, please! Who can state the supposition and conclusion of this theorem? Thanh, please!

Thanh: Supposition: triangle ABC and triangle A'B'C'; *A = A', B = B'*. Conclusion: Triangle ABC and triangle A'B'C' are similar.

Mrs. Thuong: Sit down, please. So, in the third case of similar triangles, we just need *two angles of a triangle equal to two angles of another triangle* and then they are similar. We already have proved this theorem and the proof is presented in the textbook. Please read the proof in the textbook.

*In this segment, the teacher and students emphasized 9 times the supposition **A = A' and B = B'** in the third case of similar triangles. What the teacher wanted was that the students should memorize the supposition of this case of similar triangles.*

And this continued in the next segments.

Practicing the new content (12:08 – 42:29)

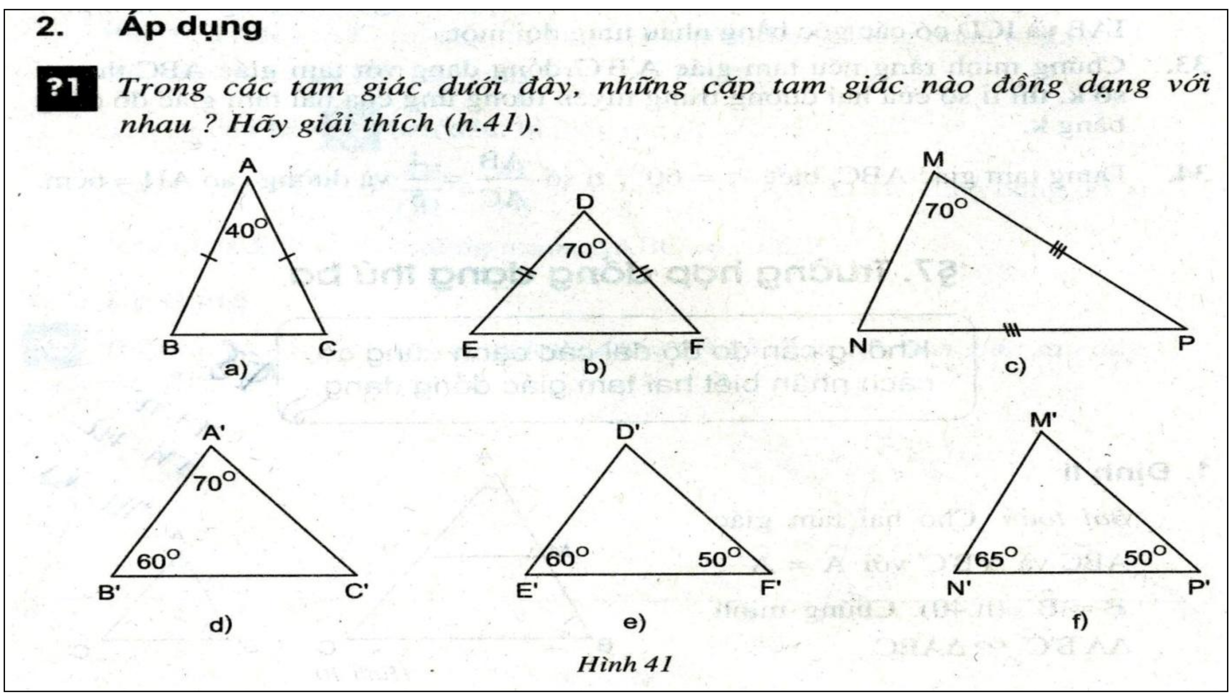
The lesson continued with Section 2 with the heading "application"

Mrs. Thuong: Now, apply this theorem to answer question 2 *(actually question 1)* in the textbook. Question 2: show a pair of similar triangles from the following triangles and explain the answers.

While students solved the problems at their seats, Mrs. Thuong drew 3 isosceles triangles a), b), and c) as shown in Figure 5.10 on the chalkboard. Then, Mrs. Thuong and students questioned and answered to find the pair of similar triangles from the three triangles by calculating other angles of the given triangles. Once again, the theorem ***"if two angles of one triangle are equal to two angles of other triangle then those two triangles are similar"*** *was reiterated.*

Next, Mrs. Thuong drew three other triangles d), e), and f) in Figure 5.10 on the chalkboard.

Figure 5.10. Question 1 in the textbook: Show a pair of similar triangles from the following triangles and explain the answers



Source: Phan Duc Chinh et al. (2010, p. 78)

Then, Mrs. Thuong and students questioned and answered to find the pair of similar triangles also by calculating the other angles of the given triangles. Question 1 seemed easy for most students.

Next, Mrs. Thuong asked students to solve Question 2 in the textbook. Question 2 was more challenging than Question 1. Mrs. Thuong read aloud Question 2 from the textbook and drew Figure 42 on the chalkboard.

Figure 5.11. Question 2 in the textbook:

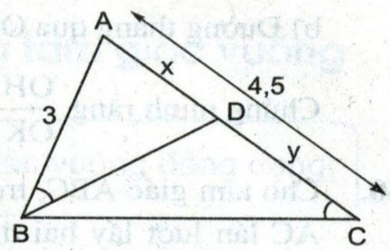
Figure 42 shows that AB = 3 cm, AC = 4.5 cm, and angle ABD = angle BCA.
a, How many triangles are in this figure? Is there any pair of similar triangles?
b, Calculate the length of x and y (AD = x, DC = y)
c, Know that BD is the bisector of triangle ABC. Calculate the length of BC and BD.

?2 *Ở hình 42 cho biết AB = 3cm ; AC = 4,5cm và $\widehat{ABD} = \widehat{BCA}$.*

a) Trong hình vẽ này có bao nhiêu tam giác ? Có cặp tam giác nào đồng dạng với nhau không ?

b) Hãy tính các độ dài x và y (AD = x, DC = y).

c) Cho biết thêm BD là tia phân giác của góc B. Hãy tính độ dài các đoạn thẳng BC và BD.



Hình 42

Source: Phan Duc Chinh et al. (2010, p. 79)

While students solved the problems at their seat, Mrs. Thuong invited one student to solve the problem at the chalkboard. Then, Mrs. Thuong and students discussed to find the correct solution for solving the problem.

Next, Mrs. Thuong asked students to solve Exercise 35 in the textbook. Mrs. Thuong asked a student (Huy) to present the task of Exercise 35.

Huy: Prove that if triangle A'B'C' is similar to triangle ABC with a ratio of similitude k, then the ratio of the two corresponding bisectors also equals k.

While Mrs. Thuong and students discussed to find the solution for Exercise 35, everyone heard the drumbeat signaling that the lesson time was over. Mrs. Thuong assigned Exercise 35 and other exercises as the homework.

Assigning homework

Mrs. Thuong: Please solve Exercises 36 and 37 in the textbook at home. Remember that you have to study carefully the three cases of similar triangles. Time is over, we stop here.

All students stood up to greet the teacher again.

It is interesting that there are three other videos in which the teachers taught the same mathematical content with the lesson we described above. We did not intend for this to happen. We should consider whether there are any differences and similarities between those lessons.

We must say that the four videos were taped in four different towns and districts. Those were 2.TH.HL in Hau Loc district, 4.TH.TT in Thach Thanh district, 7.TH.QX in Quang Xuong district, and 21.SS.TS in Sam Son town.

These towns and districts are far away from each other, and the teachers in these lessons did not know each other.

From watching the four videos, we found that

- ❖ Three teachers gave students grades after checking the homework.
- ❖ Two teachers related three cases of similar triangles to three cases of concurrent triangles.
- ❖ All four teachers asked students to present the two cases of similar triangles which had been learned in previous lessons.
- ❖ All teachers used the same problems and questions in the textbook to teach.
- ❖ All four teachers taught in order: checking the homework (and giving students grades), introducing the theorem and proving the theorem, applying the theorem to solve simple problems, applying the theorem to solve more difficult problems, summarizing the lesson and assigning the homework.

What are the differences?

- ❖ Only the teacher in video 2.TT.HL asked students to find another way to calculate the length of BC and BD.
- ❖ While teachers in videos 2.TH.HL, 4.TH.TT, and 21.SS.TS assigned Question 2 in the textbook as concurrent problems (assigning these problems at the same time), the teacher in video 7.TH.QX assigned this question as three independent problems. This made for different learning experiences.

For more detail, we should take another look at the coding of these videos.

Purposes of different segments

Table 5.6. The purpose codes of different segments in 4 lessons

	Beginning	End	Time	Percent
2.TH.HL				
P1	0:00:16	0:05:16	0:05:00	10
P2	0:05:16	0:21:41	0:16:25	34
P3	0:21:41	0:48:25	0:26:44	56
			0:48:09	
4. TH.TT				
P1	0:00:15	0:01:45	0:01:30	4
P2	0:01:45	0:12:08	0:10:23	25
P3	0:12:08	0:42:29	0:30:21	72
			0:42:14	
7. TH.QX				
P1	0:00:32	0:04:30	0:03:58	7
P2	0:04:30	0:19:35	0:15:05	27
P3	0:19:35	0:55:23	0:35:48	65
			0:54:51	
21. SS.TS				
P1	0:00:29	0:07:17	0:06:48	15
P2	0:07:17	0:18:13	0:10:56	24
P3	0:18:13	0:45:48	0:27:35	61
			0:45:19	

From Table 5.6, we can see that all 4 teachers shifted purposes 2 times, from reviewing (P1) to introducing new content (P2) and then to practicing new content (P3) with an increase in the percentage of time. We can conclude that the 4 teachers shared the same pattern of segment purposes when teaching the same mathematical content.

Pattern of classroom interaction

Table 5.7. The codes for *patterns of classroom interaction* in 4 lessons

	Beginning	End	Time
2. TH.HL			
CI 1	0:00:16	0:01:45	0:01:29
CI 3	0:01:45	0:04:16	0:02:31
CI 1	0:04:16	0:08:36	0:04:20
CI 5	0:08:36	0:09:56	0:01:20
CI 2	0:09:56	0:11:41	0:01:45
CI 3	0:11:41	0:14:51	0:03:10
CI 1	0:14:51	0:18:27	0:03:36
CI 2	0:18:27	0:19:53	0:01:26
CI 1	0:19:53	0:24:28	0:04:35
CI 3	0:24:28	0:29:27	0:04:59

CI 1	0:29:27	0:37:25	0:07:58
CI 5	0:37:25	0:38:38	0:01:13
CI 2	0:38:38	0:41:49	0:03:11
CI 3	0:41:49	0:44:15	0:02:26
CI 2	0:44:15	0:48:13	0:03:58
CI 1	0:48:13	0:48:25	0:00:12
			0:48:09
4. TH.TT			
CI 1	0:00:15	0:12:12	0:11:57
CI 2	0:12:12	0:14:53	0:02:41
CI 1	0:14:53	0:20:51	0:05:58
CI 2	0:20:51	0:22:54	0:02:03
CI 1	0:22:54	0:27:11	0:04:17
CI 5	0:27:11	0:29:08	0:01:57
CI 3	0:29:08	0:33:41	0:04:33
CI 1	0:33:41	0:38:17	0:04:36
CI 5	0:38:17	0:40:18	0:02:01
CI 2	0:40:18	0:41:27	0:01:09
CI 1	0:41:27	0:42:29	0:01:02
			0:42:14
7. TH.QX			
CI 1	0:00:32	0:02:00	0:01:28
CI 3	0:02:00	0:03:02	0:01:02
CI 1	0:03:02	0:06:29	0:03:27
CI 2	0:06:29	0:09:29	0:03:00
CI 1	0:09:29	0:10:39	0:01:10
CI 3	0:10:39	0:16:17	0:05:38
CI 1	0:16:17	0:32:49	0:16:32
CI 3	0:32:49	0:34:15	0:01:26
CI 2	0:34:15	0:35:16	0:01:01
CI 3	0:35:16	0:37:05	0:01:49
CI 1	0:37:05	0:38:22	0:01:17
CI 2	0:38:22	0:40:05	0:01:43
CI 3	0:40:05	0:43:38	0:03:33
CI 1	0:43:38	0:47:03	0:03:25
CI 2	0:47:03	0:49:49	0:02:46
CI 1	0:49:49	0:52:42	0:02:53
CI 3	0:52:42	0:54:40	0:01:58
CI 1	0:54:40	0:55:23	0:00:43
			0:54:51
21. SS.TS			
CI 1	0:00:29	0:01:02	0:00:33
CI 3	0:01:02	0:06:57	0:05:55
CI 1	0:06:57	0:12:33	0:05:36
CI 3	0:12:33	0:15:51	0:03:18

CI 1	0:15:51	0:24:14	0:08:23
CI 3	0:24:14	0:33:14	0:09:00
CI 1	0:33:14	0:35:47	0:02:33
CI 2	0:35:47	0:38:53	0:03:06
CI 1	0:38:53	0:42:01	0:03:08
CI 3	0:42:01	0:45:11	0:03:10
CI 1	0:45:11	0:45:48	0:00:37
			0:45:19

From Table 5.7, we can see that the 4 teachers shifted a lot in terms of classroom interaction (from 10 times to 17 times, see Table 5.8 below). They devoted a lot of time to public interaction (mainly teacher lectured), and 'optional, teacher presents.' They devoted little time to private interaction (CI 5). They preferred to devote more time to 'optional, student presents' (CI3) when they assigned the problems to the students.

Table 5.8. Percentage of lesson time devoted to *classroom interaction* and number of shifts in 4 lessons

Lesson	CI 1	CI 2	CI 3	CI 4	CI 5	Nr of shifts
2. TH.HL	46	21	27	0	5	15
4. TH.TT	66	14	11	0	9	10
7. TH.QX	56	15	28	0	0	17
21. SS.TS	46	7	47	0	0	10

Content activity

Table 5.9. The *content activity* codes in 4 lessons

	Beginning	End	Time	Percent
2. TH.HL				
NP	0:00:16	0:01:13	0:00:57	2
IP1	0:01:13	0:04:58	0:03:45	8
NP	0:04:58	0:08:18	0:03:20	7
IP2	0:08:18	0:17:35	0:09:17	19
NP	0:17:35	0:21:45	0:04:10	9
IP3	0:21:45	0:36:27	0:14:42	31
CPSU	0:36:27	0:37:25	0:00:58	2
SPSW	0:37:25	0:38:40	0:01:15	3
CPCW	0:38:40	0:41:49	0:03:09	7
CPSW	0:41:49	0:44:15	0:02:26	5
CPCW	0:44:15	0:48:14	0:03:59	8
NP	0:48:14	0:48:25	0:00:11	0
			0:48:09	
4. TH. TT				
NP	0:00:15	0:02:56	0:02:41	6

IP1	0:02:56	0:08:13	0:05:17	13
NP	0:08:13	0:12:08	0:03:55	9
IP2	0:12:08	0:20:36	0:08:28	20
CPSU	0:20:36	0:20:56	0:00:20	1
SCPSW	0:20:56	0:23:02	0:02:06	5
CPCW	0:23:02	0:27:11	0:04:09	10
CPSW	0:27:11	0:33:41	0:06:30	15
CPCW	0:33:41	0:37:20	0:03:39	9
NP	0:37:20	0:38:17	0:00:57	2
IP3	0:38:17	0:42:16	0:03:59	9
NP	0:42:16	0:42:29	0:00:13	1
			0:42:14	
7. TH.QX				
NP	0:00:32	0:05:29	0:04:57	9
IP1	0:05:29	0:17:44	0:12:15	22
NP	0:17:44	0:22:19	0:04:35	8
IP2	0:22:19	0:30:09	0:07:50	14
IP3	0:30:09	0:34:24	0:04:15	8
IP4	0:34:24	0:38:11	0:03:47	7
IP5	0:38:11	0:45:19	0:07:08	13
NP	0:45:19	0:47:01	0:01:42	3
IP6	0:47:01	0:51:34	0:04:33	8
NP	0:51:34	0:55:23	0:03:49	7
			0:54:51	
21. SS.TS				
NP	0:00:29	0:01:02	0:00:33	1
IP1	0:01:02	0:07:01	0:05:59	13
NP	0:07:01	0:08:22	0:01:21	3
IP2	0:08:22	0:17:04	0:08:42	19
NP	0:17:04	0:18:37	0:01:33	3
IP3	0:18:37	0:21:38	0:03:01	7
NP	0:21:38	0:21:58	0:00:20	1
CPSU	0:21:58	0:23:58	0:02:00	4
CPSW	0:23:58	0:33:14	0:09:16	20
CPCW	0:33:14	0:34:51	0:01:37	4
NP	0:34:51	0:35:47	0:00:56	2
IP4	0:35:47	0:45:17	0:09:30	21
NP	0:45:17	0:45:48	0:00:31	1
			0:45:19	

Table 5.9 above shows the content activity codes in 4 lessons. There is a difference among the 4 lessons. While teachers in videos 2.TH.HL, 4.TH.TT, and 21.SS.TS assigned Question 2 in the textbook as part of concurrent problems (assigning these problems at the same time), the teacher in video 7.TH.QX assigned this question as part of three independent problems. This made for different learning experiences.

Teachers assigned 6 problems (except 21.SS.TS, 7 problems) in the lesson. At least 6 problems were the same in all lessons.

Between two problem segments were non-problem segments. And the way in which content activities were organized looked much the same.

5.2.10. Patterns of mathematics teaching in Germany, Japan, the United States, and Vietnam

Stigler and Hiebert (1999) asserted that

> The systems of teaching within each country look similar from lesson to lesson. At least, there are certain recurring features that typify many lessons within a country and distinguish the lessons among countries. These recurring features, or *patterns*, define parts of a lesson and the way the parts are sequenced. (pp. 77-78)

By watching the videotaped lessons from the TIMSS 1995 Video Study, Stigler and Hiebert (1999) found the "patterns of [mathematics] teaching" in Germany, Japan, and the United States as follows:

❖ The German pattern: German lessons are usually taught "through a sequence of four activities": "reviewing previous material"; "presenting the topic and the problems for the day"; "developing the procedures to solve the problem"; and "practicing", in which the second and third activities may be cycled through twice or even three times in some lessons.

❖ The Japanese pattern: Japanese lessons often take place through "a sequence of five activities": "reviewing the previous lesson"; "presenting the problem for the day"; "students working individually or in groups"; "discussing solution methods"; and "highlighting and summarizing the major points", in which, except the first activity, other activities may be cycled through several times in one lesson.

❖ The U.S. pattern: U.S. lessons are usually taught through a sequence of four activities: "reviewing previous material"; "demonstrating how to solve problems for the day"; "practicing"; "correcting seatwork and assigning homework", in which the second, third, and fourth activities may be cycled through many times in one lesson. (pp. 78-81)

Vietnamese pattern of mathematics teaching

After watching 27 videotaped lessons over and over again, we found that Vietnamese lessons may be classified into two types of lessons. The first type may be called the "theory lesson," in which at least one new mathematical concept, theorem, or procedure is introduced in the lesson. The second type may be called the "practice lesson," in which students apply all of previously learned knowledge to solve similar problems. If there is any "new" problem in the lesson that students need the teacher to "serve as a model" to solve, students then imitate the model to solve similar problems, and this lesson is classified as a "theory lesson" in which a new "procedure" is introduced. With this categorization, we can describe the pattern of teaching in two types of lessons in Vietnam as outlined below.

"Theory lessons" usually follow a sequence of five activities.

❖ *Checking the homework, giving students grades, and reviewing the previous lessons*: The teacher usually calls one or more students standing in front of the class to answer the questions about the previous lessons (usually the last lesson) in verbal form, or to solve the problems, which were assigned as homework, at the chalkboard in written form. When students finish, the teacher gives students grades from 0 to 10. After that, the teacher can review the previous lessons.

❖ *Introducing the new content*: The new content may be the concepts, theorems (with the proofs), and procedures (to solve some typical kinds of problems).

❖ *Making students memorize the new content by telling them over and over again, or applying them to solving the simple problems*: In this segment, the teacher asks some students to re-read the definitions of concepts, theorems, and procedures from the textbook. The teacher emphasizes the things students should memorize. Then, the teacher asks students to solve some simple problems which require students to apply the new content to solve. For example, in lesson 4.TH.TT described above, after introducing the new theorem, the teacher and students emphasized 9 times the supposition "**A = A' and B = B'**" in the third case of similar triangles by repeating it over and over again.

❖ *Asking students to apply the new content to solve the challenge problems*: In this segment, the teacher asks students to solve more challenging problems which require students to apply the new content and previously learned content to solve. Students must use mathematical, logical thinking or mathematical reasoning to solve the problems.

❖ *Summarizing the lesson and assigning the homework*: The teacher briefly presents the main points of lesson, emphasizing the points which students should memorize. Then the teacher assigns some problems as homework.

Activities two through four can be cycled through many times in one lesson. It depends on how much new content is introduced in that lesson.

The "practice lessons" usually follow a sequence of five activities.

❖ *Checking the homework, giving students grades, and reviewing the previous lessons*: This segment is the same as in the "theory lessons" but may last longer.

❖ *Assigning new problems*: The teacher writes the new problems on the chalkboard, distributes the worksheet to students, or asks students to solve problems in the textbook. The teacher devotes a given amount of time to private interaction, in which all students solve the problems at their seats.

❖ *Inviting one or more students to go to the chalkboard to solve the problems*: In this segment, other students continue to solve problems at their seats, or watch students at the chalkboard. In some cases, the teacher just asks one student to stand up and present the key, and the teacher helps that student to write the key on the chalkboard. The importance in this segment is that the students' keys are on the chalkboard for the next activities.

❖ *Checking the students' keys on the chalkboard*: The teacher asks all students to pay attention to the chalkboard to check the keys. Then teacher and students will discuss, find the mistakes and correct the keys.

❖ *Assigning the homework*: The teacher usually uses the textbook or worksheets or writes the problems on the chalkboard to assign the homework.

Activities two through four can be cycled through many times in one lesson. It depends on how many problems are assigned in that lesson.

The Vietnamese pattern of teaching is somewhat different from the three countries' patterns presented above.

5.2.11. The lesson signature in eight countries

From "a wide-angle" view, Hiebert et al. (2003) said that "the eighth-grade mathematics lessons across the seven countries shared some general features" (p. 120). Comparing them with our video study, we saw that Vietnamese eighth-grade mathematics lessons also shared some general features with the seven countries above. For example, "at least 90 percent of lessons" in which Vietnamese teachers used a textbook or worksheet as in the seven countries (see Table 5.6 in Hiebert et al., 2003, p. 114; and Figure 4.11 in Chapter 4 of this dissertation), and Vietnamese lessons also included reviewing and introducing new content segments, as well as practicing new content segments (see Figure 5.5 and Table 5.2 in this chapter and Hiebert et al., 2003, p. 120).

Of course, besides the similarities, teaching mathematics in Vietnam has some differences from these seven countries. For example, on average, lessons in those seven countries devoted at least 20 percent of lesson time to private interaction, while

Vietnamese lessons devoted only, on average, 2 percent of lesson time to private interaction (see Table 5.4 in this chapter). Vietnamese teachers devoted a greater proportion of lesson time to 'optional, student presents information' than teachers in other countries, except the Czech Republic (see Table 5.4 in this chapter).

The *lesson signatures* in the eight countries reveal the similarities and differences in eighth-grade mathematics teaching across countries. The lesson signatures in Australia, the Czech Republic, Hong Kong SAR, Japan, the Netherlands, Switzerland, and the United States were presented in Hiebert et al. (2003, pp. 123-146). We compared these lesson signatures with the Vietnamese lesson signature presented in Chapter 4 of this dissertation.

In this section, we focus on the eighth-grade mathematics lesson signatures in three countries: Japan (1995), the United States (1999), and Vietnam (2012).

Figures 5.12, 5.13, and 5.14 below represent the lesson signatures in Japan, the United States, and Vietnam, respectively.

From these lesson signatures, we can see the differences in the variables 'introducing new content,' 'reviewing,' and 'optional, student presents information.'

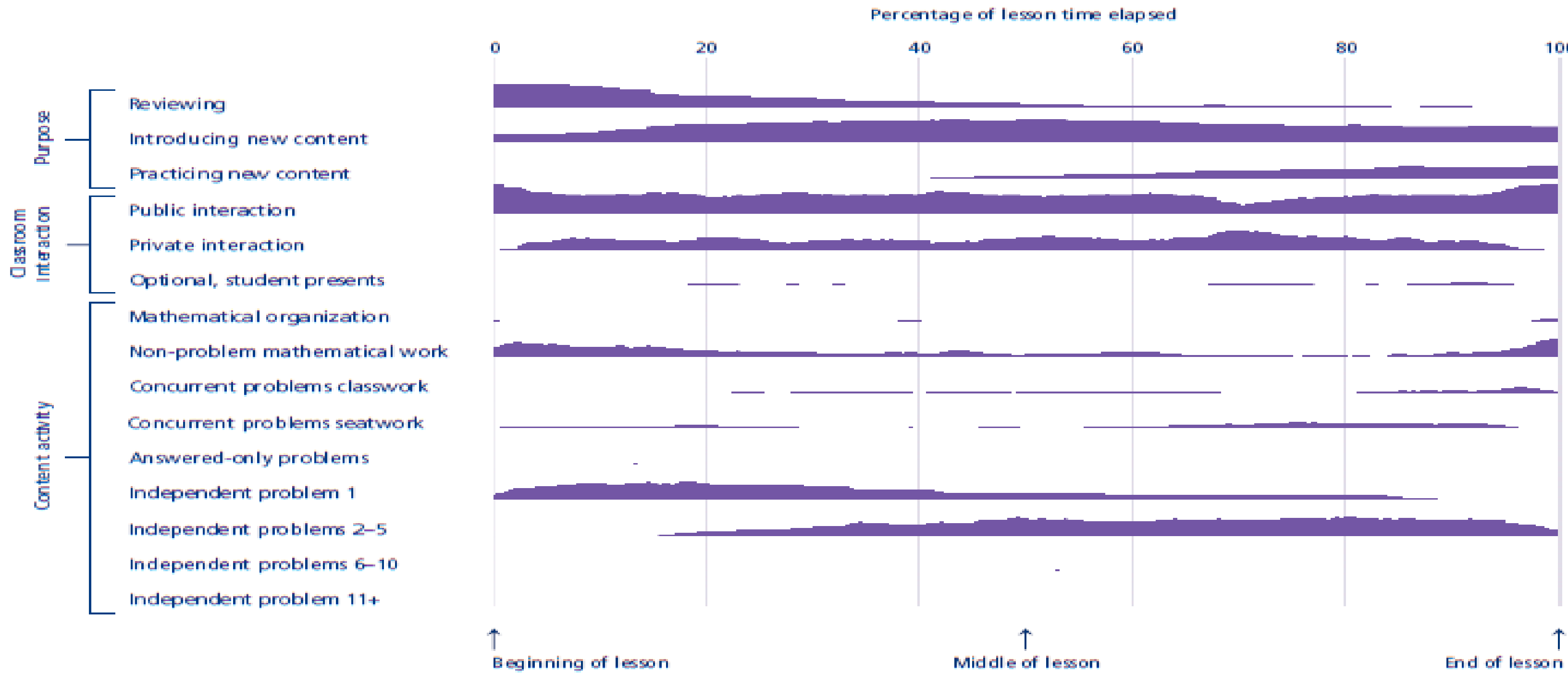
It is easier to identify the variable 'introducing new content' in the Japanese lesson signature than in that of other countries. This means that Japanese teachers emphasize 'introducing new content' more than teachers in other countries. This was also represented in Figure 5.5 in this chapter.

Comparing the lesson signatures in the three countries below, we identify the variable 'reviewing' in the U.S. lesson signature more easily than in other countries' lesson signatures. It means that U.S. teachers emphasize reviewing more than teachers in other countries. Figure 5.5 in this chapter also supports this observation.

By comparing the lesson signature in three countries, we can see that Vietnamese teachers emphasize 'optional, student presents information' more than teachers in other countries. This is because the variable 'optional, student presents information' can be identified more easily in the Vietnamese lesson signature than in other countries' lesson signatures. Table 5.4 in this chapter supports this conclusion.

Figure 5.12. ***Japanese eighth-grade mathematics lesson signature*****: 1995**

FIGURE 6.4. Japanese eighth-grade mathematics lesson signature: 1995



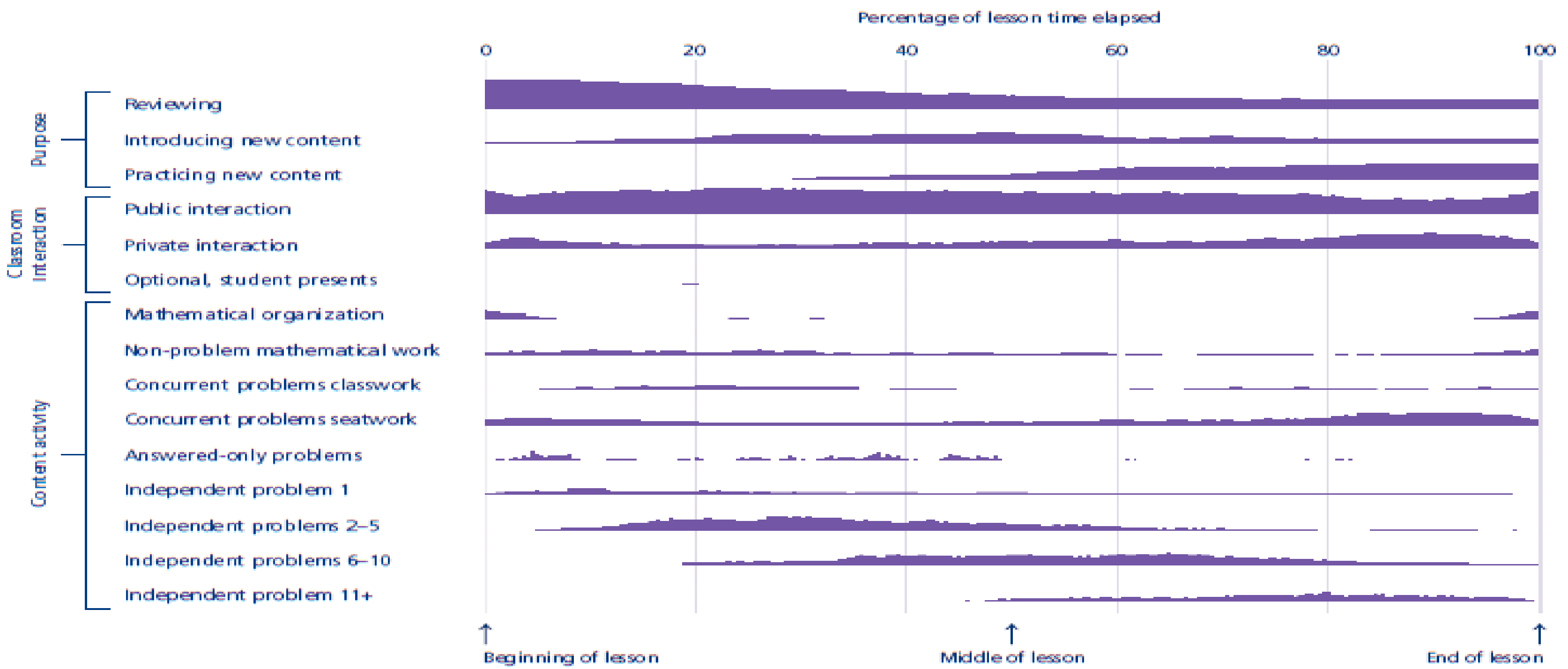
NOTE: The graph represents both the frequency of occurrence of a feature and the elapsing of time throughout a lesson. For each feature listed along the left side of the graph, the histogram (or bar) represents the percentage of eighth-grade mathematics lessons that exhibited the feature—the thicker the histogram, the larger the percentage of lessons that exhibited the feature. From left to right, the percentage of elapsed time in a lesson is marked along the bottom of the graph. The histogram increases by one pixel (or printable dot) for every 5 percent of lessons marked for a feature at any given moment during the lesson time, and disappears when fewer than 5 percent of lessons were marked (due to technological limitations). By following each histogram from left to right, one can get an idea of the percentage of lessons that included the feature as lesson time elapsed. A listing of the percentage of lessons that included each feature by the elapsing of time is included in appendix F. To create each histogram, each lesson was divided into 250 segments, each representing 0.4 percent of lesson time. The codes applied to each lesson at the start of each segment were tabulated, using weighted data, and reported as the percentage of lessons exhibiting each feature at particular moments in time.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study (TIMSS), Video Study, 1999.

Source: Hiebert et al. (2003, p. 137)

Figure 5.13. *U.S. eighth-grade mathematics lesson signature*: 1999

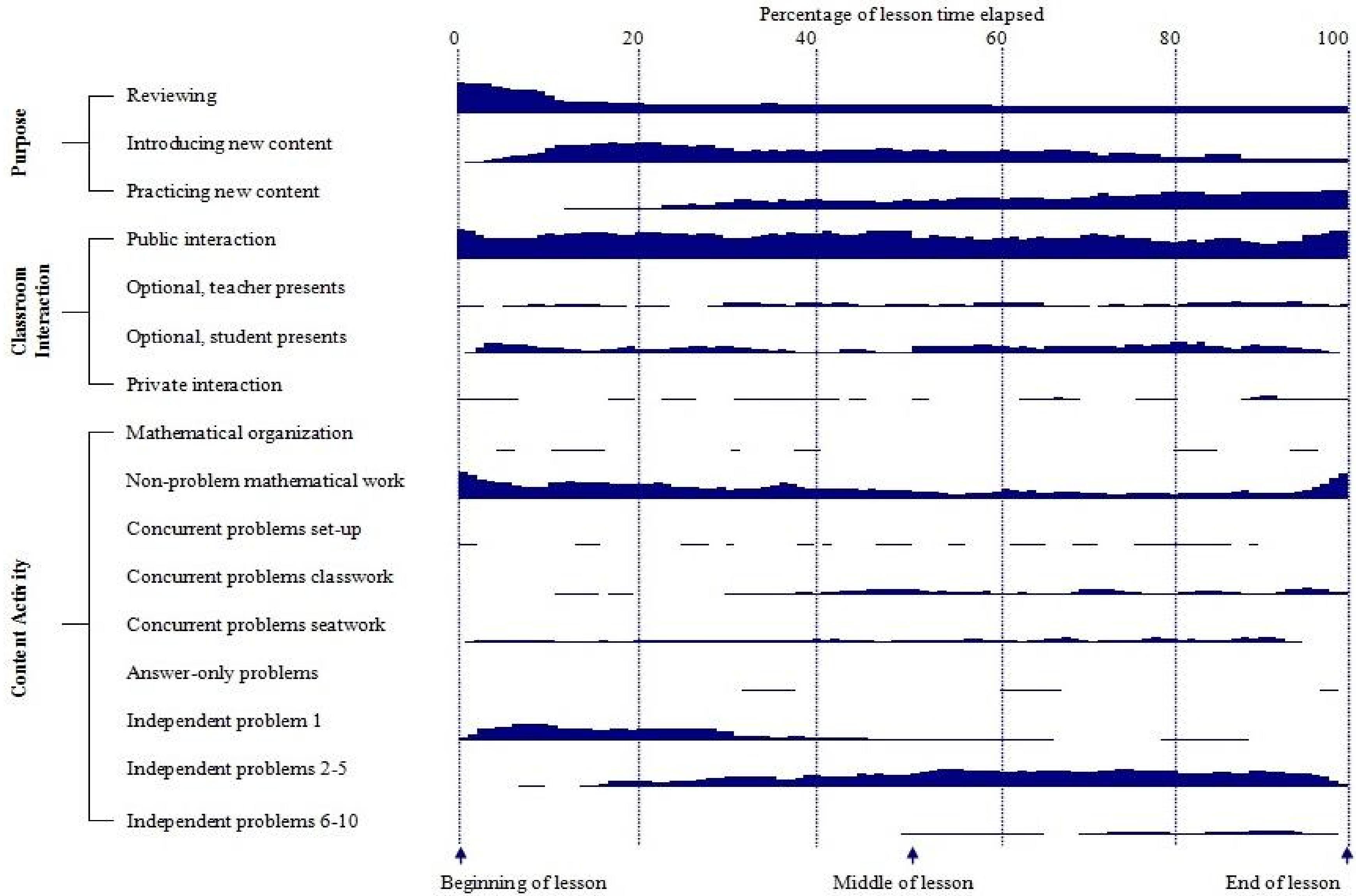
FIGURE 6.7. U.S. eighth-grade mathematics lesson signature: 1999



NOTE: The graph represents both the frequency of occurrence of a feature and the elapsing of time throughout a lesson. For each feature listed along the left side of the graph, the histogram (or bar) represents the percentage of eighth-grade mathematics lessons that exhibited the feature—the thicker the histogram, the larger the percentage of lessons that exhibited the feature. From left to right, the percentage of elapsed time in a lesson is marked along the bottom of the graph. The histogram increases by one pixel (or printable dot) for every 5 percent of lessons marked for a feature at any given moment during the lesson time, and disappears when fewer than 5 percent of lessons were marked (due to technological limitations). By following each histogram from left to right, one can get an idea of the percentage of lessons that included the feature as lesson time elapsed. A listing of the percentage of lessons that included each feature by the elapsing of time is included in appendix F. To create each histogram, each lesson was divided into 250 segments, each representing 0.4 percent of lesson time. The codes applied to each lesson at the start of each segment were tabulated, using weighted data, and reported as the percentage of lessons exhibiting each feature at particular moments in time.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study (TIMSS), Video Study, 1999.

Source: Hiebert et al. (2003, p. 146)

Figure 5.14. ***Vietnamese eighth-grade mathematics lesson signature***



5.3. Summary

In this chapter, we briefly introduced the TIMSS 2007 and 2011 Video Studies in Indonesia in Section 1. In Section 2, we compared some aspects of eighth-grade mathematics teaching in Vietnam and those in other countries participating in the TIMSS 1995 and 1999 Video Studies.

We also depicted the image and pattern of mathematics teaching in Vietnam. We compared this image, pattern and lesson signature in Chapter 4 to the same aspects in eight other countries, including Germany, Japan (participated in TIMSS 1995 Video study), 5 other countries participating in the TIMSS 1999 Video Study, and Vietnam.

CHAPTER 6

THE DEMANDS AND CHALLENGES OF INNOVATING MATHEMATICS TEACHING METHODS IN VIETNAM – LESSONS FROM THE VIDEO STUDIES

From the results of the TIMSS Video Studies and the video study in Vietnam, this chapter will present the demands and challenges of innovating mathematics teaching methods in Vietnam. Another purpose of this chapter is to introduce the viewpoints of other authors about improving teaching and innovating teaching methods.

6.1. The demands and orientation of innovating mathematics teaching methods in Vietnam

Bates and Plog (1990) asserted that "every society is in a state of flux or change, and what will emerge in the future must have ties to the present." (p. 431)

Teaching is an indispensable aspect of every society, so teaching is also *in a state of flux or change*. However, "sometimes the rate of change is so slow that people are hardly aware that it is occurring" (Bates and Plog, 1990, p. 431). It is similar to living with children while they grow up every day. We do not notice their growth until we see their old pictures.

If we look back on teaching of the past, we will see a lot of changes. The changes may come from the *artifacts level* of teaching that we can immediately feel, such as teaching vehicles, the blackboard, material facilities, the clothing of students and teachers, and so on. The changes may come from the *espoused value level* of teaching, such as the content taught which is stipulated in the curriculum and the textbook, the rules and rituals in the school, and so on. The changes may come from the *basic underlying assumptions level* of teaching: For example, in the feudal society, the students always obeyed the teacher. The teacher was always right. The students did not raise objections in the classrooms. The students could be punished with a rod. These things were taken for the granted in teaching in feudal society, but they have been changed today (see the three levels of culture in Schein (1997, p. 17)).

If we do not intervene in the changes taking place in teaching, it still changes automatically along with the changes in the society. But these changes may not be considered beneficial. So the researchers should study the present society to predict the future of teaching.

Although Hofstede (2001) wrote that

> it is an unanswered question to what extent an education system can contribute to changing a society. Can a school create values that are not already there, or can it only unwittingly reinforce what already exists in a given society? (p. 100)

But we believe that we can intervene to improve teaching so that teaching can keep pace with the changes in society, and teaching can effectively influence societal changes. For these reasons, researchers must carefully study teaching as well as society to improve teaching, or in particular, to improve mathematics teaching.

By likening *teaching methods* to *genes* and *teachers* to *individual organisms* in biological evolution, Stigler and Hiebert (1999) believed that if we want to improve teaching over the long term, we must develop effective *teaching methods* instead of just recruiting talented teachers (pp. 133-134). They explained that

> Individuals are short-lived by evolutionary standards; they don't last long enough to undergo the slow process of evolutionary change. Genes, in contrast, persist over hundreds and thousands of generations. Teaching, similarly, persists, while teachers come and go. (p. 134)

So, innovating teaching methods is a common demand in most subjects in most countries all over the world. This dissertation just focuses on the demand for innovating mathematics teaching methods in Vietnam.

According to Nguyen Ba Kim (2011), recently, there have been some common weaknesses in methods of teaching and learning in Vietnam such as the following complaints: the teacher lectured most of the lesson time; knowledge was imparted that required less student exploration and discovery; the teacher imposed in teaching, the students were passive in learning; more attention was paid to teaching rather than to learning, students lacked self-consciousness, activeness, and creativeness in learning; and learning was not controlled [1] (p. 113).

These common weaknesses in methods of teaching and learning can be seen from the results of video study in Vietnam. For example, from Figure 4.14 in Chapter 4 of this dissertation, we can see that on average, the percentage of time in which students learned mathematics by themselves is 23 percent (20 percent in CI 3, 2 percent in CI 5, and 1 percent in CI 1). While on average, the teachers lectured in 31 percent of the lesson time, teachers and students questioned and answered in 46 percent of the lesson time.

When teachers and students questioned and answered, the teachers usually asked very easy questions that students answered very quickly and briefly. Sometimes the answers were simple "yeses". Normally, only one student answered the question each time and other students listened.

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1. "Trong tình hình hiện nay, phương pháp dạy học ở [Việt Nam] còn có những nhược điểm phổ biến:
   - Thầy thuyết trình tràn lan;
   - Kiến thức được truyền thụ dưới dạng có sẵn, ít yếu tố tìm tòi, phát hiện;
   - Thầy áp đặt, trò thụ động;
   - Thiên về dạy, yếu về học, thiếu hoạt động tự giác, tích cực và sáng tạo của người học;
   - Không kiểm soát được việc học." (Nguyen Ba Kim, 2011, p. 113)

In the whole lesson time, there were not many students who participated in the question and answer segments. So in the question and answer segments, most students were passive people who just acted by order of the teacher or just listened. It means that on average, the percentage of time in which Vietnamese eighth-grade students learned mathematics actively was only 23 percent, and the percentage of time in which they played the passive role in learning mathematics was 77 percent.

These common weaknesses have led to the recent demand for innovating mathematics teaching method in Vietnam. The orientation of innovating teaching methods is that the teaching method needs to create opportunities for students to learn in and through self-conscious, active, initiative, and creative activities [2] (Nguyen Ba Kim, 2011, p. 114). Nguyen Ba Kim (2011) has also specified the orientation of innovating teaching methods through the following implications:

❖ *Students are the subject of independent or cooperative learning activity;*

❖ *Knowledge is installed in pedagogical situations;*

❖ *Teaching students how to learn, in particular how to self-study in the entire process of teaching and learning;*

❖ *Self-creation and exploitation of teaching aids to enhance the human power in the teaching and learning process;*

❖ *Creating the learning optimism based on work and achievements of students;*

❖ *Determining the new roles of the teacher: design, devolution, control, and institutionalization* (pp. 115-122)

In his above mentioned citation, *devolution* and *institutionalization* were quoted by Nguyen Ba Kim (2011) from Comiti (1991) and Bessot (1997).[3]

In recent decades, almost all Vietnamese teachers have known about these demands and orientation of innovating teaching methods through in-service teacher training courses, through colleagues, through journals and periodicals, and so on. However, by watching the videotaped lessons, the dissertation found that Vietnamese mathematics teachers did not implement these orientations of innovating teaching methods as well as expected.

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2. Định hướng đổi mới phương pháp dạy học là: phương pháp dạy học "cần tạo cơ hội cho người học học tập trong hoạt động và bằng hoạt động tự giác, tích cực, chủ động, và sáng tạo". (Nguyen Ba Kim, 2011, p. 114)

3. Nguyen Ba Kim (2011) đã cụ thể hóa định hướng đổi mới phương pháp dạy học qua những hàm ý sau:
   - ❖ "Người học là chủ thể hoạt động học tập độc lập hoặc hợp tác."
   - ❖ "Tri thức được cài đặt trong những tình huống có dụng ý sư phạm"
   - ❖ "Dạy việc học, dạy tự học thông qua toàn bộ quá trình dạy học"
   - ❖ "Tự tạo và khai thác những phương tiện dạy học để tiếp nối và gia tăng sức mạnh của con người"
   - ❖ "Tạo niềm lạc quan học tập dựa trên lao động và thành quả của bản thân người học"
   - ❖ "Xác định vai trò mới của người thầy với tư cách người thiết kế, ủy thác, điều khiển và thể thức hóa" (pp. 115-122)

Trong phần viết nói trên của mình, *ủy thác* và *thể thức hóa* đã được Nguyễn Bá Kim trích dẫn lại của Comiti (1991) và Bessot (1997)

For example, from the result of coding the classroom interactions, the dissertation found that Vietnamese teachers devote only 2 percent of the lesson time to CI 5, while they devote 20 percent of the lesson time to CI 3 (see Table 4.6 in Chapter 4 of this dissertation). The teachers think that CI 5 and CI 3 segments have the same characteristics, namely that the teacher assigns problems and all of the students solve the same problems. In fact, there are some differences between CI 3 and CI 5 segments. While all students solve problems at their seats in CI 5 segments, some students solve problems on the chalkboard in CI 3 segments that other students can see and they may look at the chalkboard or work on the assignment privately (see Jacobs et al, 2003, pp. 402-403). As we observed in the videos, when the teachers assigned the problems to students, most students worked self-consciously on the assignment. But when the teachers invited some students to the chalkboard to solve assigned problems, some other students stopped working on the assignment and attended to the chalkboard. It means that these students did not learn mathematics self-consciously or actively.

By watching and coding the videotaped lessons, the dissertation also discovered that Vietnamese mathematics teachers shifted very often between classroom interaction types. On average, Vietnamese mathematics teachers shifted 8 times each lesson. If the teacher shifts many times, then students may not learn mathematics actively because each type of classroom interaction happens very quickly. For example, in lesson 14.NA.V, the teacher shifted 20 times within a span of 45 minutes 03 seconds. On average, each interaction segment lasts about 2 minutes. Actually, the result of coding this lesson shows that there were 4 segments of CI 5 which lasted less than 1 minute 45 seconds. These segments happened very quickly so that some students did not have enough time to solve the difficult problem at their seats.

Another aspect of coding video, which the dissertation considers here, is the content activity aspect. In this aspect, the dissertation focus on the time devoted to independent problems, concurrent problems, and answered-only problems. From Figure 5.3 in Chapter 5, we can see that, in Vietnam, on average, the percentage of lesson time devoted to independent problems is 48 percent, while the percentage of lesson time devoted to concurrent problems is 19 percent.

What is different between independent problem segments and concurrent problem segments?

In independent problem segments, “the exact time the whole class spends working on the particular problem is known” (Jacobs et al., 2003, p. 418). All students work on the same problem at the same time. On the other hand, in concurrent problem segments, we do not know “on which problems students are working” and we do not know “the exact time spent working on each” concurrent problem (Jacobs et al., 2003, pp. 418-419).

When a teacher assigns some independent problems, the students will solve each independent problem in the same period of time. When a teacher assigns concurrent problems, then each student will solve each problem in a different period of time. This means that in the same period of time, the best student may solve all of the problems which the teacher assigned, and other students may just solve some of the problems, depending on their ability.

Assigning independent problems helps teachers control the lesson time. All students have to focus on one problem which teachers want their students to work on. This is advantageous in teaching new content. But in the classrooms, there are some students who are better than others. So, one problem may be too easy for some students and too difficult for others. If teachers always give an assignment as independent problems, they will not improve the ability of their students. Some students will have nothing to do in the classroom simply because the independent problem is too easy or too difficult for them.

Giving assignments as concurrent problems will overcome this. Concurrent problems normally include easy problems and difficult problems. This means all students will find the problems suitable for them. The students will be more active, self-conscious, and will take initiative in learning mathematics. There is but a small disadvantage in concurrent problem segments, which is that teachers will not know exactly which problem students are solving and how long they took to solve that problem.

So, if Vietnamese teachers want their students to be the subject of an independent or cooperative learning activity, they should devote more time to private interaction (CI 5) and concurrent problem segments.

Through this section, the dissertation emphasizes that the innovation of mathematics teaching methods in Vietnam has recently become necessary. However, by watching and coding the videotaped lessons, the dissertation found that Vietnamese mathematics teachers knew well the demands and orientation for innovating mathematics teaching methods. But they did not implement the orientation in the videotaped lessons as well as expected. Reasons for this will be suggested in the next section.

6.2. The challenges of innovating mathematics teaching methods in Vietnam

Stigler and Hiebert (1999) asserted that “teaching is a system,” and that “teaching is a cultural activity,” so that teaching is not easily changed (pp. 75, 85, 97). “If we want to improve teaching, both its systemic and its cultural aspects must be recognized and addressed.” (p. 97)

Teaching method is one element of a teaching and learning system. Stigler and Hiebert (1999) implied that teaching method is the *cultural script* which the teachers follow and acquire as members of their culture (pp. 133-134). So it is not easy to innovate teaching methods. Innovating teaching methods does not look like changing the blackboard to another kind of chalkboard. The blackboard is a physical vehicle and changing the physical vehicle is much easier than changing the cultural scripts (see also in Nguyen Ba Kim (2011, pp. 103-104)). If the students and the teacher have not gotten used to a new teaching method, the lesson may not be successful.

Hiebert and Stigler (2000) gave an example in which the change in teaching methods impaired the system of teaching as follows:

> One sixth-grade teacher decided to change his traditional approach to a more problem-solving approach [as] shown in the tapes. He carefully planned a new lesson to try out the approach. Instead of asking short-answer questions, he began his lesson by presenting a challenging problem and asking students to spend 10 minutes working on a solution. Although the teacher changed his behavior to correspond with the teacher on the videotape, the students, not having seen the videotape and discussed its implications for them, did not change their behavior. They waited for the teacher to show them how to solve the problem. The lesson did not succeed. (p. 7)

Recently, Vietnamese teachers are oriented to innovating mathematics teaching methods by using the projector and the computer to teach mathematics. The students somewhat like this change. But it is not easy for teachers who have not gotten used to the projector and the computer yet. Sometimes they focus too much on the new elements – the projector and the computer – so that they do not co-ordinate perfectly the projector and the computer with other familiar teaching elements. Sometimes the projector and the computer become unnecessary. In these cases, the lessons are not as successful as those taught with familiar teaching methods.

Actually, applying information technology to mathematics teaching, by itself, is not good or bad. Its value depends on how the teachers fit this new feature into the normal system of teaching (see Stigler and Hiebert, 1999, p. 75). Some Vietnamese teachers only use the projector to display the mathematical problems which have already been written in the textbook or are even written again on the chalkboard by the teachers. This is unnecessary use. Sometimes a few teachers are confused when they try to fit the slides from the projector with writing on the chalkboard, and their verbal words. We feel that if those teachers did not use the projector, their lessons may be taught better.

From the viewpoints of Hiebert and Stigler (2000), it is very difficult to change just one element of the teaching system (p. 7); we can see that if we want to innovate the mathematics teaching methods, we must also change other elements of the teaching system. For example, if Vietnamese teachers want to innovate a teaching method by applying information technology to mathematics teaching, then Vietnamese schools must be equipped with computers and projectors. And then, Vietnamese teachers must be taught to use the computer and projector.

So, before studying the challenge of innovating mathematics teaching methods in Vietnam, let us see the elements which influence mathematics teaching and learning in Vietnam.

6.2.1. Elements influencing mathematics teaching and learning in Vietnam – extracted from the video study

There are many things that influence mathematics teaching and learning in Vietnam. Some of them are the teachers' professional qualifications and teaching methods, students' knowledge and attitude, teaching resources, environments inside and outside classroom, and especially the culture.

This dissertation will use the videotaped lessons to illustrate these influences.

6.2.1.1. Teachers' professional qualifications and teaching methods

Put simply, teaching is the process of imparting knowledge. The teacher supplies the knowledge and the students receive the knowledge. To achieve the goals of mathematics teaching effectively, teachers must have good professional qualifications. If the teacher cannot solve the problems by themselves, they cannot teach the students how to solve those problems either.

We can see from the videotaped lessons in Vietnam that there were some lessons in which the wrong knowledge was taught somewhere, such as in the videos of lesson 1.TH.TG (from 41:50 to 42:08), 6.TH.NS2 (from 46:17 to 46:19), 9.TH.TH (from 25:42 to 26:18), and 23.HN.PT (from 10:38 to 11:11).

More specifically, one student gave an example of inequality "$x^2 > -2$" but the teacher said that the inequality "$x^2 > -2$" is wrong because x^2 is not less than 0. In another lesson, a student said that "$|A(x)|$ is equal to negative $A(x)$ if $A(x) < 0$". The teacher said that it is wrong because $|A(x)|$ never gets a negative value, so we must say $-|A(x)| = -A(x)$ if $A(x) < 0$. Actually, $|A(x)|$ never gets a negative value, but $A(x)$ can get a negative value. So, the correct answer must be $|A(x)| = -A(x)$ if $A(x) < 0$.

There were some lessons in which the teachers had a lot of difficulties when solving difficult problems. They spent a lot of time finishing those problems. Thus, they did not have enough time to teach other information.

Maybe the teachers in these lessons were somewhat nervous when these lessons were videotaped so that they made the mistakes or were confused. Of course, we cannot assert that all teachers never make mistakes. We just mention a few examples of mistakes here to illustrate our point that the teachers' professional qualifications influence mathematics teaching and learning in Vietnam.

We can say that the teachers' professional qualification is very important for effective lessons. But the teachers having good professional qualifications are not necessarily good teachers. Along with good professional qualifications, the teachers must also have good teaching methods. If they do not have good teaching methods, they will not be able to impart the knowledge to their students well. We watched the videotaped lessons in Vietnam and we could see more clearly how important the teaching methods are. As mentioned, some teachers did not spend much time on private interaction in which students could learn mathematics self-consciously, actively, initiatively, and creatively. The teachers still imposed strict control of teaching, and students were passive in learning.

We played two roles when watching videotaped lessons. One role was as student in the classroom learning mathematics, and other role was as researcher studying mathematics teaching and learning. From our experience with the two roles above, we can assess that in the videotaped lessons, the students did not really learn mathematics self-consciously, actively, and creatively according to the goals of innovating teaching methods described above.

6.2.1.2. Students' knowledge and attitude

Firstly, we may assert that if students have good basic knowledge, the teacher will impart new knowledge more easily. The teacher will have more time to develop the students' intelligence and improve the students' personality. Conversely, if the students' basic knowledge is not good, the teacher will have difficulty imparting the new mathematical knowledge, skills, and methods, and the teacher will not have enough time for other goals of mathematics teaching. We can watch the videotaped lessons to confirm this. Unfortunately, we did not have multiple videotaped lessons with the same teacher, the same mathematics content but different students, to compare the influences of students' knowledge on the success of lessons. But we can clearly see in the videotaped lessons how the students' knowledge influences the goals of mathematics teaching.

Secondly, we refer to the students' attitude. We asked teachers the following question in the questionnaire:

"How would you describe your students' behavior and participation during the videotaped lesson?

☐ better than usual
☐ about the same as usual
☐ worse than usual " (Jacobs et al., 2003, p. 237)

Some teachers answered that their students' behavior was better than usual, some answered that their students' behavior was about the same as usual and others answered that their students' behavior was worse than usual. And the teachers said to us that the students' behavior influenced the mathematics teaching very much.

If the students do not cooperate with the teachers to learn mathematics, then the teachers will have difficulty in teaching and the lesson will not succeed. For example, in the videotaped lesson 6.TH.NS2, the teacher asked the students many times ***"Sao hôm nay các em học trầm vậy?"*** (Translated into English: "***why are you so quiet today?"***). The teacher waited for students to raise their hands with an answer when she asked the students a question but no one did. The question was very easy but the students' attitude was not good so the lessons did not happen according to the teachers' expectations.

6.2.1.3. Environments inside and outside the classroom

The TIMSS Video Study paid attention to outside interruptions, which are "any incident that disrupts classroom activities, such as announcements over the intercom, fire drills, a teacher remarking on a student(s) late arrival, or some individual from outside requiring the teachers' attention" (Jacobs et al., 2003, p. 442).

In Vietnam, outside interruptions are reduced as much as possible. Sometimes when we watched the videotaped lessons, we heard other students singing from the neighboring classroom, such as in videos 1.TH.TG, 4.TH.TT, and 9.TH.TH. We played the role of the students learning mathematics when we watched these videos. We lost a bit of focus when we heard the singing. But if you always hear the singing when you learn mathematics, maybe you will not pay attention to the singing anymore. It is like living near the train station. You cannot sleep when the trains go through at first. But after that you will not pay attention to the train anymore even you do not know when the trains go through or not. That means the teachers and students will adapt themselves to the environment. But it does not mean the environment does not influence mathematics teaching. Mathematics teaching needs a quiet environment for students to think to solve the problems. They have to concentrate to do the difficult assignments. Any outside interruptions can break the flow of lessons.

We did not hear only singing but also ringtones when watching videos of lessons, such as videos 7.TH.QX (from 40:57 to 41:07), 12.NA.CL (from 32:36 to 32:39). This has a negative influence on teaching and learning. So teachers and students should not use the telephone in the classrooms.

6.2.1.4. The culture

There are not many people that think that the culture can influence mathematics teaching and learning. Actually, when teachers teach mathematics and students learn mathematics, they always bring their culture into the classrooms. But they do not realize that because teaching and learning are very familiar activities to them.

> We [are often] blind to most familiar aspects of our everyday environment, and teaching turns out to be one of these aspects. Looking across cultures is one of the best ways to see beyond the blinders and sharpen our view of ourselves. (Stigler and Hiebert, 1999, p. x)

With the same mathematics content, the teachers and students coming from different cultures have different goals when teaching and learning that content. For example, with the content "congruent triangles", Vietnamese teachers will focus on using congruent triangles to solve the problems in mathematics while some other countries' teachers will spend more time using congruent triangles to solve the problems in the real life. People in different cultures have different views about the same thing.

"We don't see things as they are, we see them as we are."
(Anaïs Nin)

From the results of the IBM Corporation survey, Hofstede (1986) differentiated 50 countries and three regions into four groups of cultures:

- Small power distance and collectivistic cultures: Costa Rica
- Large power distance and collectivistic cultures: Singapore, Philippines, Thailand, Hong Kong, Malaysia, Indian, Japan, Taiwan, South Korea…
- Small power distance and individualistic cultures: Germany, Australia, United States, Denmark, Netherlands, Great Britain…
- Large power distance and individualistic cultures: Frances, Italia, Spain, Belgium, South Africa. (p. 309)

From the characteristics of the individualistic-collectivistic cultures and the power distance cultures as elaborated in Chapter 1 of this dissertation, we can suppose that Vietnamese culture is a large power distance and collectivistic culture, like many Asian countries' cultures. So teaching and learning in Vietnam are influenced by characteristics of large power distance and collectivistic cultures (see Table 1.4 and Table 1.8 in Chapter 1 of this dissertation).

Trumbul, Rothstein-Fisch, and Greenfield (2000) asserted that

> Skillful self-expression, critical thinking, and the ability to engage in discussion and argument are all valued attributes of the "ideal student," according to current educational theory. Individualistic parents tend to socialize their children to ask questions, "speak up," and "tell the teacher what you need."… [However, in collectivistic parents'] view, a quiet student learns more and is more respectful than one who speaks up, singling [himself or] herself out from the group and taking time away from the teachers' lesson. (p. 9)

The educational reform efforts are somewhat restricted by the characteristics of culture in Vietnam. Vietnamese students usually learn mathematics with respect for their teacher. They think or they are told that the teachers are always right. In the video 9.TH.TH, one student wrote on the chalkboard the inequality "$x^2 > -2$", the teacher said that this example was wrong and the correct inequality must be "$x^2 \geq 0$". All students were quiet after the teacher's comment. Maybe they were quiet not because they did not know whether the teacher's comment was right or wrong, but because they did not have the habit of speaking up in class without being called upon personally by the teacher (one characteristic of teaching and learning in collectivistic cultures) or they were quiet because they did not have the habit of contradicting or criticizing their teacher publicly (one characteristic of teaching and learning in large power distance cultures).

In some videos of lessons, such as 15.NA.YT, 19.SS.QT1, 22.SS.ToS, and 23.HN.PT, the teachers usually told the students ***"không nói leo!"*** or ***"không phát biểu tự do!"*** (Translate into English: "***do not interrupt adults!"*** or **"*do not speak spontaneously!*"**). Sometimes the students had a different method of solving the problems but they did not dare express their opinion. In these cases, the teachers could not develop the students' intelligence and improve the students' personality.

"If we want to improve teaching, both its systemic and its cultural aspects must be recognized and addressed" (Stigler and Hiebert, 1999, p. 97). If we want to innovate mathematics teaching methods, we must change some other elements of the teaching system, such as "the behaviors of the teacher, the expectations and behaviors of the students, the physical setting, the participation structures that guide social interactions and discourse, the lesson activities, the curriculum, the materials, and so on" (Hiebert and Stigler, 2000, p. 7). So, it is not easy to innovate mathematics teaching methods.

6.2.2. The difficulties in innovating mathematics teaching methods in Vietnam

The desire to innovate mathematics teaching methods was formed many years ago. However, the practice of Vietnamese mathematics teaching is currently not living up to expectations.

Vietnamese mathematics teachers did not innovate teaching methods according to the desires described above, did they?

The answer is that they did. Actually, they thought that they did. Many years ago, teachers lectured most of the lesson. Recently, they have changed by inviting some students to question and answer with them or inviting some students to read aloud from the textbook. They think that this helps their students learn mathematics through active participation. But they have just changed the *artifacts level* of teaching, enacting "change at the margins of teaching" (see Hiebert and Stigler, 2000, p. 6).

To innovate mathematics teaching methods, teachers must apply the results of research in mathematics education to their teaching practice. Teachers can use their own results of research through many years of experience teaching mathematics in school, or they can use the results obtained by other researchers. By applying these results to their teaching practice, the teachers gradually change their teaching and make it better and better.

Some mathematics teachers in school say that they read a lot of scientific articles and some of them are very interesting. However, they cannot apply what they read to their teaching practice because there are so many elements that may affect the teaching practice, such as lesson time, students' level of ability, or material facilities. For example, many scientific articles showed that it is a good idea to apply information technology to mathematics teaching but the teachers cannot do this because there is no computer or projector in their school.

According to Hiebert and Stigler (2000), most U.S. teachers responded on the questionnaire of the TIMSS 1995 Video Study that they knew the "current ideas about teaching and learning mathematics" and believed that they were implementing such ideas in their teaching (pp. 4-5). However, "the evidence from their actual practice" showed that U.S. teachers thought they changed mathematics teaching but, actually, they had only made changes “at the margins”. Hiebert and Stigler (2000, pp. 5-6)

A similar situation is currently happening in Vietnamese mathematics teaching and learning. Out of the teachers who participated in our video study, we received 15 responses to the question:

“To what extent do you feel that the videotaped lesson is in accord with current ideas about the teaching and learning of mathematics?

- ☐ a lot
- ☐ a fair amount
- ☐ a little
- ☐ not at all” (Jacobs et al., 2003, p. 238).

Out of 15 responses, 10 teachers chose the answer “a lot”, and 5 teachers chose the answer “a fair amount”. However, from watching the videotaped lessons, in our opinion, these teachers just changed mathematics teaching *at the margins*.

Responding to the next question, “Please describe one part of the videotaped lesson that you feel exemplifies current ideas about the teaching and learning of mathematics and explain why you think it exemplifies these ideas” (Jacobs et al., 2003, p. 239), some teachers related that they asked students to work in groups, they used information technology in teaching, they taught with students-centered, and so on. Hiebert and Stigler (2000) asserted that “although [U.S.] students were working in groups, the nature of the mathematics they were doing had not changed. Arranging students in small groups was a change at the margins” (p. 6). Once again, a similar situation was happening in videotaped classrooms in Vietnam.

As mentioned, the demand for innovating mathematics teaching methods in Vietnam arose many years ago. However, the practice of Vietnamese mathematics teaching is currently not good as expected. The difficulties of innovating mathematics teaching in Vietnam may come from two main causes:

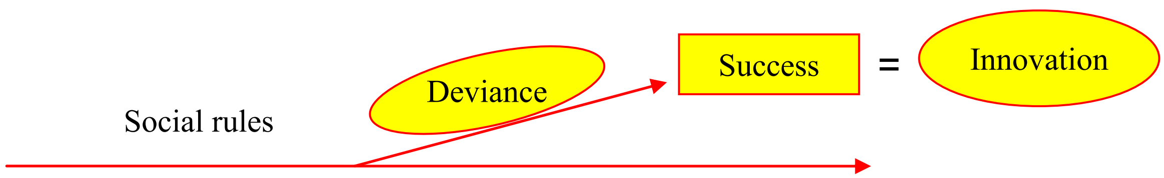
❖ The first cause: *mathematics teaching is a system* and *a cultural activity,* so it is very difficult to improve mathematics teaching in general and to innovate mathematics teaching methods in particular.

Most Vietnamese mathematics teachers have not known the importance of the fact that “teaching is a system” and “teaching is a cultural activity” so that it is not easy to change mathematics teaching (see Stigler and Hiebert, 1999). When Vietnamese teachers know a new approach to teach mathematics in school, they will try to apply this approach to their lessons. But they hope that the new approach will bring an immediate effect within a short period of time. If they feel that the new approach takes them a lot of lesson time or does not bring about an immediate effect, they will give up on the new approach. And they will revert to the usual teaching methods.

Actually, when we apply the new approach, we have to wait for other elements of the teaching and learning system to get used to the new approach. In particular, teachers have to wait for their students to get used to the new teaching methods. This can take a lot of time: one month, one year, or more.

Bates and Plog (1990) believed that "innovations may be accepted immediately and permanently," or they may have to wait for the "major environmental changes" that make them adaptive to the new environment (p. 435). Stigler and Hiebert (1999) also asserted that the mathematics teachers must "expect improvement to be continual, gradual, and incremental" (p. 132).

Let us see how innovation is accepted in a society. Bates and Plog (1990) asserted that "deviance is essential in the area of innovation. When certain members of a society violate a social rule and their actions succeed in resolving some problems, they are called entrepreneurs or inventors rather than deviants". (p. 433)



In teaching, educational researchers and a few teachers play the role of *entrepreneurs or inventors*. They research to discover new teaching methods. It means that they *violate* the normal teaching customs to find new teaching methods. If their new teaching methods succeed in achieving a good outcome for students, the new teaching methods become accepted. But when educational researchers instigate the innovation, it is important that they are able to convince other teachers to accept it. Bates and Plog (1990) also asserted that "change occurs when [inventors] and their ideas are accepted as legitimate and not rejected as deviant" (p. 435). In teaching, researchers and some teachers are people who invent new teaching methods, and the innovation of teaching methods occurs when their new suggested teaching methods are accepted by most teachers in society.

When educational researchers propose a new teaching method it is very important that they convince the majority of teachers to apply this new teaching method in their career. If most teachers apply the new teaching method for a long time and this method is effective in teaching, then the new method is gradually merged into current teaching scripts to make a new script.

From the viewpoints of Stigler and Hiebert (1999) and Bates and Plog (1990) above, we can see that educational researchers play an important role in finding new mathematics teaching methods. However, the mathematics teachers themselves play a more important role in using the new mathematics teaching methods to make a new cultural script for teaching in each country.

Do Vietnamese mathematics teachers really want to innovate mathematics teaching methods?

The second cause that presents difficulties in innovating mathematics teaching in Vietnam has to do with teacher acceptance.

❖ The second cause: Vietnamese mathematics teachers do not readily accept the innovation of mathematics teaching methods

Bates and Plog (1990) asserted that

> people do not usually seek and accept change easily, for change always has inherent risks. As we have seen, innovation is often instigated either by people who have little to lose or by those who have resources with which to absorb the risk. (p. 431)

In education, researchers are often people who instigate an innovation and teachers are people who implement the innovation. Actually, when an innovation is implemented, the researchers have little to lose, but the teachers may lose many things, such as time, students' progress, and so on. So, most teachers *do not usually seek and accept* the innovation readily.

As mentioned above, Vietnamese mathematics teachers are currently advised to apply information technology to mathematics teaching. Researchers have suggested that there are many advantages to applying information technology to mathematics teaching. However, to apply information technology to mathematics teaching, the teachers have to spend a lot of time to learn how to use computers and projectors. They also have to spend a lot of time making the presentation, looking for information on the internet, and so on.

In the video study in Vietnam, in 33 percent of lessons the teachers used the projector and computer to teach mathematics (see Table 4.11 in Chapter 4 of this dissertation). However, from questionnaires and direct interviews, we found that Vietnamese teachers just use projectors and computers in special cases, such as when there is someone observing the lesson. This means that Vietnamese mathematics teachers only change mathematics teaching methods at the *artifact level* of teaching (see Chapter 1 of this dissertation).

Sometimes the teachers know that they should change mathematics teaching methods, but it is somewhat difficult to encourage the teachers to change themselves.

In this section, the dissertation explained some reasons why it is very difficult to innovate mathematics teaching methods in Vietnam. There are always many scientific studies in mathematics education in Vietnam every year. However, applying these scientific results to the practice of mathematics teaching on a large scale is very difficult.

Improving mathematics teaching requires the efforts of teachers, students, parents, schools, and politicians, and it should take place as a long-term process with small changes in core classroom practices over time (Stigler and Hiebert, 1999, pp. 132, 135).

Based on the results of coding the videotaped lessons, we propose some measures which teachers and schools should do immediately to improve mathematics teaching and learning and innovate mathematics teaching methods in Vietnam. The measures for significant improvement need to be studied in other careful research studies.

- ❖ About *classroom interaction*: teachers should spend more time on private interaction (CI 5) before shifting to ‘optional, student presents information’ (CI 3). Teachers should reduce the time spent on lecturing (CI 1). They should not shift a lot between classroom interactions so much that each classroom interaction happens very quickly, leading to ineffective learning.

- ❖ About *content activity*: teachers should spend more time on concurrent problem segments in which each student can find some problems suitable to his or her ability.

- ❖ About *aspects that influence lesson clarity and flow*: Teachers should state the goals of the lesson more clearly and in more detail such that students can know what they will learn in this lesson, why they should learn this lesson, and even how they will learn this lesson. This is very important in that it encourages the students’ involvement in the lesson. When summarizing the lesson, teachers should emphasize the important content of the lessons which students should remember. Teachers should spend more time connecting or applying mathematics to real life so that students can use mathematics knowledge in their day-to-day lives. In some videotaped lessons, we heard very clearly singing from neighboring classrooms. This might interrupt the flow of a lesson. The schools should have a separate room far from the classrooms or a soundproof room for music education. The teachers and students should not use telephones in the classrooms, or the telephone should at least be set to its silent profile.

- ❖ About the *resources used during the lesson*: teachers should not depend much on the textbook. The teachers can change some contents of the textbook that are suitable for students’ ability, or even suitable for the teachers’ ability. Teachers should use the computer and projector more often and more effectively. Teachers should use more real-world objects so that students can easily connect the mathematics with real life.

- ❖ About the *purpose of different lesson segments*: Teachers should change the methods of review. The teachers usually review by checking the answers for previously completed homework problems, quizzes and grading exercises. This may cause stress for students at the beginning of each lesson. The teachers can change the review by including warm-up problems and games. The teachers should spend more time on class discussion of new content, or exploration through solving new problems in introducing new content segments. And, as mentioned, teachers should spend more time on private work and discussions of problem methods and solutions previously presented in the form of practicing new content.

Once again, this dissertation emphasizes the fact that improving mathematics teaching and learning requires the efforts of all people in society, in which teachers play an important role in improvements (Stigler and Hiebert, 1999, p. 135).

6.3. Summary

This chapter presented the demands and challenges of innovating mathematics teaching methods in Vietnam. The dissertation also presented certain elements' influence on mathematics teaching and learning in Vietnam – extracted from the Vietnamese video study.

This chapter also introduced the viewpoints of some researchers about improving mathematics teaching that may help in the improvement of mathematics teaching in Vietnam.

Improving mathematics teaching and learning requires the efforts of all people in society, and teachers play an important role in the improvements (Stigler and Hiebert, 1999, p. 135). So, this dissertation simply proposes some measures which teachers and schools may take immediately to improve mathematics teaching and learning and innovate mathematics teaching methods in Vietnam. The measures for the significant improvement of mathematics teaching need to be studied in more depth in future studies as well.

CHAPTER 7

CONCLUSION AND FURTHER STUDIES

7.1. Conclusion

Let us take another glance at the research tasks of the dissertation which were presented in the research purpose of the dissertation. This dissertation has carried out the following research tasks:

- ❖ Studying the characteristics of teaching and learning in different cultures and relating the results to mathematics teaching and learning in Vietnam

- ❖ Introducing the TIMSS, the TIMSS Video Study and the advantages of using video study in investigating mathematics teaching and learning

- ❖ Carrying out the video study in Vietnam to bring out the image, scripts and patterns, and the lesson signature of eighth-grade mathematics teaching in Vietnam

- ❖ Comparing some aspects of mathematics teaching in Vietnam and other countries and identifying the similarities and differences across countries

- ❖ Studying the demands and challenges of innovating mathematics teaching methods in Vietnam – the lessons from the video studies

The findings of these research tasks were presented in the previous chapters. In my viewpoint, the dissertation carried out these research tasks quite well.

In Chapter 1, we discovered the relationship between mathematics teaching and the culture in each particular country. It can be asserted that teaching and learning in different cultures have different characteristics. We can see three levels of culture in mathematics teaching and learning. We also see that theoretically, students are direct 'products' of the education system in each country, but students are also the 'products' of the expectations of the society. The teachers are teaching what their society expects their students to achieve. So the characteristics of culture can affect the characteristics of teaching in general and mathematics teaching in particular.

From studying mathematics teaching in different cultures and from the reality of Vietnamese society, this dissertation hypothesized that Vietnamese culture is a large power distance and collectivistic culture. This hypothesis is reinforced by the fact that most other Asian countries such as Singapore, the Philippines, Thailand, Hong Kong, Malaysia, Indian, Japan, Taiwan, and South Korea also have large power distance and collectivistic cultures. This hypothesis can be used to interpret some of the characteristics of mathematics teaching in Vietnam.

Chapters 2 and 3 briefly presented the purpose and some of the findings of the TIMSS and the TIMSS Video Study. It was found that video study can be seen as an effective research method in mathematics education. Video study overcomes some limitations of the questionnaires and direct observation methods. It allows an iterative research approach and also allows an integration of qualitative and quantitative approaches in mathematics education (see Jacobs, Kawanaka, and Stigler, 1999). Based on the purposes, procedures, and findings of the TIMSS and the TIMSS Video Study in these chapters, we carried out a video study in Vietnam. The purpose, procedure and methodology of the Vietnam video study were presented in Chapter 4 of this dissertation.

Chapter 4 also presented the main findings of the video study in Vietnam. Through watching and coding 27 videotaped eighth-grade mathematics lessons, the dissertation highlighted the quantitative and qualitative results of mathematics teaching and learning in Vietnam. From the results of coding videotaped lessons, the dissertation identified the Vietnamese eighth-grade lesson signature (see Chapter 4 and Appendices C, D, E, F, G, H, I, K, and L in this dissertation). Some characteristics of eighth-grade mathematics teaching and learning in Vietnam can be listed as below:

❖ On average, Vietnamese eighth-grade mathematics teachers devoted only 2% of the lesson time to private interaction (CI 5), while they devoted 20% of the lesson time to ‘optional, student presents information’ (CI 3).

❖ On average, Vietnamese eighth-grade mathematics teachers devoted 32% and 67% of lesson time to non-problem (NP) segments and problem segments, respectively.

❖ On average, there were 4 independent problems (IP) solved in each lesson and each independent problem was solved within 6 minutes.

❖ Vietnamese teachers assigned homework and stated the goal of the lesson very often (in 89% and 93% of videotaped lessons, respectively). However, they rarely connected the mathematics contents to real life or to the historical background of the content (in only 15% and 4% of videotaped lessons, respectively).

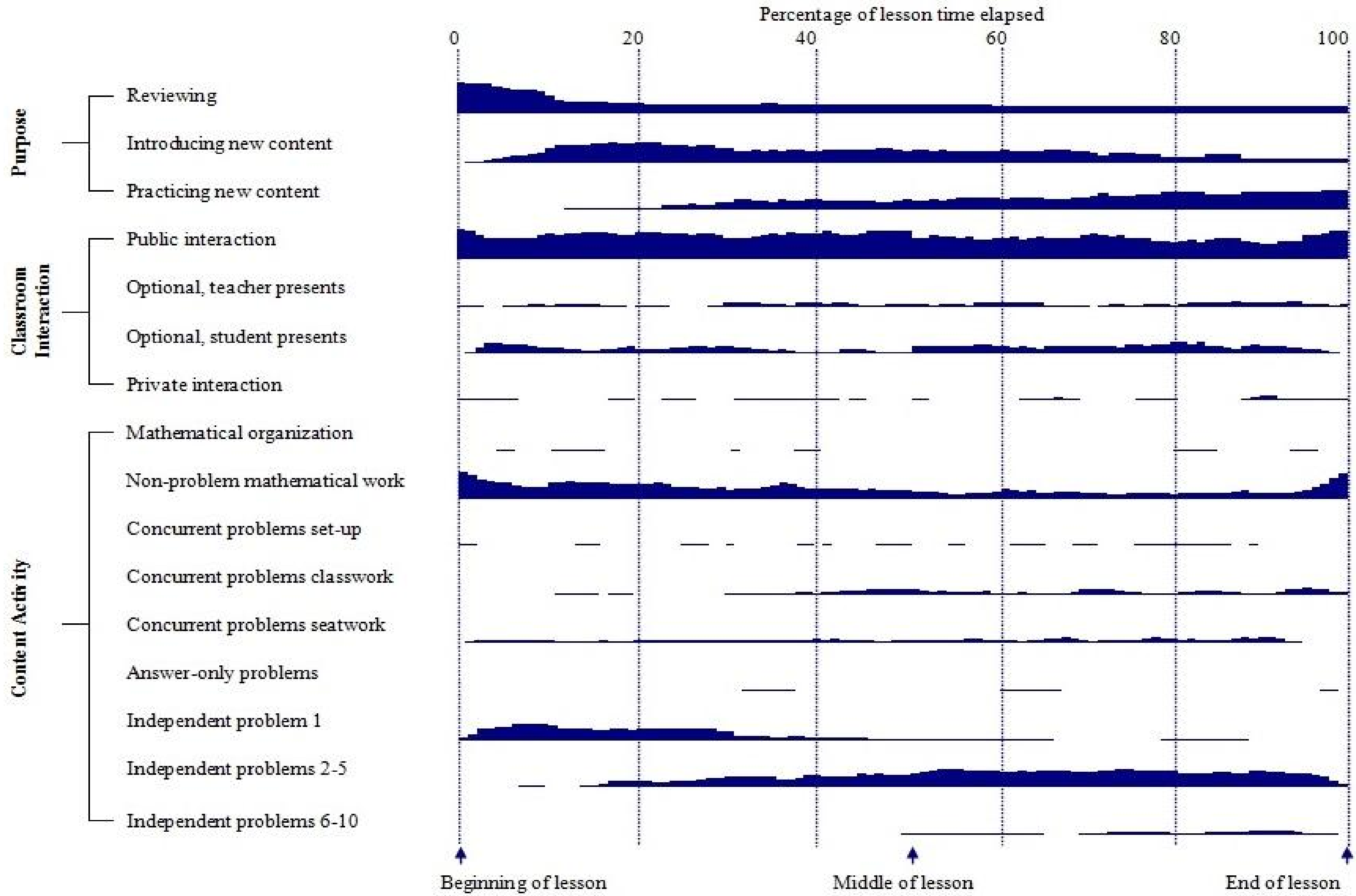
❖ 100% of teachers used the chalkboard (CH) and textbooks or worksheets (TXW) to teach mathematics in Vietnam.

❖ On average, Vietnamese teachers devoted 35%, 34%, and 31% of lesson time to reviewing (P1), introducing new content (P2), and practicing new content (P3), respectively.

❖ On average, Vietnamese teachers devoted 31% of lesson time to teacher-only segments, 46% lesson time to teacher-student segments, and 23% of lesson time to student-only segments (see Section 4.3.7 in Chapter 4 of this dissertation).

❖ The Vietnamese eighth-grade mathematics lesson signature is described in Figure 7.1.

Figure 7.1. Vietnamese *eighth-grade mathematics lesson signature*



The Vietnamese eighth-grade mathematics lesson signature was created based on the results of three coverage codes, namely the purpose code, classroom interaction code, and content activity code. A comparison of the Vietnamese eighth-grade mathematics lesson signature with those in other countries can be found in Chapter 5 of this dissertation.

Chapter 5 compared Vietnamese eighth-grade mathematics teaching with that in eight other countries. The dissertation compared the results of the Vietnam video study with the results of the TIMSS 1995 Video Study in Germany, Japan, and the United States; the TIMSS 1999 Video Study in Australia, the Czech Republic, Hong Kong SAR, Japan, the Netherlands, Switzerland, and the United States; and the TIMSS 2007 Video Study in Indonesia.

Through Chapter 5, the dissertation found that eighth-grade mathematics teaching in the nine countries above shared some common characteristics. For example, mathematics teaching in these countries included three types of purpose segments, namely reviewing, introducing new content, and practicing new content (see definitions in Jacobs et al. (2003) and Hiebert et al. (2003)). The mathematics teachers in these countries devoted about 90% of lesson time to mathematical work.

However, there were also some differences in eighth-grade mathematics teaching among these countries. For example, mathematics teachers in Vietnam and the Czech Republic devoted at least 18% of lesson time to ‘optional, student presents’ (CI 3) segments while mathematics teachers in other countries devoted less than 5% of lesson time to this kind of segment. Vietnamese teachers devoted only 2% of lesson time to private interaction (CI 5), while teachers in other countries devoted at least 20% of lesson time to this kind of segment.

Hiebert et al. (2003) quoted from LeTendre et al. (2001) that “the suggestion that the countries share some common ways of teaching eighth-grade mathematics is consistent with an interpretation that emphasizes the similarities of teaching practices across countries because of global institutional trends” (p. 120). However, as mentioned, mathematics teaching in each country is always affected by many elements, such as the teachers, material facilities, culture, and so on. So there are always differences in mathematics teaching across countries.

Schoenfeld (2000) asserted that

> Research in mathematics education has two main purposes, one pure and one applied:
>
> - Pure (Basic Science): To understand the nature of mathematical thinking, teaching, and learning;
> - Applied (Engineering): To use such understandings to improve mathematics instruction.
>
> These are deeply intertwined, with the first at least as important as the second. The reason is simple: without a deep understanding of thinking, teaching, and learning, no sustained progress on the “applied front” is possible. (pp. 641-642)

From Chapter 1 to Chapter 5, the dissertation identified many characteristics of mathematics teaching and learning in Vietnam and other countries. These findings should be used to improve mathematics teaching and learning in Vietnam. However, improving mathematics teaching requires the efforts of teachers, students, parents, schools, and politicians, and should take place in long-term processes with small changes in core classroom processes over time (Stigler and Hiebert, 1999). So in Chapter 6, the dissertation focused on the demands and challenges of innovating mathematics teaching methods in Vietnam – the lessons from the video studies.

This chapter revealed that innovating teaching methods is a common goal for most subjects in most countries all over the world. From the findings of the video study in Vietnam and the viewpoints of other researchers, this dissertation showed the common weaknesses that lead to the current demand for innovating mathematics teaching methods in Vietnam.

However, it also discovered that it is not easy to innovate mathematics teaching methods in Vietnam. The challenge of innovating mathematics teaching methods in Vietnam may come from the fact that "[mathematics] teaching is a system" and "[mathematics] teaching is a cultural activity," so it is very difficult to improve mathematics teaching in general and to innovate mathematics teaching methods in particular (see Stigler and Hiebert, 1999). The challenge may also come from the fact that "people do not usually seek and accept change easily, for change always has inherent risks" (Bates and Plog, 1990), so Vietnamese mathematics teachers do not accept the innovation of mathematics teaching method easily either. This is really the difficulty in innovating mathematics teaching methods in Vietnam. This is because improving mathematics teaching and learning requires the efforts of all people in society in which teachers play an important role for improvement (Stigler and Hiebert, 1999).

Based on the results of coding the videotaped lessons, this dissertation proposes some measures which teachers and schools should take immediately to improve mathematics teaching and learning in Vietnam. The measures for significant improvement need to be studied in further detail in other careful research studies.

As presented in Chapter 4, the goal was to videotape 100 mathematics lessons in Vietnam. But the limitation of time and finances did not allow for this. Also, many other important aspects of mathematics teaching and learning in Vietnam were not studied in this dissertation. So other video studies need to be conducted in the future as well.

Ideas for these future video studies in Vietnam will be presented in the next section.

7.2. Proposals for further studies

The video study has opened up many opportunities to examine in depth mathematics teaching and learning in Vietnam. Video study is not only used to investigate mathematics education in lower secondary schools, but is also used to investigate mathematics education in upper secondary schools and even in colleges and universities.

However, to conduct a video study effectively, we need to coordinate closely groups of people in several areas such as mathematicians, mathematics educators, informatics specialists, educational managers, sponsors, and so on.

The preliminary plans for some video studies in Vietnam will be presented below.

7.2.1. Conducting the video study on mathematics teaching and learning in the eighth grade on a larger scale in Vietnam

In this dissertation, the video study was conducted to investigate mathematics teaching and learning in the eighth grade. However, the sample size was small, with 27 videotaped lessons in three provinces and cities. So, the need to conduct another video study on a larger scale arose from this. The sample of this video study should be large enough to ensure the reliability of the results. If possible, the number of videotaped lesson should be 100 lessons, like the TIMSS Video Study samples in most countries. And these lessons should be videotaped from the North to South of Vietnam.

The techniques and procedures are based heavily on the TIMSS 1999 Video Study (see Jacobs et al., 2003). Of course, we can modify these techniques and procedures in accordance with the goals and reality of research in Vietnam. This video study can be conducted in the following stages:

❖ Use random selection methods to select 100 lower secondary schools from the North to the South of Vietnam. This selection can be divided into two steps. The first step is to use the PPS method to select the provinces and cities where the 100 lessons will be videotaped. The second step is to use the systematic selection method to choose the schools in each selected province or city in the first step (see Sullivan, May, and Maberly (2000, pp. 21-25); World Bank (2010, p. 27); and Chapter 4 of this dissertation).

❖ Contact the principals and teachers of the randomly selected schools to obtain their agreement to participate in the video study. In some cases, we should contact Education and Training Offices of districts, or even Education and Training Services of provinces or cities first. We should go to meet the principals and teachers directly or contact with them by phone if a direct meeting is not possible.

❖ Contact the teachers to get the schedule of mathematics classes in schools, then select one (or two) lessons to videotape. Inform the principals and the teachers of the selected lesson, requiring that the teacher should teach that lesson as usual and the teacher should not prepare more than usual for that lesson.

- ❖ Follow the "data collection manual" in the TIMSS 1999 Video Study (see Jacobs et al. 2003) to collect the video data as well as other kinds of data in the selected schools. This stage can be done by professional cameramen, but it is better if the educational researchers are trained to use the camera to videotape the lessons directly. This is because the educational researchers know what should be videotaped in the mathematics lessons.

- ❖ Follow the "mathematics video coding manual" in the TIMSS 1999 Video Study (see Jacobs et al. 2003) to code the videos (see Chapter 4 and Appendix C of this dissertation).

- ❖ Use Microsoft Excel to save and analyze the coded data (see Chapter 4 and Appendices D, E, F, G, H, I, and K in this dissertation).

- ❖ Report the results of the study.

The study on a larger scale will be conducted by a group of researchers. Thus, this larger study will hopefully bring out more comprehensive results than the study in this dissertation, which was conducted by only one person.

7.2.2. Conducting the video study to investigate mathematics teaching and learning in upper secondary schools in Vietnam and comparing the results of this video study with the video study in lower secondary schools above to find out the similarities and differences between mathematics teaching and learning in Vietnamese lower secondary and upper secondary education.

As a lecturer in the Faculty of Mathematics at Hanoi National University of Education, I usually lecture in Mathematics Education for pedagogy students who will become in-service teachers in upper secondary schools in Vietnam. So, when the dissertation was conducted, some questions arose in my mind, such as what are the differences and similarities between mathematics teaching and learning in lower and upper secondary schools in Vietnam? Or, do the students in lower secondary schools learn mathematics more actively than the students in upper secondary schools? And so on.

After finishing the video study in this dissertation, we believe that it is possible to conduct a similar video study in upper secondary schools. The techniques and procedures are also based heavily on the TIMSS 1999 Video Study. The target sample should be twelfth-grade mathematics lessons in upper secondary schools, because there are several special characteristics of mathematics teaching in twelfth-grade lessons. Twelfth-grade students are about to take two important examinations. One examination is to obtain upper secondary education diplomas and the other examination is for entrance into college or university. Mathematics is an important subject for both examinations, so it is very interesting to closely examine twelfth-grade mathematics classrooms in Vietnam.

This video study can be conducted following the same stages in the video study in lower secondary schools presented here. The results of this video study can be used to interpret more deeply the mathematics teaching in upper secondary schools in Vietnam and these results can be used to compare with the results of the video study in lower secondary schools presented above.

The videotaped lessons and the results of this video study should be translated into English for international comparison.

The videotaped lessons and the results of this video study may be very useful for lecturing in Mathematics Education at the Hanoi National University of Education.

7.2.3. Instructing pedagogy students in the Faculty of Mathematics and Informatics at Hanoi National University of Education to conduct their own video study on a small scale

Every year, there are some prospective teachers in the Faculty of Mathematics and Informatics at Hanoi National University of Education who are planning to write their final thesis paper. Video study may bring out new approaches for this task.

It is possible for prospective teachers to conduct their own video study on a small scale to interpret more closely what happens inside mathematics classrooms in upper secondary schools in Vietnam.

Before the prospective teachers write their final thesis, they have to go to upper secondary schools for teaching practice over a number of months. It is quite advantageous for students to videotape these mathematics lessons. Each student has about 6 months to write the final thesis, so a video study on a small scale is totally possible.

It is better if the prospective teachers can videotape the in-service teachers' mathematics lessons. However, as mentioned above, the school and the teachers may not allow them to videotape their lessons. In this case, the prospective teachers can videotape their own lessons when they teach mathematics in upper secondary schools as part of their teaching practice. Usually, there is a group of prospective mathematics teachers practice-teaching in the same school, so the number of lessons for this video study would be enough for one video study on a small scale.

With the advantages above, we suggest these plans for instructing pedagogy students in the Faculty of Mathematics and Informatics at Hanoi National University of Education to conduct their own video study on a small scale as follows:

❖ Firstly, when a student wants to conduct a video study on a small scale for the thesis, we ask that the student carefully study the documents of the TIMSS Video Study, such as the data collection manual and the mathematics video coding manual (see Jacobs et al, 2003).

- ❖ Ask the student to choose one or more aspects to code in the videotaped lessons, for example the student can only code about the *Content Activity* or *Classroom Interaction*, or so on. It is better if we ask different students to choose different aspects to code. After choosing the aspects to code, ask the student to carefully study these chosen aspects again.

- ❖ Introduce one or more videotaped lessons to the student, asking that the student try to code these videos according to the chosen aspects. Discuss the difficult situations to code with the student. At this time, ask the student to write a part of the thesis paper.

- ❖ When the student goes to the upper secondary schools for teaching practice up to 6 weeks, ask the student to videotape about 6 to 10 lessons in that school. As mentioned above, these lessons can be taught by in-service teachers or other prospective teachers, or even by the particular student in question. At this time, ask the student to code these videos according to chosen aspects and analyze the data.

- ❖ After the teaching practice period, the student has about one month to complete the thesis.

This video study on a small scale may be conducted in about 6 months.

We need to design a website to collect and organize the videotaped lessons and the results of these video studies. This website will be very helpful for students in secondary schools, for prospective teachers at universities of education, for in-service teachers in secondary schools, for lecturers at universities of education, and even for educational researchers.

7.3. Summary

This dissertation summarized the findings of the study in this chapter. It can be said that the dissertation carried out the research tasks quite well. However, the limitations of time and finances did not allow a study as comprehensive as the TIMSS Video Studies. So, the need for further studies arose and was presented in this chapter.

This dissertation identified a new approach in studying mathematics education in Vietnam. This approach will be hopefully become popular nation-wide.

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APPENDIX A. Random selection methods

1. Proportionate to Population Size (PPS) method

❖ Sullivan, May, and Maberly (2000) suggested the way to use the PPS method by making a list with four columns (see table below):

> The first column lists the name of each community [or school]. The second column contains the total [student] population of each community [or school]. The third column contains the cumulative [student] population which is obtained by adding the [student] population of each community [or school] to the combined [student] population of the communities preceding it on the list. The list can be in any order, such as alphabetical order, from smallest to largest [student] population, or any other order. (pp. 22-23)

The fourth column is used for identifying which communities [or schools] will have one or more clusters selected.

Name	Population (student)	Cumulative Population (student)	Cluster
Hanoi	339170	339170	1, 2
Vinh Phuc	56496	395666	
Bac Ninh	63672	459338	3
Quang Ninh	66774	526112	
Hai Duong	95205	621317	
Hai Phong	90806	712123	4
…..	…..	…..	….
Ho Chi Minh City	311096	4079445	20, 21
…..	…..	….	….

❖ Sullivan, May, and Maberly (2000) also suggested four steps to select communities (schools) using the PPS method (for example we intend to select 25 clusters to survey):

> Step 1: Calculate the sampling interval [k] by dividing the total [student] population by the number of clusters [k = 4945178/25 = 197807].
> Step 2: Choose a random starting point [x] between 1 and the sampling interval (*k*, in this example, [197807]). [x = round(k*rand(),0) in excel) for example x = 40135].
> Step 3: The first cluster will be where the [40135th] individual is found, based on the cumulative [student] population column, in this example, [Hanoi].
> Step 4: [The next clusters will be where the $(x + k)^{th}$, $(x + 2k)^{th}$, $(x +3k)^{th}$, and so on, up to $(x + 25k)^{th}$ individual is found]. In communities with large [student]

populations, more than one cluster will probably be selected [e.g Hanoi, Ho Chi Minh City]. (pp. 22-23)

2. Selection of schools using the systematic selection method

According to Sullivan, May, and Maberly (2000), five steps can be used to randomly select schools using the systematic selection method as follows:

> Step 1: Obtain a list of the schools and number them from 1 to *N* (the total number of schools, [for example N = 600])
> Step 2: Determine the number of schools to sample (*n*), which is usually thirty.
> Step 3: Calculate the "sampling interval" (*k*) by N/n (always round down to the nearest whole integer) [for example k = 600/30 = 20].
> Step 4: [Select a random number x] between 1 and *k* [x = round(k*rand(),0) in excel, for example x = round(20*rand(),0) = 15. The first school to be selected is the 15^{th} school on the list].
> Step 5: Select every k^{th} school after the first selected school. [For example the selected schools are 15^{th}, 35^{th}, 55^{th},…595^{th} schools on the list]. (p. 24)

APPENDIX B. Questionnaires in Vietnamese

1. **Student questionnaire (translated from Jacobs et al., 2003, pp. 247-251)**

PHIẾU ĐIỀU TRA HỌC SINH
LỚP 8

MÃ SỐ VIDEO #: □ □ □ □ □ □ □ □ □ □ □ □

TIMSS-R Video Study
James Stigler- Study Director
12436 Santa Monica Blvd.
Los Angeles, CA 90025

TIMSS-R

Videotape Classroom Study

PHIẾU ĐIỀU TRA HỌC SINH

Cảm ơn bạn đã tham gia vào nghiên cứu của chúng tôi. Cả video lẫn phiếu điều tra sẽ chỉ sử dụng vào mục đích nghiên cứu, trừ khi bạn đã ký một thỏa thuận có những điều khoản khác. Những người có quyền sử dụng thông tin này sẽ được cấp phép để bảo vệ sự riêng tư của bạn.

Cảm ơn sự chú tâm của bạn tới phiếu điều tra này. Chúng tôi đánh giá cao thời gian bạn đang sử dụng để giúp chúng tôi hiểu tốt hơn việc dạy học toán.

Tên trường: ____

1. Ngày tháng năm sinh

    NGÀY___ ___ THÁNG ___ ___ NĂM ___ ___ ___ ___

2. Giới tính

    Khoanh tròn vào A hoặc B.

    Nam………………..A
    Nữ………………….B

3. Dân tộc ……………………… Tôn giáo …………

4. Có phải bạn sinh ra ở Việt Nam không ?

    Khoanh tròn A hoặc B

    Phải……………..A

    Không phải………B

5. Nếu bạn không sinh ra tại Việt Nam thì bạn tới Việt Nam khi bạn bao nhiêu tuổi ?

    Điền tuổi của bạn.

    Tôi __________ tuổi khi tôi tới Việt Nam.

6. Bạn có thường xuyên nói tiếng Việt ở nhà không ??

    Khoanh tròn một trong các lựa chọn ở dưới.

    Luôn luôn hoặc hầu như là luôn luôn…………..A
    Khoảng một nửa thời gian……………………...B
    Rất hiếm khi hoặc không bao giờ………………C

7. Có bao nhiêu thành viên trong gia đình bạn?
Viết tổng số người.

__________ *(Đừng quên tính cả bạn.)*

8. Trình độ học vấn của cha mẹ bạn?
Khoanh tròn 1 chữ cái trong mỗi cột

	Bố	Mẹ
a. Hết tiểu học…………………………………………………………	A	..A
b. Học đến trung học...…………………………………………………	B	..B
c. Tốt nghiệp trung học...………………………………………………	C	..C
d. Học trường hướng nghiệp/kỹ thuật sau khi tốt nghiệp trung học………	D	..D
e. Học đến cao đẳng hoặc đại học…………………………………………	E	..E
f. Tốt nghiệp cử nhân ở trường cao đẳng hoặc đại học…………………....	F	..F
g. Tôi không biết………………………………………………………	G	..G

9. Bạn mong đợi sẽ học đến trình độ nào?

a. Hết tiểu học..	A
b. Học đến trung học...	B
c. Tốt nghiệp trung học..	C
d. Học trường hướng nghiệp/kỹ thuật sau khi tốt nghiệp trung học	D
e. Học đến cao đẳng hoặc đại học…………………………..........	E
f. Tốt nghiệp cử nhân ở trường cao đẳng hoặc đại học……...........	F
g. Tôi không biết…...	G

10. Có phải mẹ của bạn được sinh ra ở Việt Nam không?
Khoanh tròn A hoặc B

Phải……………..A

Không phải...……B

11. Có phải bố của bạn được sinh ra ở Việt Nam không?
Khoanh tròn A hoặc B

Phải……………..A

Không phải...……B

12. Nhà bạn có bao nhiêu quyển sách? (không kể tạp chí, báo hoặc sách học của bạn).
Khoanh tròn chỉ một trong các chữ cái A-E

Không có hoặc rất ít (1-10 quyển)…………………………………………..A

Một giá sách (11-25 quyển)……………………………………………….B

Một tủ sách (26-100 quyển)………………………..............................C

Hai tủ sách (101-200 quyển)……………………………………………...D

Lớn hơn hoặc bằng ba tủ sách (hơn 200 quyển)……………………............E

Cảm ơn bạn!

2. **Teacher questionnaire (translated from Jacobs et al., 2003, pp. 227-244)**

PHIẾU ĐIỀU TRA
GIÁO VIÊN TOÁN
LỚP 8

MÃ VIDEO. #: □ □ □ □ □ □ □ □ □ □ □ □

TIMSS Videotape Study Center
James Stigler- Study Director
LessonLab, Inc.
12436 Santa Monica Blvd.
Los Angeles, CA 90025

HƯỚNG DẪN:

• Xin vui lòng điền vào phiếu điều tra sớm nhất có thể sau khi việc quay video đã hoàn tất – Thích hợp nhất là vào cùng ngày quay video.

• Nếu có thể, xin thầy cô vui lòng gửi kèm bản copy giáo án hoặc những ghi chép của tiết học được quay video (Xem câu hỏi 5)

• Xin gửi kèm theo một bản copy việc đánh giá cho điểm (bài kiểm tra, thi vấn đáp…) của thầy cô trong tiết học. (Xem câu hỏi 20).

• Gửi phiếu điều tra, giáo án, bản đánh giá cho điểm trong cùng một phong bì đã cung cấp trước sớm nhất có thể.

• Nếu thầy cô chưa có sẵn bản đánh giá cho điểm, gửi phiếu điều tra trước, và gửi bản đánh giá cho điểm sau.

• Chi phí gửi thư sẽ được gửi cho các thầy cô cho tới khi chúng tôi nhận được tài liệu.

CẤU TRÚC CỦA PHIẾU ĐIỀU TRA:

Phiếu điều tra này được chia thành 7 mục hỏi về các vấn đề sau:

A. TIẾT HỌC ĐƯỢC QUAY VIDEO: Tiết học chúng tôi đã quay video và học sinh trong lớp
B. MỐI QUAN HỆ CỦA TIẾT HỌC NÀY VỚI TOÀN BỘ CHƯƠNG TRÌNH: Tiết học này có mối quan hệ như thế nào với chuỗi các tiết học khác
C. CÓ NÉT GÌ ĐẶC TRƯNG? Tiết học này có gì đặc trưng hoặc có gì không thường xuyên diễn ra trong lớp học của thầy cô
D. QUAN NIỆM CỦA BẠN VỀ DẠY HỌC: hỏi về những cái ảnh hưởng và chỉ dẫn việc dạy học toán của thầy cô
E. TRÌNH ĐỘ VÀ KINH NGHIỆM CỦA THẦY CÔ: hỏi về kinh nghiệm dạy học và giáo dục cũng như khối lượng công việc dạy học của thầy cô
F. TRƯỜNG CỦA THẦY CÔ: Số lượng học sinh, giáo viên và lớp học ở trường của thầy cô
G. THÁI ĐỘ: Thái độ của thầy cô về dạy học Toán

TIMSS-R

VIDEOTAPE CLASSROOM STUDY

PHIẾU ĐIỀU TRA GIÁO VIÊN TOÁN LỚP 8

Cảm ơn sự tham gia của thầy cô vào nghiên cứu này. Cả video cũng như phiếu điều tra sẽ chỉ sử dụng vào mục đích nghiên cứu, trừ khi thầy cô ký một thỏa thuận có điều khoản khác. Những người có quyền sử dụng thông tin này sẽ được cấp phép để bảo vệ sự riêng tư của thầy cô.

Cảm ơn sự chú tâm của thầy cô vào phiếu điều tra này. Chúng tôi đánh giá cao thời gian mà thầy cô đang sử dụng để giúp chúng tôi hiểu tốt hơn việc dạy học toán.

Tên của thầy cô: ____________________________________ ☐ Nam ☐ Nữ

Tên trường: _________________________________ Ngày: ___________________

Tên khóa học được quay video: _______________________

Tỉnh, thành phố: ______________________________________

Số buổi học toán của lớp được quay video hàng tuần _______________

Thời gian mỗi buổi ? _______________ phút cho mỗi buổi học

Trình độ học sinh trong lớp: ________; Số lượng học sinh nữ trong lớp ____
Số lượng học sinh nam trong lớp ____

(Điền số 0 nếu không có nam hoặc nữ)

Số điện thoại liên lạc nếu chúng tôi có nảy sinh câu hỏi (_____)______-________

Thời gian tốt nhất trong ngày chúng tôi có thể gọi điện cho thầy cô ……….Sáng/Chiều

Địa chỉ email ____

A. TIẾT HỌC ĐƯỢC QUAY VIDEO

1. Vui lòng miêu tả các đối tượng, vấn đề, nội dung trong tiết học được quay video. (có thể chọn nhiều ô)

- ☐ 1. Tính toán với số nguyên
- ☐ 2. Tính toán với phân số
- ☐ 3. Tính toán với phân số thập phân
- ☐ 4. Tính chất của số nguyên và phân số
- ☐ 5. Tập số nguyên
- ☐ 6. Phần trăm
- ☐ 7. Ước lượng và làm tròn số
- ☐ 8. Đơn vị đo chiều dài
- ☐ 9. Diện tích
- ☐ 10. Thể tích
- ☐ 11. Hình và góc
- ☐ 12. Áp dụng các trường hợp bằng nhau và đồng dạng trong hình học
- ☐ 13. Chứng minh sự bằng nhau và đồng dạng trong hình học
- ☐ 14. Phép đối xứng, phép tịnh tiến, phép quay
- ☐ 15. Tỉ lệ và tỉ lệ thức
- ☐ 16. Hàm số, quan hệ và mô hình
- ☐ 17. Phương trình, đẳng thức, bất phương trình, bất đẳng thức
- ☐ 18. Dữ liệu và thống kê
- ☐ 19. Xác suất
- ☐ 20. Tập hợp và lôgic
- ☐ 21. Khác (vui lòng chỉ rõ)

____

2. Những yếu tố sau đây có vai trò như thế nào trong quyết định dạy học nội dung này của thầy cô?
Xin hãy chọn 1 ô trong mỗi dòng.

	Không có vai trò	Đóng vai trò rất nhỏ	Đóng vai trò chính
a. Đường lối chỉ đạo chương trình dạy học của quốc gia, tỉnh thành hoặc của nhà trường	☐	☐	☐
b. Các kì thi hoặc các bài kiểm tra đã được chuẩn hóa	☐	☐	☐
c. Nội dung này có trong sách giáo khoa phải dạy	☐	☐	☐
d. Sự thoải mái và hứng thú của thầy cô với nội dung này	☐	☐	☐
e. Đánh giá của thầy cô về nhu cầu và sự quan tâm của học sinh	☐	☐	☐
f. Làm việc hợp tác với các giáo viên khác hoặc người cố vấn	☐	☐	☐

3. Nếu thầy cô đánh dấu "Đóng vai trò chính" cho sự chọn lựa (a) ở câu hỏi 2 trên, vui lòng liệt kê những đường lối chỉ đạo hoặc những tài liệu mà thầy cô đã dung:________________________
____

4. Thầy cô đã sử dụng những thứ dưới đây ở mức độ nào khi lập kế hoạch cho tiết học này, (không phải là những tài liệu cần thiết thầy cô đã sử dụng trong quá trình giảng dạy)…

	Không sử dụng	Một Chút ít	Một vài	Khá nhiều	Rất nhiều
a. Một giáo án mà thầy cô đã chuẩn bị và sử dụng trước đó	☐	☐	☐	☐	☐
b. Kế hoạch dạy học được phát triển bởi Các nhà giáo dục khác	☐	☐	☐	☐	☐
c. Một bài soạn mà thầy cô hợp tác với các thầy cô khác hoặc các chuyên gia toán học khác	☐	☐	☐	☐	☐
d. Sách giáo khoa	☐	☐	☐	☐	☐
e. Sách giáo viên	☐	☐	☐	☐	☐
f. Cái thay thế sách hướng dẫn giáo viên (bộ đồ nghề, Các học phần, sách hướng dẫn thực hành..)	☐	☐	☐	☐	☐
g. Nguồn sách (sách cho mọi người, Sách tham khảo, các sách khác)	☐	☐	☐	☐	☐
h. Nguồn đa phương tiện (video, đĩa CD, TV ...)	☐	☐	☐	☐	☐
i. Internet	☐	☐	☐	☐	☐
j. Những ý tưởng từ hội thảo	☐	☐	☐	☐	☐
k. Hiểu biết về mối quan tâm, suy nghĩ hoặc Khó khăn của học sinh	☐	☐	☐	☐	☐
l. Đường lối chỉ đạo chương trình địa phương	☐	☐	☐	☐	☐

(trường, quận huyện)					
m. Tiêu chuẩn hoặc đường lối chỉ đạo chương trình của quốc gia	☐	☐	☐	☐	☐
n. Các bài kiểm tra đã được chuẩn hóa Hoặc các kì thi hiện tại	☐	☐	☐	☐	☐
o. Những cái khác (vui lòng ghi rõ)___________________	☐	☐	☐	☐	☐

5. Để chúng tối hiểu về tiết học được quay video, chúng tôi cần biết những khái niệm và kỹ năng nào đã được dạy trước đây đối với lớp này và những khái niệm và kỹ năng nào mới. Với mỗi khái niệm hoặc kỹ năng đã dạy trong tiết học được quay video, vui lòng chỉ ra nó là:

   - Chủ yếu là ôn tập lại
   - Chủ yếu là mới.

   Nếu thầy cô cần nhiều chỗ trống hơn, hãy viết tiếp vào mặt sau của tờ giấy. Xin gi nhớ: Nếu thầy cô có một bài soạn hoặc ghi chép cho tiết học được quay video, chúng tôi muốn có 1 bản copy. Vui lòng gửi kèm theo bản copy cùng với phiếu điều tra này cho chúng tôi.

Những kiến thức và kỹ năng trong tiết học được quay video chủ yếu là ôn tập lại đối với học sinh:

Những kiến thức và kỹ năng trong tiết học được quay video chủ yếu là mới đối với học sinh:

6. Kiến thức chủ yếu thầy cô muốn học sinh học được từ tiết học được quay video là gì?

7. Thầy cô có hài lòng là tiết học này đã đạt được mục đích đó không? ☐ CÓ ☐ KHÔNG

   Giải thích tại sao thầy cô lại hài lòng hoặc không hài lòng.

8. Nghĩ về việc thầy cô đã dạy tiết học này như thế nào so với ý định các thầy cô muốn dạy tiết học đó. Mức độ nào mà những điều sau đây hạn chế thầy cô không thực hiện được ý tưởng của mình?

	Không ảnh hưởng	Một chút	Một vài	Khá nhiều	Rất nhiều	Không áp dụng
a. Chỉ đạo, hướng dẫn thực hiện chương trình và/hoặc các bài kiểm tra đã được chuẩn hóa	☐	☐	☐	☐	☐	☐
b. Yếu cầu dạy quá nhiều chủ đề	☐	☐	☐	☐	☐	☐
c. Động lực hoặc sự chuẩn bị của học sinh chưa đủ để học	☐	☐	☐	☐	☐	☐
d. Độ lớn của lớp học (Nếu có sự hạn chế, vui lòng mô tả cái hạn chế đó) ____	☐	☐	☐	☐	☐	☐
e. Không đủ thời gian cho việc soạn bài	☐	☐	☐	☐	☐	☐
f. Thiếu thời gian để làm việc cùng đồng nghiệp về bài học	☐	☐	☐	☐	☐	☐
g. Không đủ sách (sách giáo khoa, sách cho mọi người, sách tham khảo..)	☐	☐	☐	☐	☐	☐
h. Thiếu thời gian để hoàn thành cái tôi dự định dạy	☐	☐	☐	☐	☐	☐
i. Thiếu máy vi tính hoặc máy vi tính lỗi thời	☐	☐	☐	☐	☐	☐
j. Thiếu các phần mềm thích hợp cho máy tính	☐	☐	☐	☐	☐	☐
k. Thiếu trang thiết bị dạy học cần thiết (Đầu video, máy chiếu…).	☐	☐	☐	☐	☐	☐
l. Thiếu tài liệu đa phương tiện cần thiết (video, đĩa CD…)	☐	☐	☐	☐	☐	☐
m. Thiếu trang thiết bị và nguồn cung cấp cho dạy học toán, (máy tính bỏ túi, thiết bị thực hành...)	☐	☐	☐	☐	☐	☐
n. Phương tiện, cơ sở vật chất không đầy đủ (độ lớn phòng học hoặc tòa nhà, đồ đạc...)	☐	☐	☐	☐	☐	☐
o. Sự tập huấn hoặc hỗ trợ không đầy đủ cho việc sử dụng những kỹ thuật công nghệ trong lớp học	☐	☐	☐	☐	☐	☐
p. Sự có mặt của máy quay và người quay video	☐	☐	☐	☐	☐	☐

9. Thầy cô dành bao nhiêu thời gian để lập kế hoạch cho tiết dạy này? ____________ phút

9b. Thầy cô thường xuyên dành bao nhiêu thời gian để lên kế hoạch cho những kiểu tiết toán như thế này? ____ phút

10. Học sinh của thầy cô có làm việc theo nhóm một lúc nào đó trong tiết dạy này hay không?

☐ CÓ ☐ KHÔNG

11. Nếu có, vui lòng mô tả thành phần chính của mỗi nhóm (chẳng hạn: trình độ, giới tính, học sinh lựa chọn….).

12. Nghĩ về sự sẵn có của những hạng mục sau ở trường của thầy cô. Thầy cô có cơ hội sử dụng những hạng mục này trong lớp học của mình ở mức độ nào?

	Đủ cơ hội	Quá ít	Không có Cơ hội
a. Máy vi tính			
b. Phần mềm máy tính			
c. Máy vi tính với kết nối internet			
d. Thiết bị điện tử (TV, đầu video, máy chiếu)			
e. Thiết bị hỗ trợ dạy học (Chẳng hạn, thiết bị hỗ trợ thực hành..)			
f. Máy tính bỏ túi			
g. Tài liệu tham khảo (sách, báo, tạp chí)			

13. Có phải tất cả học sinh trong trường đều học cùng nội dung chương trình này?

☐ Phải (Bỏ qua câu 14) ☐ Không phải

14. Nếu không phải, nội dung chương trình này khó hơn hay dễ hơn nội dung chương trình lớp 8 chuẩn của trường? Đánh dấu một trong ba sự lựa chọn dưới đậy:

☐ Khó hơn ☐ Đây là nội dung chương trình chuẩn ☐ Dễ hơn

15. Thầy cô có ra bài tập toán về nhà và hạn phải nộp bài, chữa bài là ngày quay video không?

☐ CÓ ☐ Không (bỏ qua các câu tới câu 19)

16. Vui lòng mô tả <u>cái mà học sinh được mong đợi phải làm</u> cho những bài tập về nhà này.

17. Bài tập được giao về nhà này có mối liên hệ tới tiết học này hoặc những bài học trước đó không?

☐ Tiết học được quay video ☐ Bài học trước đó ☐ Cả hai

18. Những học sinh tiêu biểu trong lớp của thầy cô sẽ hoàn thành bài tập về nhà này trong bao lâu?

__________phút.

19. Các học sinh sẽ được chính thức đánh giá những điều họ học ở trong tiết học này hay không? (chẳng hạn: Kiểm tra vấn đáp, kiểm tra viêt, công trình nghiên cứu...)

☐ CÓ ☐ KHÔNG

20. Nếu có, họ sẽ được đánh giá bằng cách nào ? (Vui lòng gửi kèm bản copy sự đánh giá của thầy cô sẽ sử dụng cho bài tiết học hoặc đơn vị học phần).

B. ĐƠN VỊ HỌC PHẦN LỚN HƠN hoặc HỆ THỐNG CÁC BÀI HỌC LIÊN QUAN

21. Tiết học được quay video này là một phần của đơn vị lớn hơn hoặc một hệ thống các bài học liên quan, hoặc là một tiết học độc lập

☐ Tiết học độc lập ☐ Một phần của một đơn vị

(Nếu nó đứng độc lập, giải thích tại sao và bỏ cách đến câu 26)

22. Mô tả đơn vị học phần hoặc hệ thống các bài học liên quan với một nhóm từ ngắn hoặc tiêu đề:

23. Những cái chính nào thầy cô muốn học sinh học từ toàn bộ đơn vị học phần hoặc hệ thống các bài học liên quan?

24. Ước lượng có bao nhiêu tiết học trong toàn bộ hệ thống bài học hoặc đơn vị đó? ____________

25. Tiết học được quay video nằm ở vị trí nào trong hệ thống đó
(Chẳng hạn, vị trí thứ 3 trong 5 tiết)? _______

26. Để giúp chúng tôi hiểu cái chúng tôi sẽ thấy trên video, vui lòng cung cấp thông tin về tiết học được quay video và về hai bài học trước đó và hai bài học sau đó.

- Vui lòng mô tả những yếu tố chính mà thầy cô muốn học sinh học từ những bài học này
- Vui lòng chọn 1 hoặc 2 từ mà phần lớn các thầy cô ở Việt Nam sử dụng để mô tả mỗi <u>kiểu bài học</u> này (chẳng hạn, ôn tập, bài mới...)

	Những cái chính mà bạn muốn học sinh học từ bài học	Kiểu bài
Bài trước bài gần đây		
Bài gần đây		
Bài được quay video	**KHÔNG ĐIỀN VÀO ĐÂY**	
Bài sau ngay đây		
Bài tiếp theo bài trên		

C. TIẾT HỌC ĐƯỢC QUAY VIDEO CÓ TÍNH CHẤT ĐIỂN HÌNH NHƯ THẾ NÀO?

27. Đối với nghiên cứu này, chúng tôi quan tâm nắm bắt việc dạy học toán điển hình của thầy cô. Nó rất quan trọng cho chúng tôi để biết những kiểu dạy học nào trong tiết học này có lẽ không phải là điển hình

Thầy cô có thường xuyên sử dụng phương pháp dạy học như đã dạy trong tiết học này không?

- ☐ hiếm khi
- ☐ thỉnh thoảng
- ☐ thường xuyên
- ☐ Hầu như là luôn luôn

28. Cái gì khác biệt trong tiết học được quay video so với cách dạy học thông thường hàng ngày của thầy cô (liệt kê bất kể thứ gì khác biệt)?

29. Thầy cô mô tả thái độ và sự tham gia của học sinh trong suốt tiết học này như thế nào?

- ☐ tốt hơn thường ngày
- ☐ như mọi khi
- ☐ tồi hơn thường ngày

30. Cái gì khác trong đặc điểm cư xử và số lượng học sinh tham gia trong tiết học này? (xin liệt kê bất kể cái gì khác biệt)

31. Nội dung của tiết học khó hơn thường lệ đối với học sinh hay như nhau hoặc dễ hơn ?

- ☐ khó hơn cho học sinh hơn phần lớn các bài học khác
- ☐ như nhau
- ☐ dễ hơn

32. Thầy cô có nghĩ là sự hiện diện của camera gây cho thầy cô dạy tốt hơn thường ngày hay kém hơn hoặc như nhau?

- ☐ Tốt hơn thường ngày
- ☐ Như nhau
- ☐ Kém hơn

D. NHỮNG TƯ TƯỞNG ĐỊNH HƯỚNG VIỆC DẠY HỌC CỦA THẦY CÔ

33. Liệt kê ba thứ quan trọng nhất trong toán mà thầy cô muốn học sinh học được năm nay.

1. ______________________________

____

2. ______________________________

____

3. ______________________________

5. Nói chung, tôi cảm thấy thoải mái thử kỹ thuật mới cho dạy học toán ở lớp tôi.

- ☐ Tôi đồng ý
- ☐ Không có ý kiến gì
- ☐ Tôi không đồng ý

6. Nói chung, tôi theo kịp được với những quan điểm dạy học gần đây.

- ☐ Tôi đồng ý
- ☐ Không có ý kiến gì
- ☐ Tôi không đồng ý

36. Thầy cô thường nghe về những quan điểm dạy học toán gần đây như thế nào?

37. Những tài liệu viết nào thầy cô hiểu là mô tả những quan điểm dạy học toán gần đây? Vui lòng liệt kê 3 tài liệu, và chỉ ra liệu thầy cô đã đọc mỗi cái như thế nào.

______________________________ Tôi đã đọc:
- ☐ tất cả nội dung của nó
- ☐ phần lớn nội dung
- ☐ một vài nội dung
- ☐ chưa đọc

______________________________ Tôi đã đọc:
- ☐ tất cả nội dung của nó
- ☐ phần lớn nội dung
- ☐ một vài nội dung
- ☐ chưa đọc

______________________________ Tôi đã đọc:
- ☐ tất cả nội dung của nó
- ☐ phần lớn nội dung
- ☐ một vài nội dung
- ☐ chưa đọc

38. Thầy cô cảm thấy tiết học được quay video phù hợp với quan điểm dạy học toán gần đây ở mức độ như thế nào?

- ☐ rất phù hợp
- ☐ đôi phần

☐ rất ít
☐ không phù hợp chút nào (bỏ cách tới câu 41)

39. Vui lòng mô tả một phần tiết học được quay video mà thầy cô cảm thấy như là ví dụ điển hình cho quan điểm dạy học toán gần đây và giải thích tại sao thầy cô nghĩ nó là ví dụ điển hình cho những quan điểm này.

40. Như là một phần hoạt động phát triển nghề nghiệp, trong những năm qua, các giáo viên đồng nghiệp có thường xuyên quan sát thầy cô dạy hoàn chỉnh một bài dạy toán không? (không bao gồm sự quan sát được tạo ra trong những tình huống dạy học theo đội hoặc là một phần của sự đánh giá chính thức)

Khoanh tròn a, b, c, hoặc d

a. chưa bao giờ
b. một hoặc hai lần
c. đôi tháng một lần
d. một tháng một lần hoặc hơn

41. Như là một phần hoạt động phát triển nghề nghiệp, trong những năm qua, thầy cô có thường xuyên quan sát một giáo viên đồng nghiệp dạy hoàn chỉnh một bài dạy toán không? (không bao gồm sự quan sát được tạo ra trong những tình huống dạy học theo đội hoặc là một phần của sự đánh giá chính thức)

Khoanh tròn a, b, c, hoặc d

a. chưa bao giờ
b. một hoặc hai lần
c. đôi tháng một lần
d. một tháng một lần hoặc hơn

E. KINH NGHIỆM, TRÌNH ĐỘ VÀ SỰ ĐẢM ĐƯƠNG CÔNG VIỆC CỦA THẦY CÔ

42. Mức độ cao nhất của giáo dục chính qui của thầy cô là gì?

☐ Tập huấn giáo viên mà chưa hoàn thành THPT
☐ Trung học phổ thông
☐ Trung học phổ thông và 1 hoặc 2 năm tập huấn giáo viên
☐ Trung học phổ thông và 3 hoặc 4 năm tập huấn giáo viên
☐ Cử nhân hoặc tương đương mà không tập huấn giáo viên
☐ Cử nhân hoặc tương đương với sự tập huấn giáo viên

☐ Thạc sỹ hoặc tiến sỹ mà không tham gia tập huấn giáo viên
☐ Thạc sỹ hoặc tiến sỹ có sự tham gia tập huấn giáo viên

43. Những môn học và lớp nào mà thầy cô được cấp chứng nhận dạy học?

Môn học	Lớp

44. Chuyên ngành thầy cô học đại học, cao đẳng là gì? ________________________________

45. Chuyên ngành hẹp thầy cô học đại học, cao đẳng là gì? ________________________________

46. Chuyên ngành thầy cô học ở cao học, tiến sỹ là gì? ________________________________

47. Chuyên ngành hẹp thầy cô học ở cao học, tiến sỹ là gì ? ________________________________

48. Tính cả năm học này, bao nhiêu năm thầy cô đã dạy học? (bao gồm dạy học bán thời gian nhưng không phải là dạy học thay thế)
Vui lòng làm tròn số. ______________năm

49. Tính cả năm học này, bao nhiêu năm thầy cô đã dạy toán? (bao gồm dạy học bán thời gian nhưng không phải là dạy học thay thế)
Vui lòng làm tròn số. ______________năm

50. Trong suốt hai năm gần đây, bao nhiêu khóa học ở cao đẳng hoặc đại học mà thầy cô đã tham dự về môn toán hoặc giáo dục toán? (khoanh tròn một chữ cái.)

A. Không
B. 1
C. 2
D. 3
E. 4 hoặc hơn

51. Trong suốt hai năm gần đây, thầy cô đã tham gia vào các hoạt động phát triển nghề nghiệp hoặc tham dự các khóa học nào dưới đây? (khoanh tròn tất cả các chữ cái phù hợp).
A. sử dụng công nghệ chẳng hạn như máy tính
B. kỹ năng dạy học toán
C. dạy hợp tác nhóm
D. dạy các nội dung môn học
E. dạy học cao hơn hoặc kĩ năng tư duy
F. dạy học sinh từ nhiều nền văn hóa khác nhau

G. dạy học sinh thiếu năng ngôn ngữ
H. dạy học sinh với yêu cầu đặc biệt (chẳng hạn, khiếm thị, năng khiếu, tài năng)
I. nền tảng dạy học cơ bản
J. quản lý và tổ chức lớp học
K. các vấn đề nghề nghiệp khác
L. không thứ nào ở trên

52. Trong một tuần thông thường, tôi dành:

a) ______giờ tại trường dạy các buổi học toán. Tên các buổi đó là: ___________

____

____

b) ______ giờ tại trường để dạy các buổi học khác. Tên các buổi đó là: ______________________

____

____

c) ______ giờ tại trường gặp gỡ các giáo viên khác để làm việc về các vấn đề lập kế hoạch chương trình dạy học và nội dung chương trình.

d) ______ giờ tại trường làm công việc liên quan tới dạy học toán (chẳng hạn, soạn giáo án, chấm điểm…).

e) ______ giờ tại nhà làm công việc liên quan tới dạy toán (chẳng hạn, soạn giáo án, chấm điểm…).

f) ______ giờ tại nhà hoặc trường làm các hoạt động liên quan tới trường học.

F. CÁC CÂU HỎI VỀ TRƯỜNG CỦA THẦY CÔ

53. Liệt kê các lớp được dạy ở trường của thầy cô:___________________________________

54. Loại trường của thầy cô đang dạy là gì?

Xác định tình trạng hoặc mục đích của trường: *có thể điền nhiều ô*.

- ☐ Trường phổ thông
- ☐ Trường dạy nghề
- ☐ Trường chuyên (Mô tả loại:_______________________________________)
- ☐ Trường dân lập
- ☐ Thuộc một trường đại học
- ☐ Trường thực nghiệm sư phạm
- ☐ Trường phổ thông trong một trường phổ thông
- ☐ Trường tôn giáo, tín ngưỡng
- ☐ Trường tư thục
- ☐ Trường nam sinh, nữ sinh
- ☐ Khác (vui lòng mô tả:____)

55. Học sinh được chấp nhận vào trường như thế nào? (chẳng hạn, cư trú ở vùng lân cận trường, thi tuyển đầu vào, tất cả các học sinh muốn đến học, khác…)?

56. Năm học này có khoảng bao nhiêu giáo viên toán trong trường? _______________

G. THÁI ĐỘ DẠY HỌC.

57. Vui lòng phản hồi mỗi phát biểu sau.	Hoàn toàn đồng ý	Có phần đồng ý	Có phần không đồng ý	Hoàn toàn không đồng ý
a. Tôi say mê việc dạy học toán.	☐	☐	☐	☐
b. Tôi thích thú dạy học sinh ở độ tuổi này.	☐	☐	☐	☐
c. Tôi có đủ tài liệu, cơ sở vật chất hỗ trợ cho việc dạy học toán.	☐	☐	☐	☐
d Tôi tích cực theo đuổi cơ hội học tập để nâng cao khả năng dạy học toán.	☐	☐	☐	☐
e. Tôi đọc sách, báo về việc dạy học toán.	☐	☐	☐	☐
f. Tôi có đủ cơ hội trong các ngày ở trường để hợp tác với đồng nghiệp về toán	☐	☐	☐	☐
g. Tôi thích thú làm việc với đồng nghiệp về dạy học và chương trình toán, thậm chí đó có thể là những buổi làm việc ngoài trường học.	☐	☐	☐	☐
h. Tôi thích thú tham dự các hội nghị giáo viên toán học để học về những xu hướng dạy học toán mới.	☐	☐	☐	☐
i. Số lượng học sinh trong lớp của tôi là thích hợp cho việc dạy học toán.	☐	☐	☐	☐
j. Tôi dạy trong một môi trường mà tôi cảm thấy an toàn cho bản thân.	☐	☐	☐	☐
k. Nếu tôi phải chọn lựa lại, tôi vẫn muốn làm giáo viên lần nữa.	☐	☐	☐	☐
l. Tôi có nền tảng toán tốt trong lĩnh vực, bộ môn, nội dung tôi dạy.	☐	☐	☐	☐
m. Tôi theo đuổi các mối quan tâm, các vấn đề về toán trong cuộc sống cá nhân của tôi.	☐	☐	☐	☐
n. Tôi thích xem các chương trình ti vi về các phát triển mới trong toán học.	☐	☐	☐	☐
o. Dạy học toán là một công việc khó khăn vất vả.	☐	☐	☐	☐
p. Dạy học toán là một công việc bổ ích, đáng làm.	☐	☐	☐	☐
q. Tôi tự hào về chất lượng dạy học của tôi.	☐	☐	☐	☐
r. Tôi thích những câu hỏi của học sinh về toán học, thậm chí khi tôi không trả lời được	☐	☐	☐	☐
s. Các học sinh nữ trong trường được khuyến khích để phát triển mối quan tâm về toán	☐	☐	☐	☐
t. Tôi làm việc vất vả để lôi cuốn học sinh nữ vào toán học.	☐	☐	☐	☐
u. Tôi đặc biệt thích dạy học sinh có năng lực cao.	☐	☐	☐	☐
v Tôi đặc biệt thích dạy học sinh có năng lực thấp.	☐	☐	☐	☐
w. Tôi thích dạy một lớp mà có nhiều học sinh ở tất cả các trình độ khác nhau.	☐	☐	☐	☐

x. Tôi thường ấn tượng với chất lượng suy nghĩ của học sinh của tôi.	☐	☐	☐	☐
y. Công việc dạy toán của tôi được học sinh đánh giá cao.	☐	☐	☐	☐
z. Công việc dạy toán của tôi được cha mẹ học sinh đánh giá cao.	☐	☐	☐	☐
aa. Công việc dạy học toán của tôi được đồng nghiệp đánh giá cao.	☐	☐	☐	☐
bb. Công việc dạy học toán của tôi được các nhà quản lý đánh giá cao.	☐	☐	☐	☐

CẢM ƠN QUÝ THẦY CÔ!!!

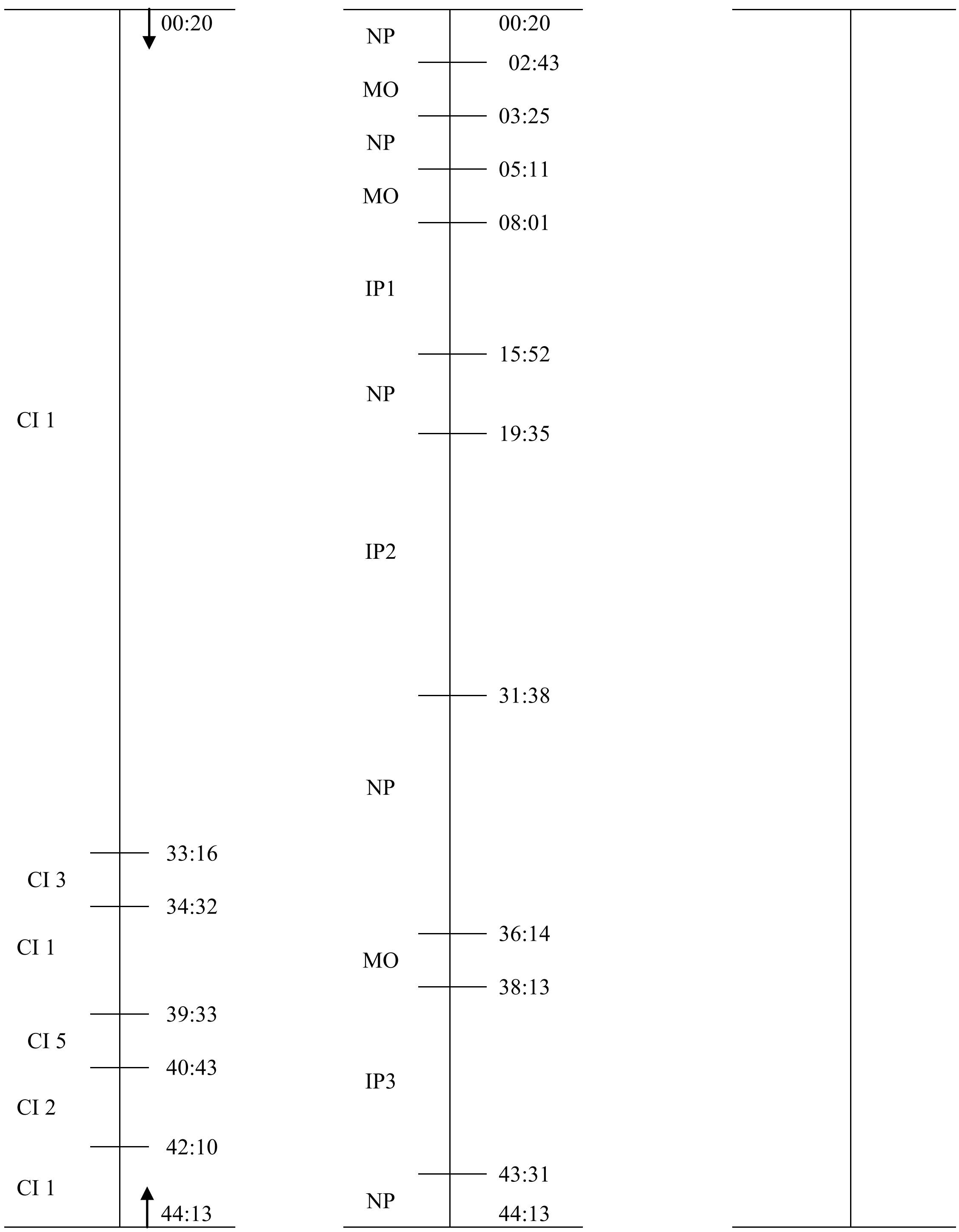
Đã hợp tác và quan tâm

Vui lòng gửi cho chúng tôi phiếu điều tra này, bài soạn hoặc ghi chép cho tiết học được quay video, bản đánh giá cho điểm của thầy cô càng sớm càng tốt

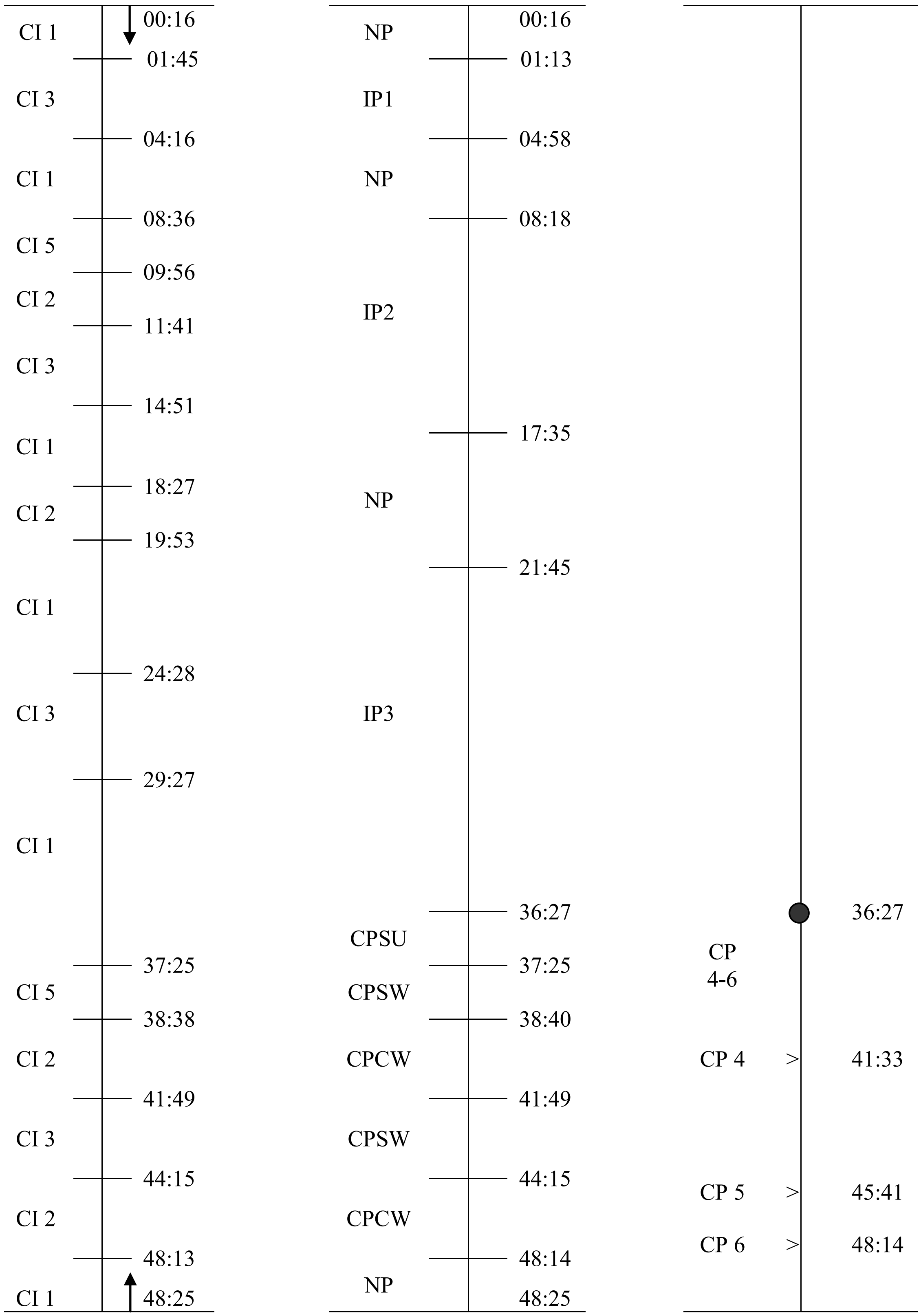
APPENDIX C. Transcriptions of coding Classroom Interaction and Content Activities

Classroom Interaction (CI) | **Content Activities (NP, MO, IP, AO, CPSU, CPSW, CPCW)** | **Concurrent Problems (CP)**

1.TH.TG



2. TH.HL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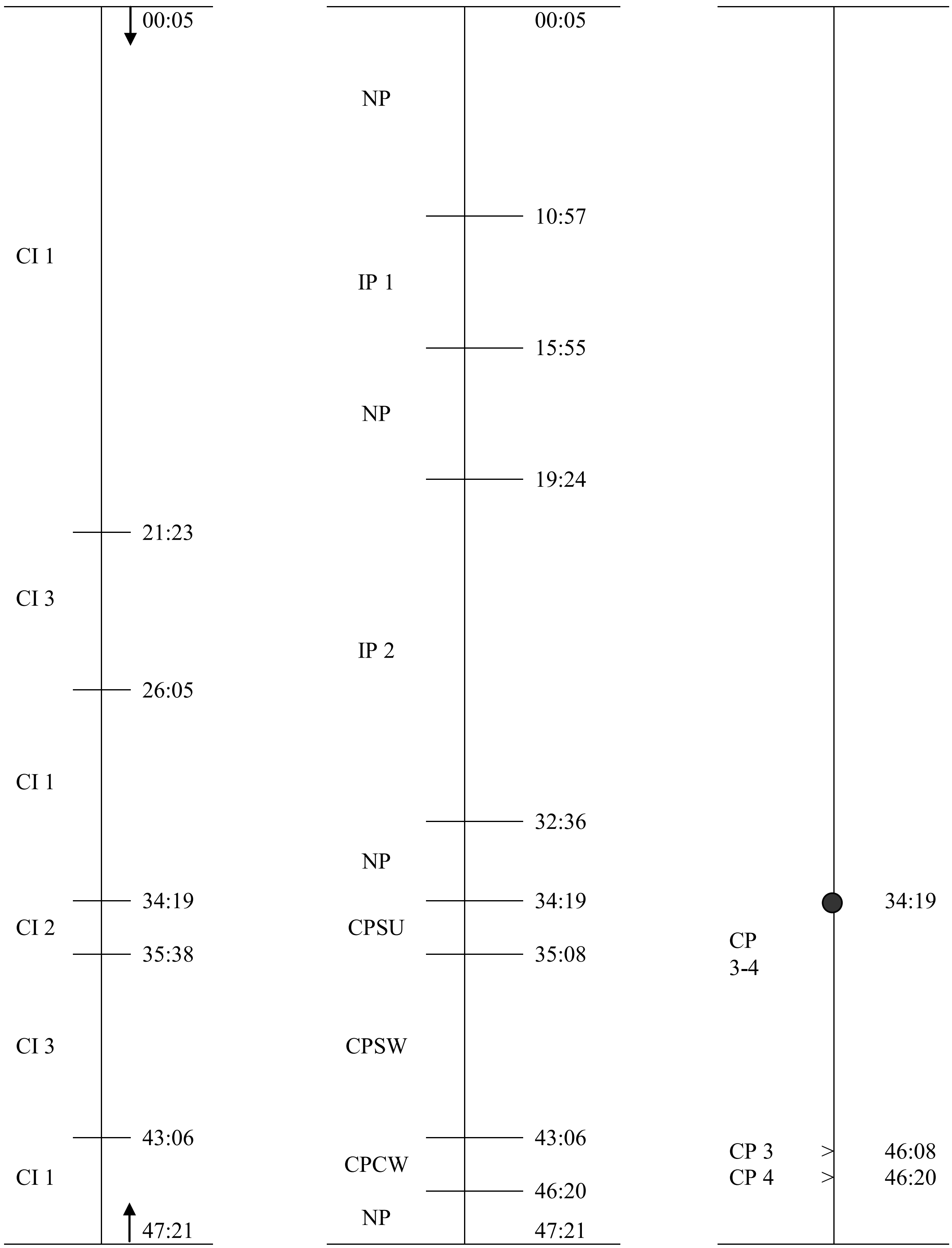
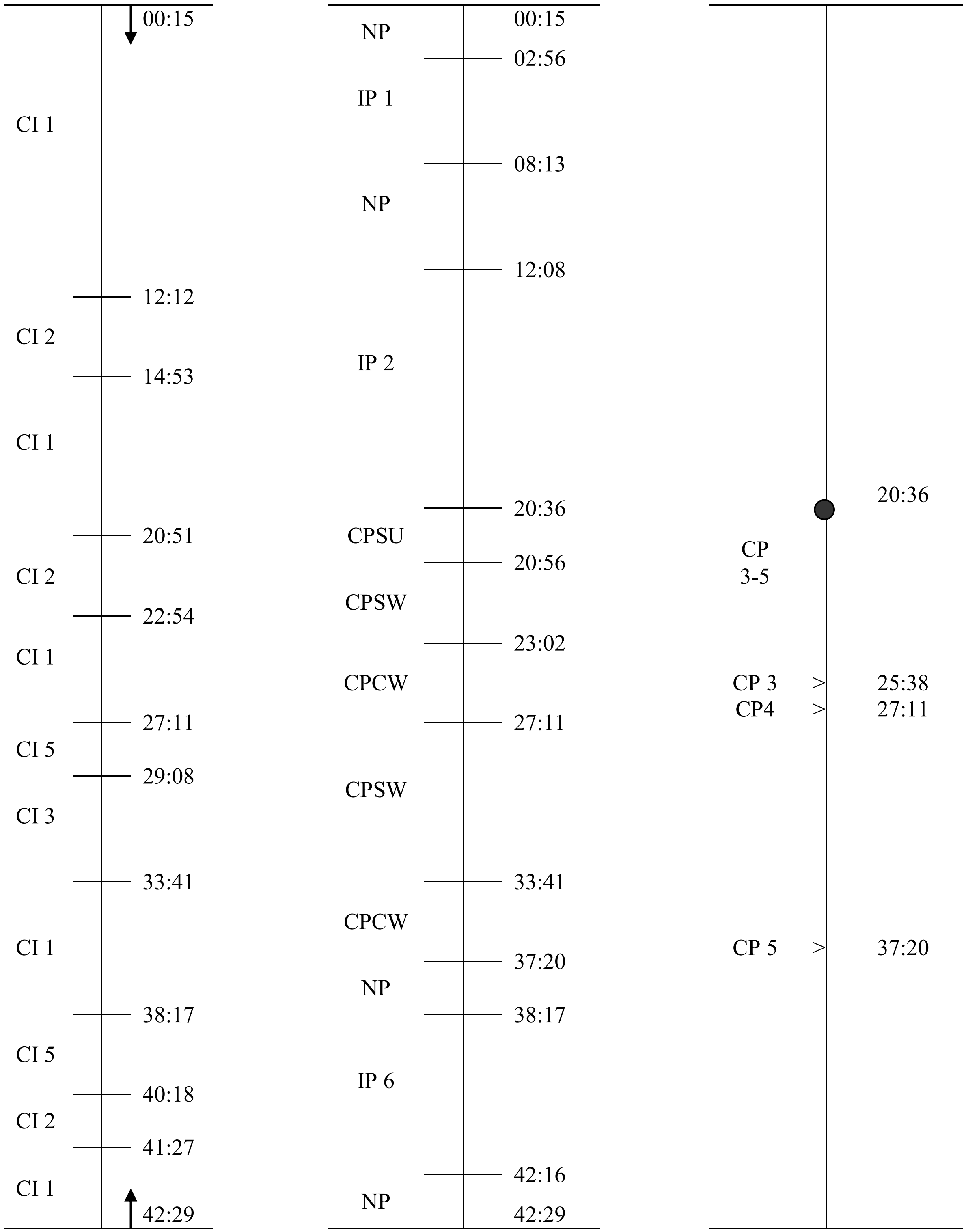
00:16
01:45
CI 3
04:16
CI 1
08:36
CI 5
09:56
CI 2
11:41
CI 3
14:51
CI 1
18:27
CI 2
19:53
CI 1
24:28
CI 3
29:27
CI 1
37:25
CI 5
38:38
CI 2
41:49
CI 3
44:15
CI 2
48:13
CI 1
48:25
NP
00:16
01:13
IP1
04:58
NP
08:18
IP2
17:35
NP
21:45
IP3
36:27
CPSU
37:25
CPSW
38:40
CPCW
41:49
CPSW
44:15
CPCW
48:14
NP
48:25
36:27
CP
4-6
CP 4
>
41:33
CP 5
>
45:41
CP 6
>
48:14

3.TH.HH



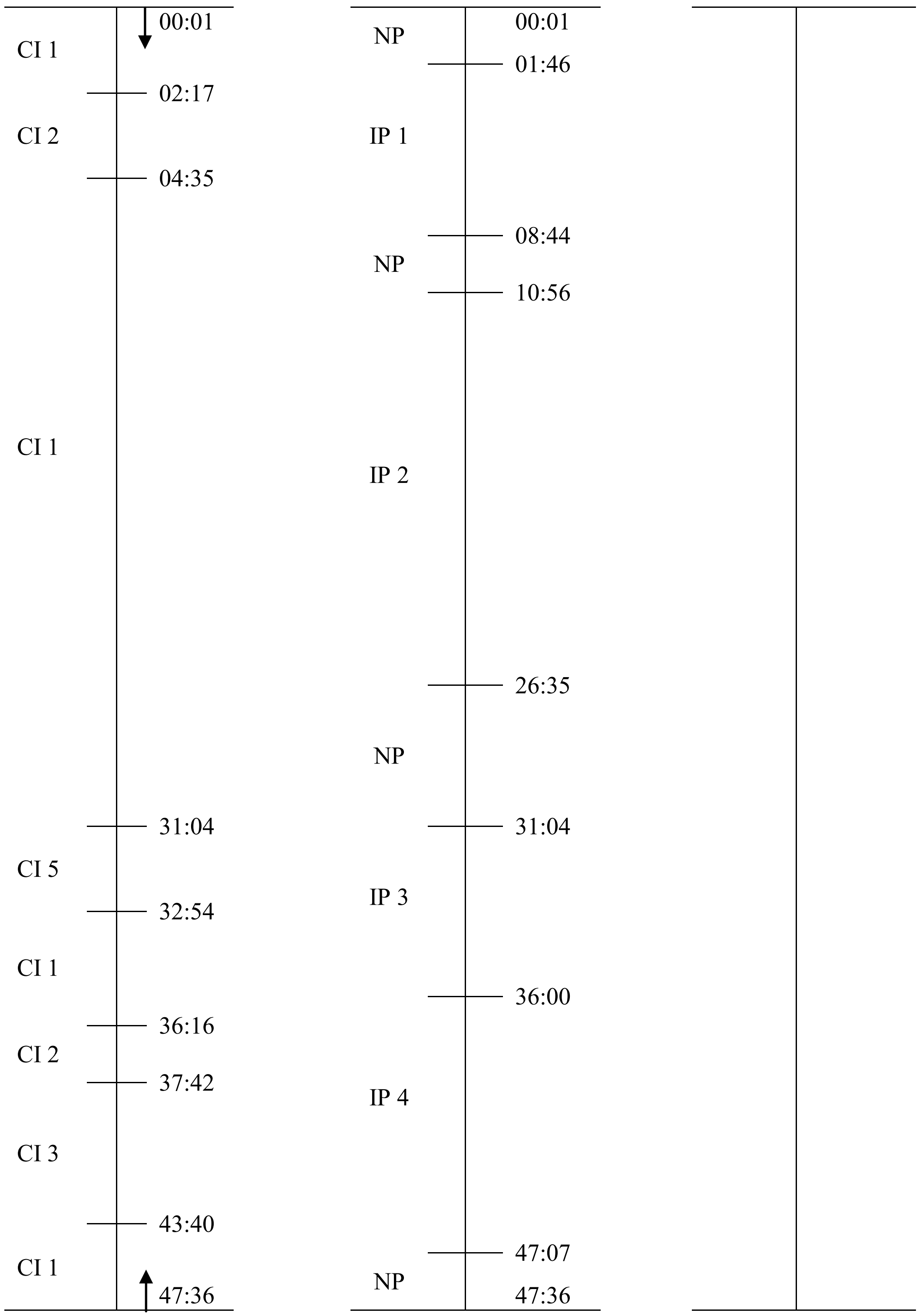
00:05
CI 1
21:23
CI 3
26:05
CI 1
34:19
CI 2
35:38
CI 3
43:06
CI 1
47:21
00:05
NP
10:57
IP 1
15:55
NP
19:24
IP 2
32:36
NP
34:19
CPSU
35:08
CPSW
43:06
CPCW
46:20
NP
47:21
34:19
CP
3-4
CP 3
46:08
CP 4
46:20

4.TH.TT

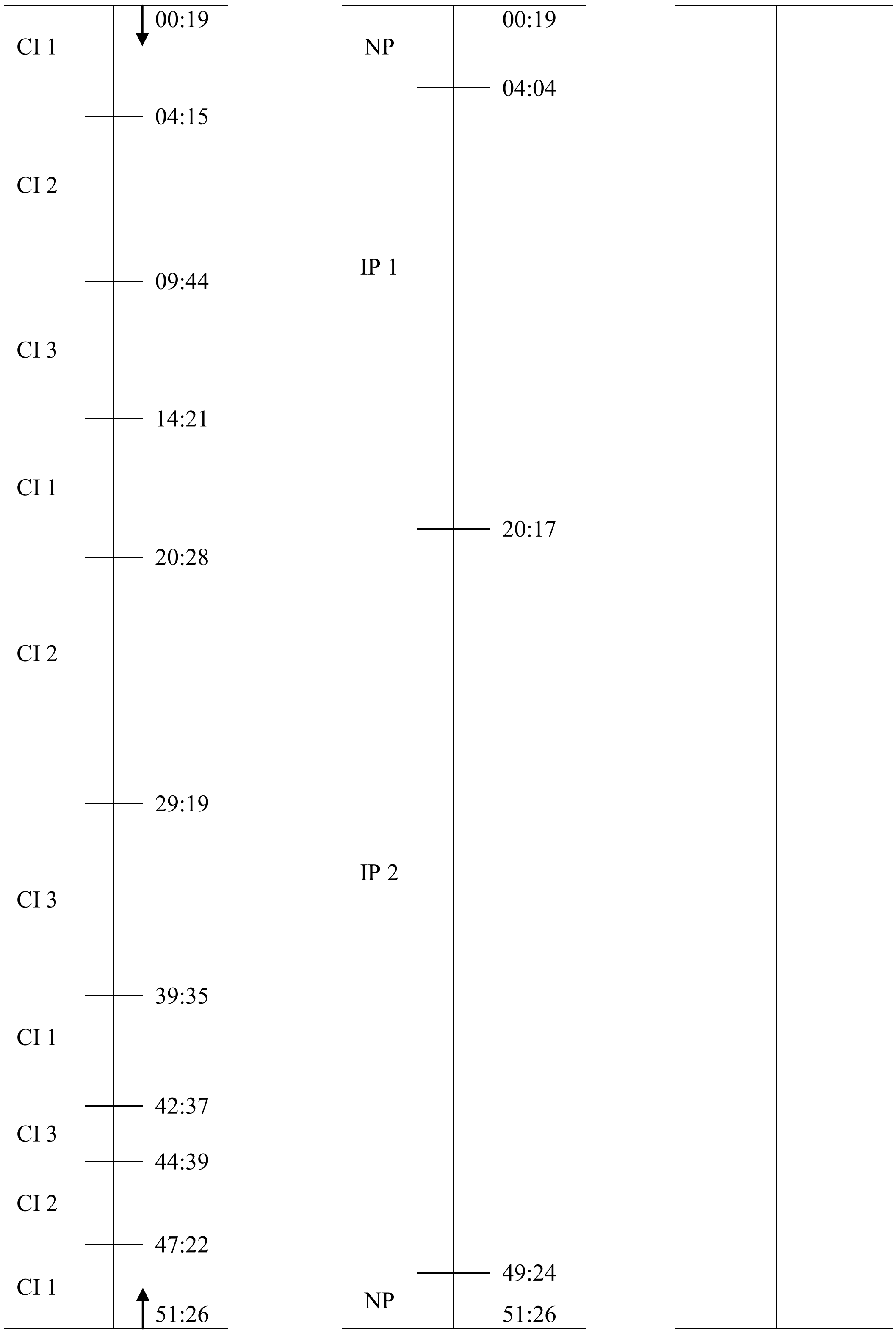


00:15
CI 1
12:12
CI 2
14:53
CI 1
20:51
CI 2
22:54
CI 1
27:11
CI 5
29:08
CI 3
33:41
CI 1
38:17
CI 5
40:18
CI 2
41:27
CI 1
42:29
NP
00:15
02:56
IP 1
08:13
NP
12:08
IP 2
20:36
CPSU
20:56
CPSW
23:02
CPCW
27:11
CPSW
33:41
CPCW
37:20
NP
38:17
IP 6
42:16
NP
42:29
20:36
CP
3-5
CP 3 > 25:38
CP4 > 27:11
CP 5 > 37:20

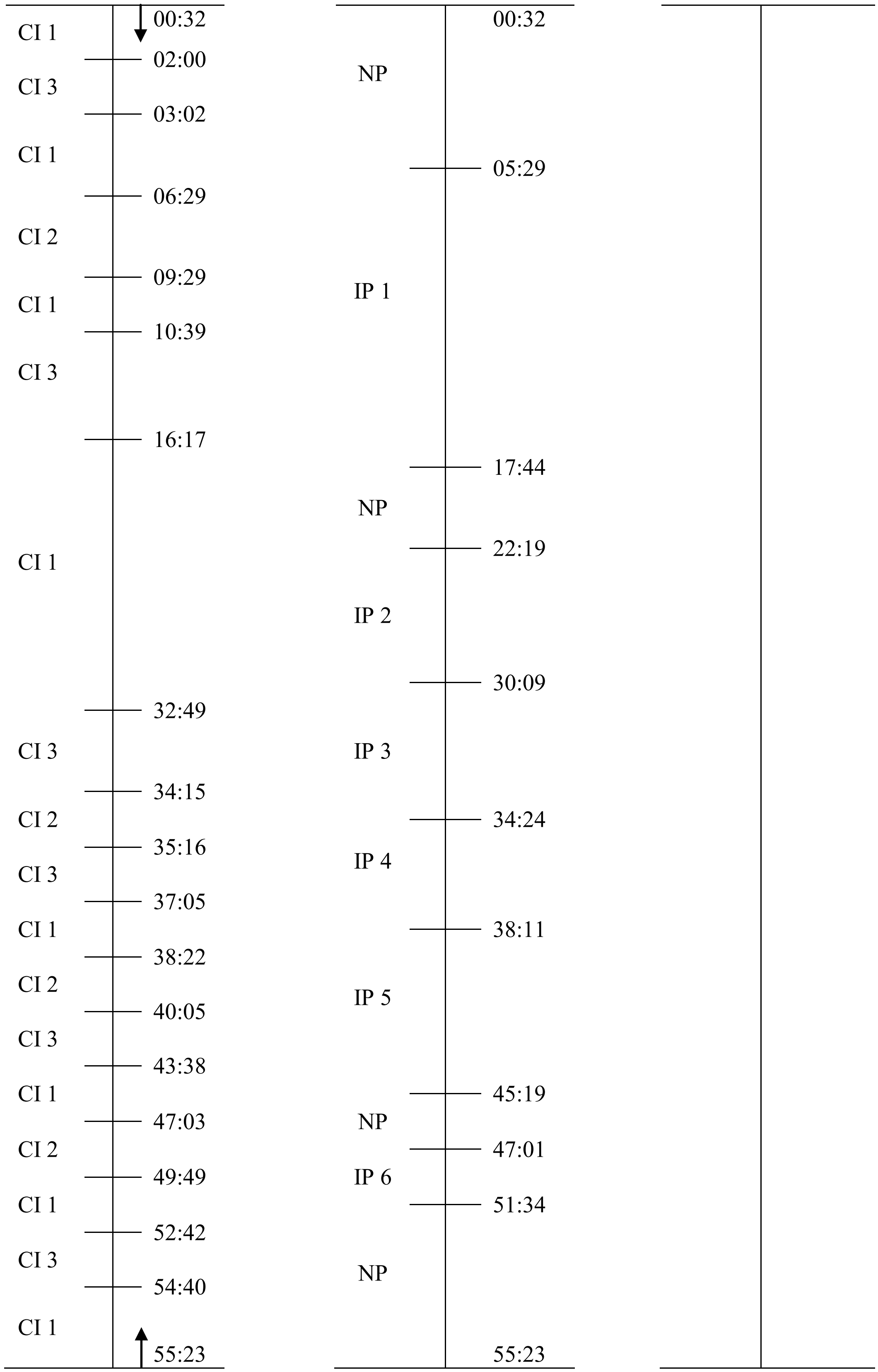
5.TH.NS1


CI 1
00:01
02:17
CI 2
04:35
CI 1
31:04
CI 5
32:54
CI 1
36:16
CI 2
37:42
CI 3
43:40
CI 1
47:36
NP
00:01
01:46
IP 1
08:44
NP
10:56
IP 2
26:35
NP
31:04
IP 3
36:00
IP 4
47:07
NP
47:36

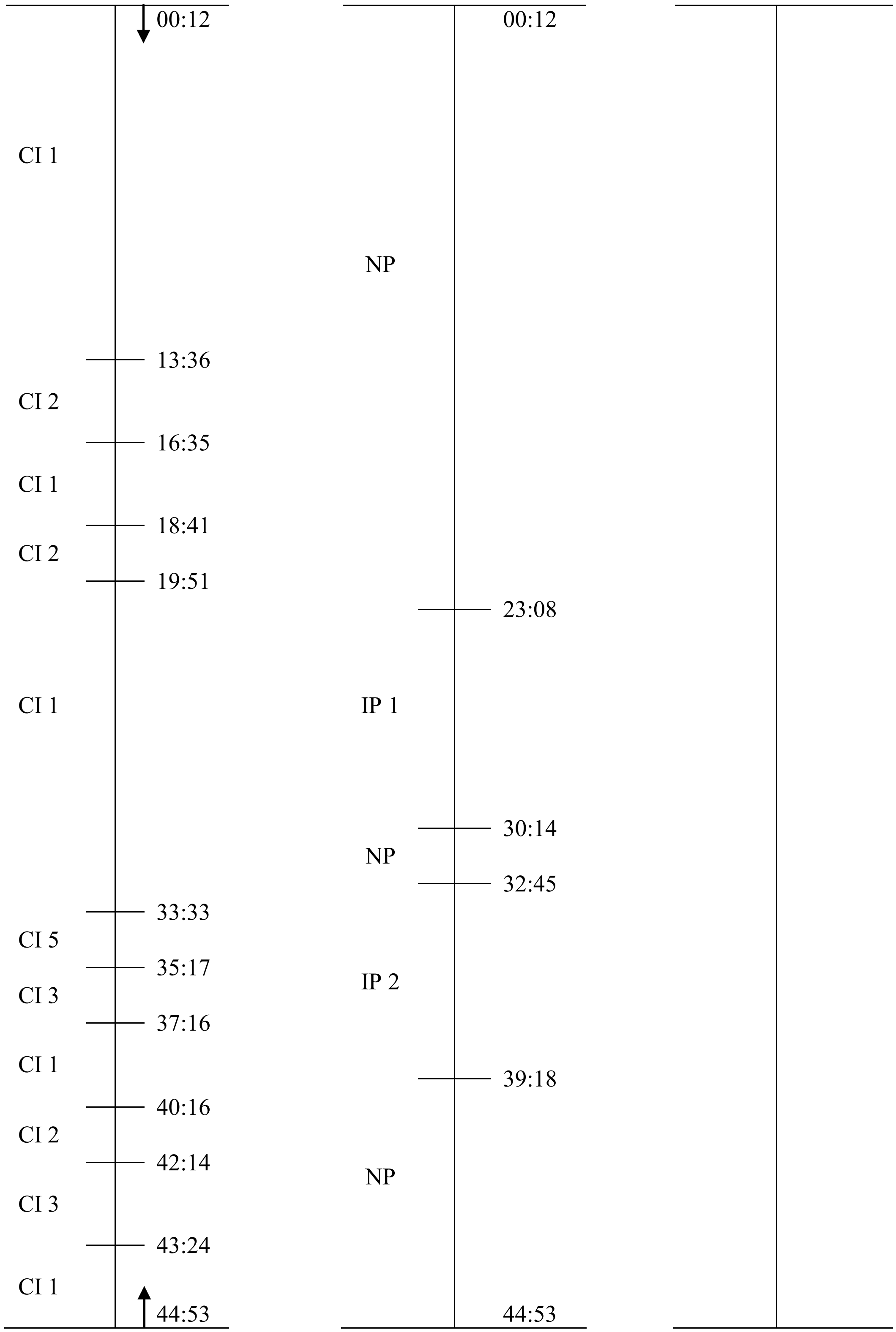
6.TH.NS2


00:19
CI 1
04:15
CI 2
09:44
CI 3
14:21
CI 1
20:28
CI 2
29:19
CI 3
39:35
CI 1
42:37
CI 3
44:39
CI 2
47:22
CI 1
51:26
00:19
NP
04:04
IP 1
20:17
IP 2
49:24
NP
51:26

7.TH.QX

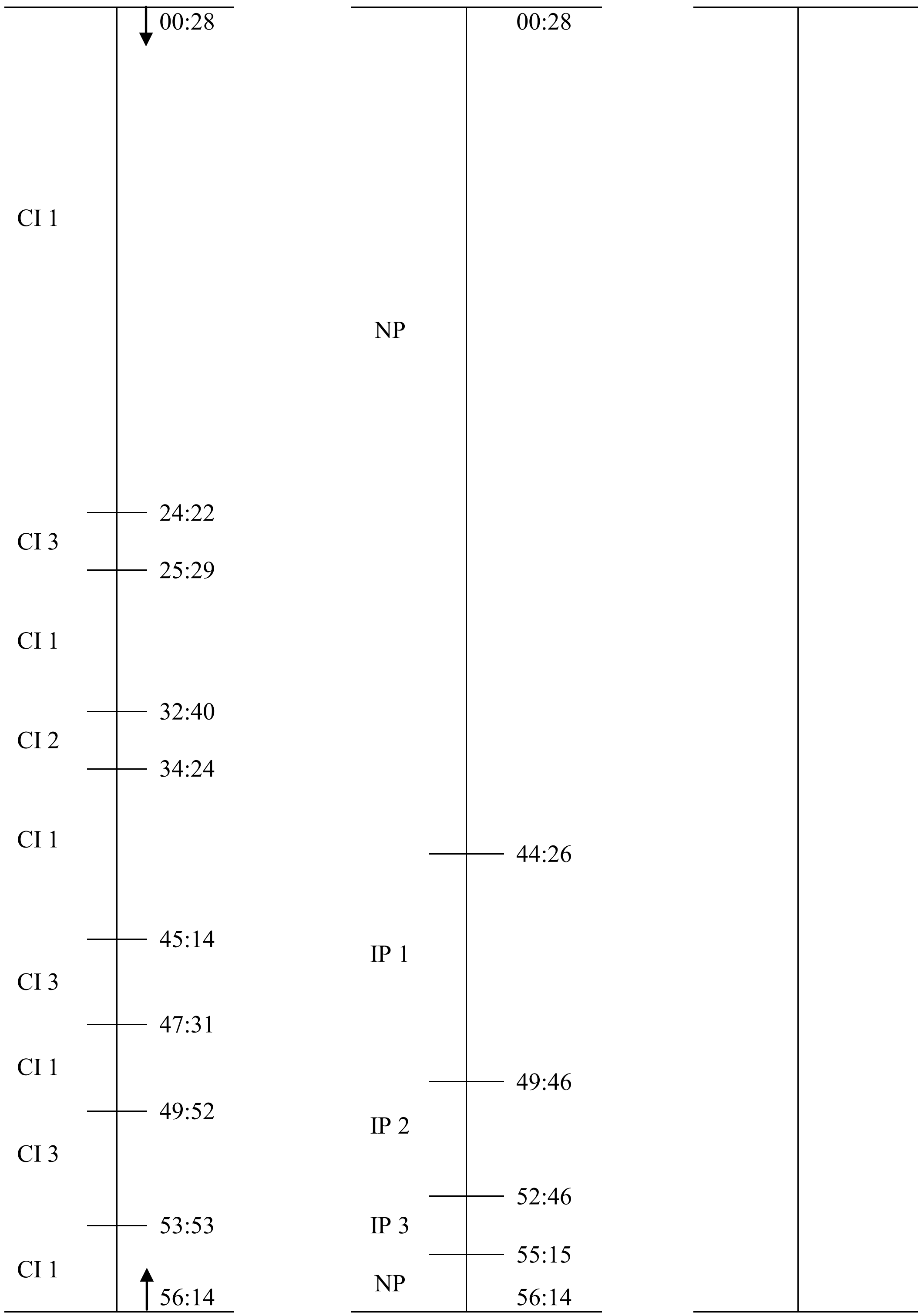

CI 1
00:32
02:00
CI 3
03:02
CI 1
06:29
CI 2
09:29
CI 1
10:39
CI 3
16:17
CI 1
32:49
CI 3
34:15
CI 2
35:16
CI 3
37:05
CI 1
38:22
CI 2
40:05
CI 3
43:38
CI 1
47:03
CI 2
49:49
CI 1
52:42
CI 3
54:40
CI 1
55:23
00:32
NP
05:29
IP 1
17:44
NP
22:19
IP 2
30:09
IP 3
34:24
IP 4
38:11
IP 5
45:19
NP
47:01
IP 6
51:34
NP
55:23

8.TH.TS



00:12
CI 1
13:36
CI 2
16:35
CI 1
18:41
CI 2
19:51
CI 1
33:33
CI 5
35:17
CI 3
37:16
CI 1
40:16
CI 2
42:14
CI 3
43:24
CI 1
44:53
00:12
NP
23:08
IP 1
30:14
NP
32:45
IP 2
39:18
NP
44:53

9.TH.TH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CI 1
24:22
CI 3
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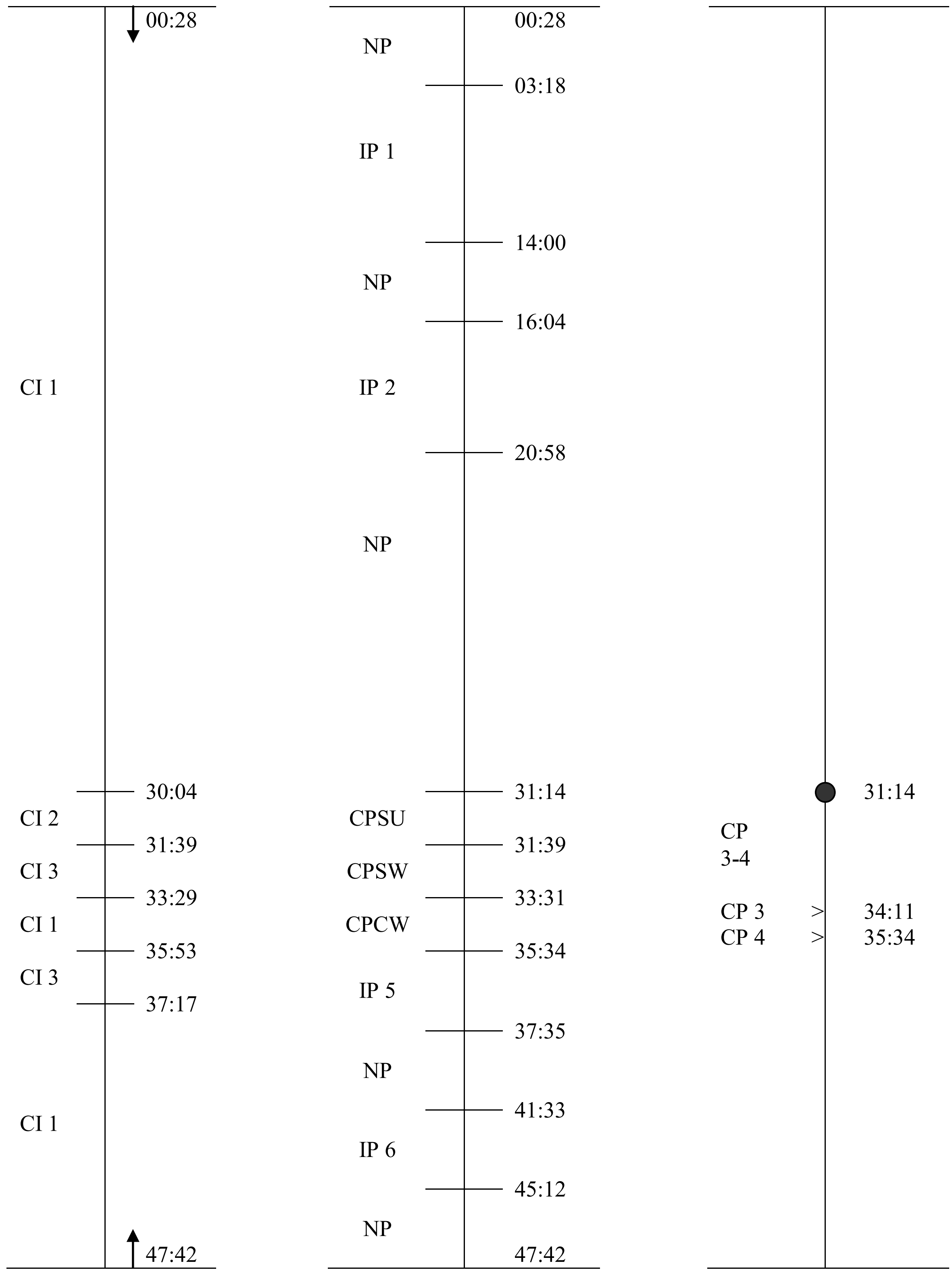
CI 1
32:40
CI 2
34:24
CI 1
45:14
CI 3
47:31
CI 1
49:52
CI 3
53:53
CI 1
56:14
00:28
NP
44:26
IP 1
49:46
IP 2
52:46
IP 3
55:15
NP
56:14

10.NA.ND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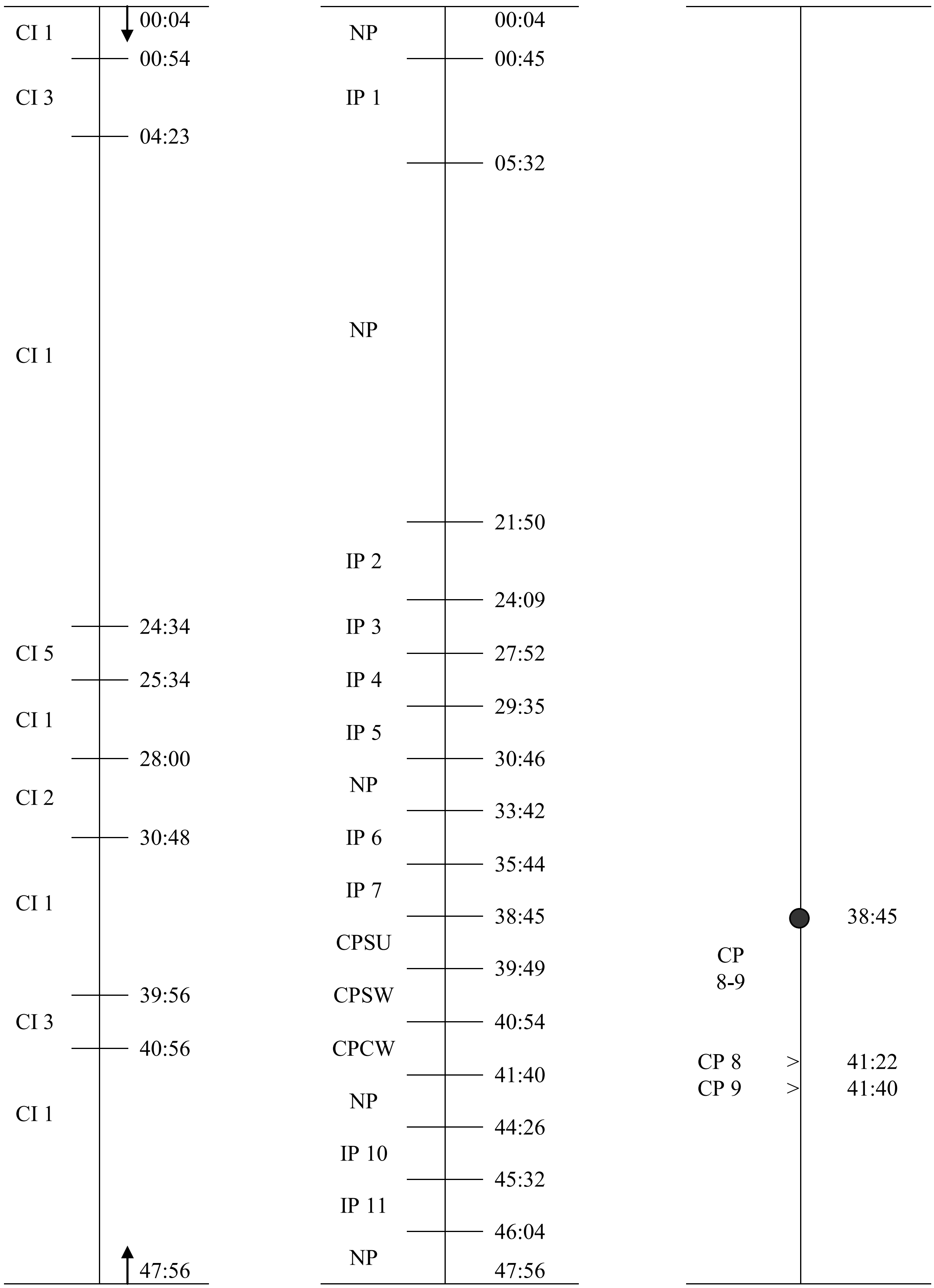
CI 1
30:04
CI 2
31:39
CI 3
33:29
CI 1
35:53
CI 3
37:17
CI 1
47:42
00:28
NP
03:18
IP 1
14:00
NP
16:04
IP 2
20:58
NP
31:14
CPSU
31:39
CPSW
33:31
CPCW
35:34
IP 5
37:35
NP
41:33
IP 6
45:12
NP
47:42
31:14
CP
3-4
CP 3 > 34:11
CP 4 > 35:34

11.NA.HN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00:54
CI 3
04:23
CI 1
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CI 5
25:34
CI 1
28:00
CI 2
30:48
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39:56
CI 3
40:56
CI 1
47:56
NP
00:04
00:45
IP 1
05:32
NP
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IP 2
24:09
IP 3
27:52
IP 4
29:35
IP 5
30:46
NP
33:42
IP 6
35:44
IP 7
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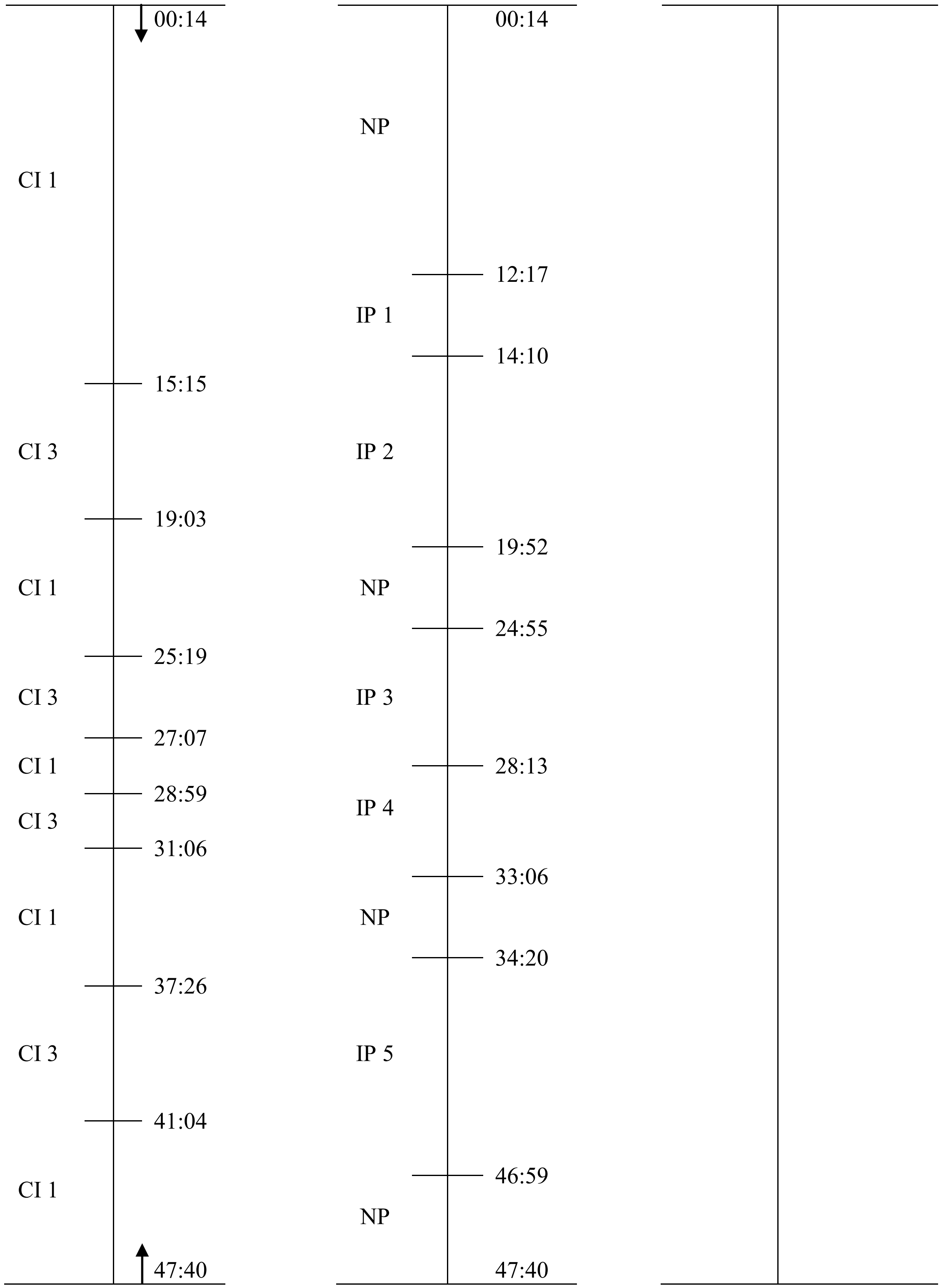
CPSU
39:49
CPSW
40:54
CPCW
41:40
NP
44:26
IP 10
45:32
IP 11
46:04
NP
47:56
38:45
CP
8-9
CP 8 > 41:22
CP 9 > 41:40

12.NA.CL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CI 3
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CI 1
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CI 3
27:07
CI 1
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CI 3
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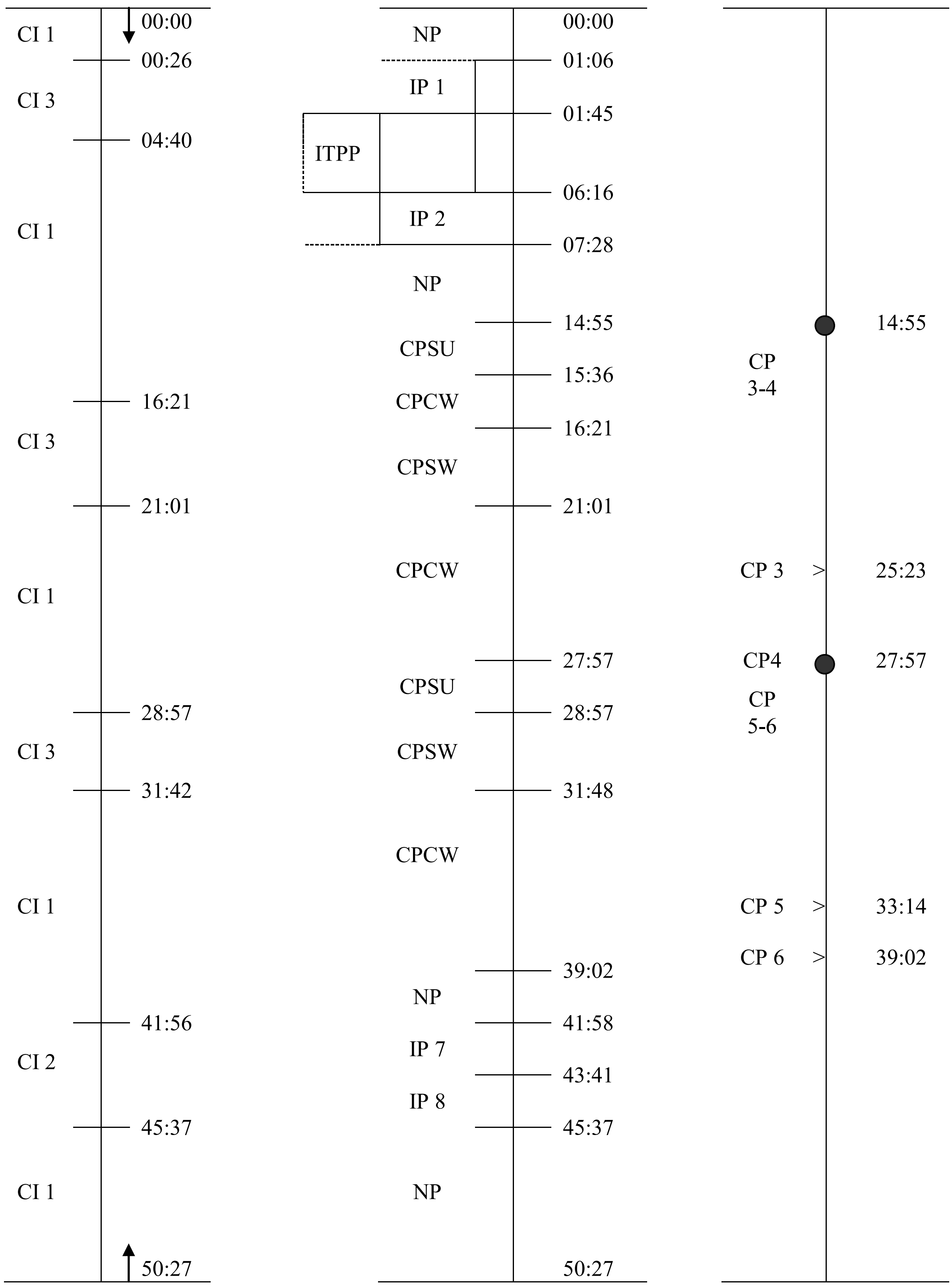
CI 1
37:26
CI 3
41:04
CI 1
47:40
00:14
NP
12:17
IP 1
14:10
IP 2
19:52
NP
24:55
IP 3
28:13
IP 4
33:06
NP
34:20
IP 5
46:59
NP
47:40

13.NA.NL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CI 3
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CI 1
28:57
CI 3
31:42
CI 1
41:56
CI 2
45:37
CI 1
50:27
NP
00:00
01:06
IP 1
01:45
ITPP
06:16
IP 2
07:28
NP
14:55
CPSU
15:36
CPCW
16:21
CPSW
21:01
CPCW
27:57
CPSU
28:57
CPSW
31:48
CPCW
39:02
NP
41:58
IP 7
43:41
IP 8
45:37
NP
50:27
14:55
CP
3-4
CP 3
25:23
CP4
27:57
CP
5-6
CP 5
33:14
CP 6
39:02

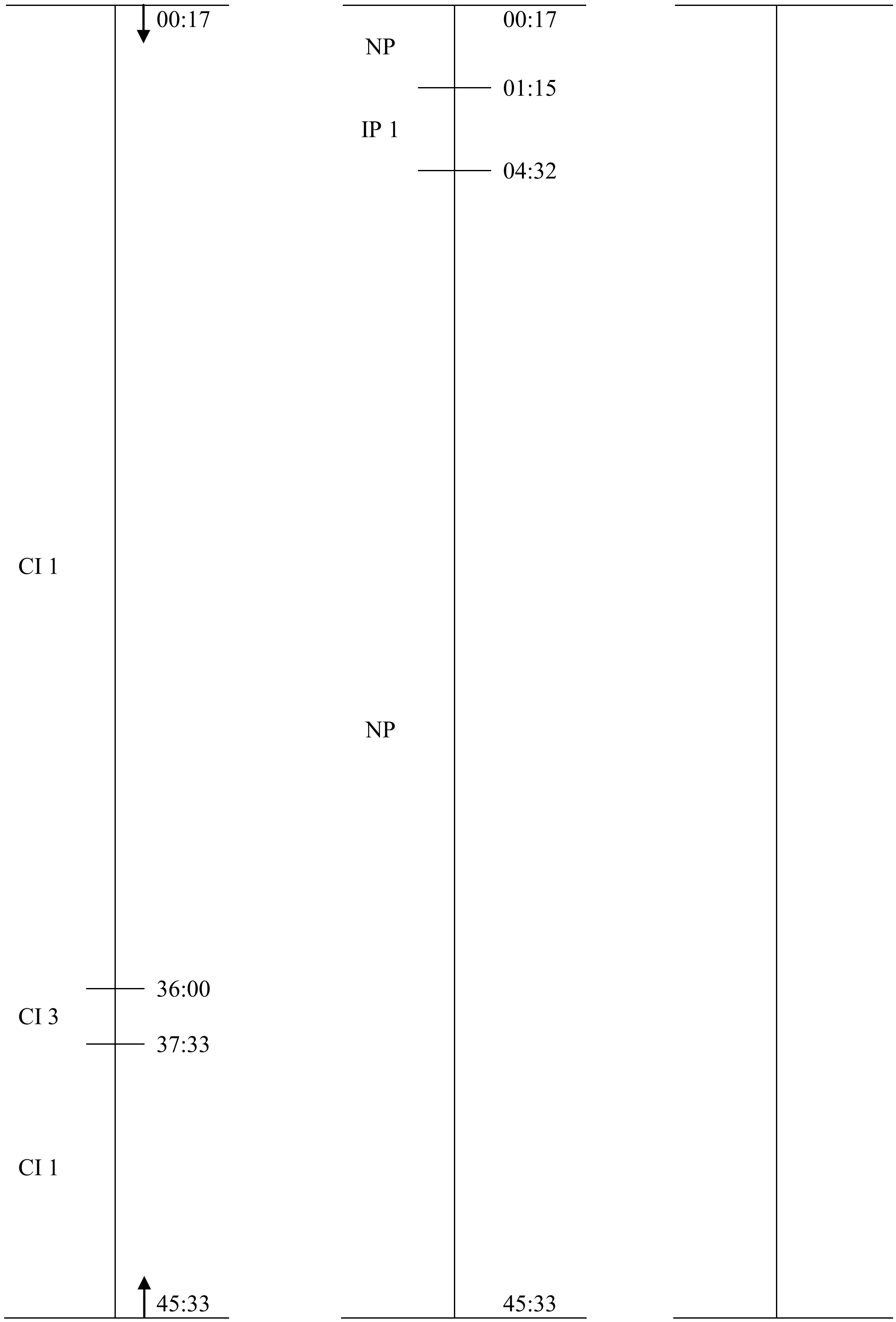
14.NA.V

	00:07
CI 1	
	07:25
CI 3	
	09:23
CI 1	
	10:32
CI 5	
	12:15
CI 1	
	16:25
CI 3	
	17:28
CI 1	
	20:00
CI 5	
	21:00
CI 1	
	23:06
CI 3	
	24:07
CI 1	
	26:25
CI 3	
	29:20
CI 1	
	30:37
CI 5	
	31:55
CI 1	
	35:36
CI 3	
	37:09
CI 1	
	38:38
CI 2	
	39:38
CI 1	
	40:59
CI 5	
	42:24
CI 1	
	45:10

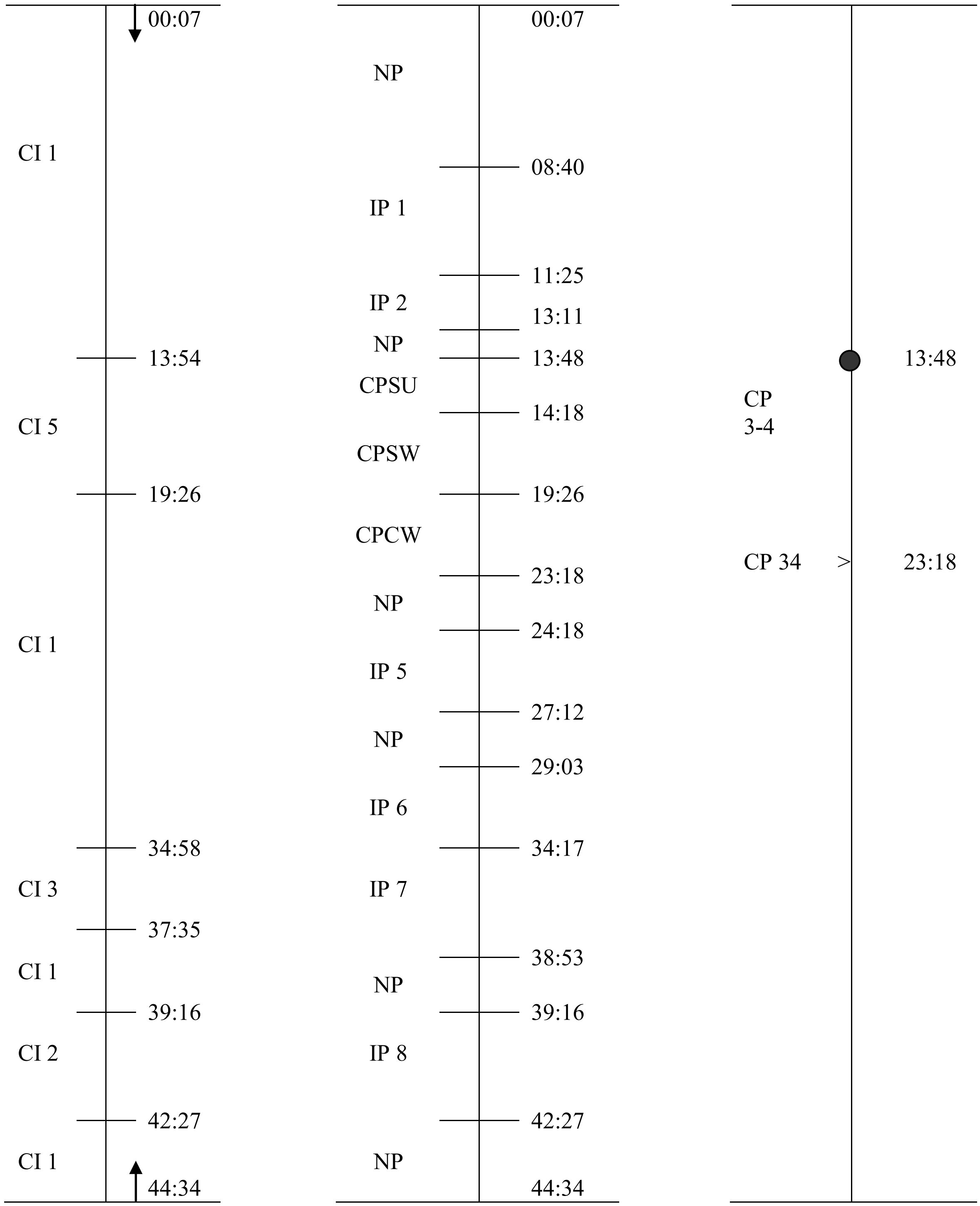
NP	00:52
IP 1	02:22
NP	03:05
IP 2	04:18
NP	
	07:06
IP 3	
	09:41
NP	
	10:26
IP 4	
	14:42
NP	
	16:11
IP 5	
	18:34
NP	
	22:24
IP 6	
	25:11
IP 7	
	27:43
IP 8	
	29:34
NP	
	30:37
CPSU	30:49
CPSW	31:35
CPCW	32:59
IP 11	
	38:43
NP	
	40:14
CPSU	
	40:50
CPSW	
	42:21
CPCW	
	44:14
NP	45:10

		30:37
CP 9-10		
CP 9	>	32:58
CP 10	>	32:59
		40:14
CP 12-13		
CP 12	>	43:00
CP 13	>	44:14

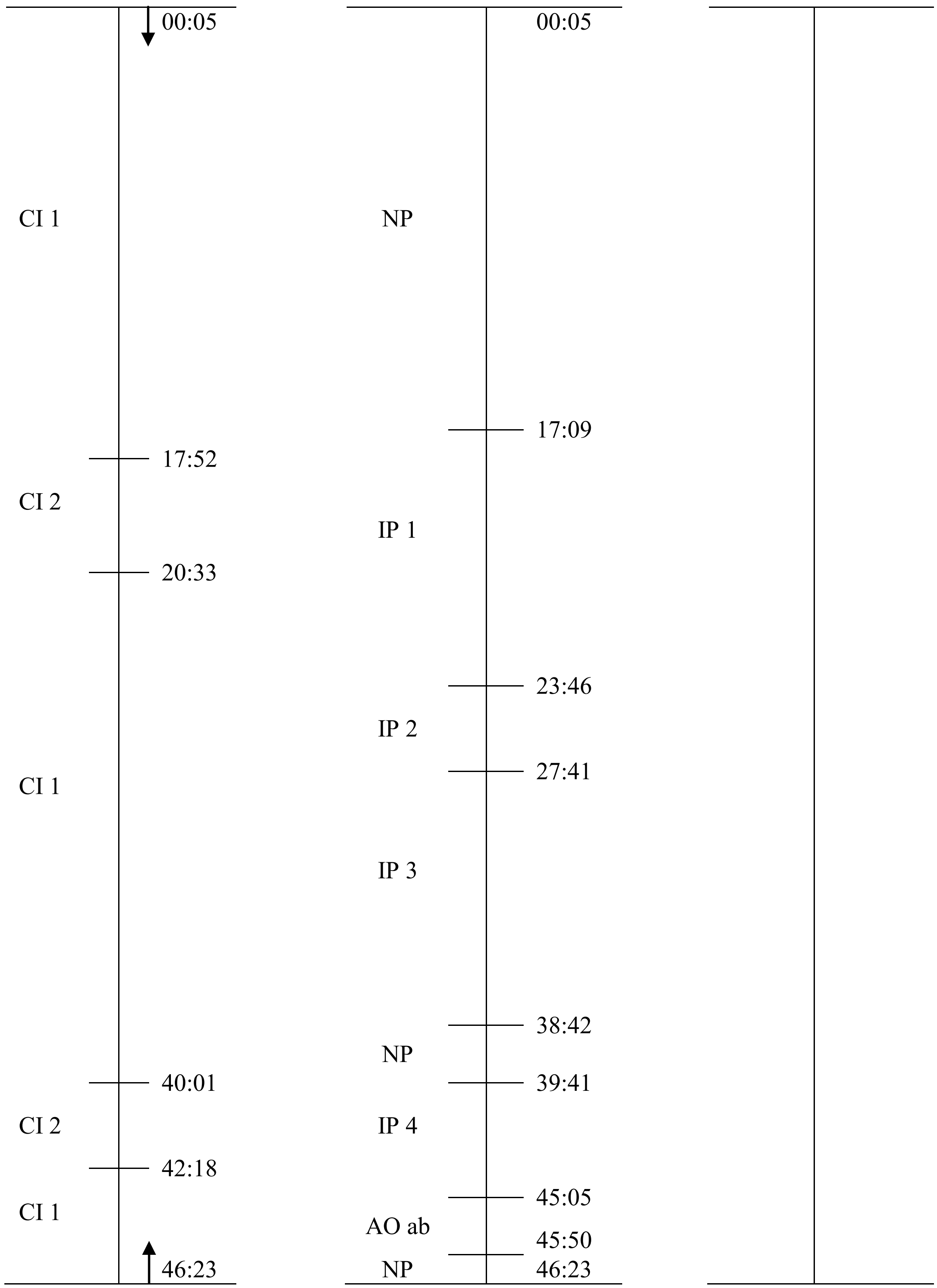
15.NA.YT



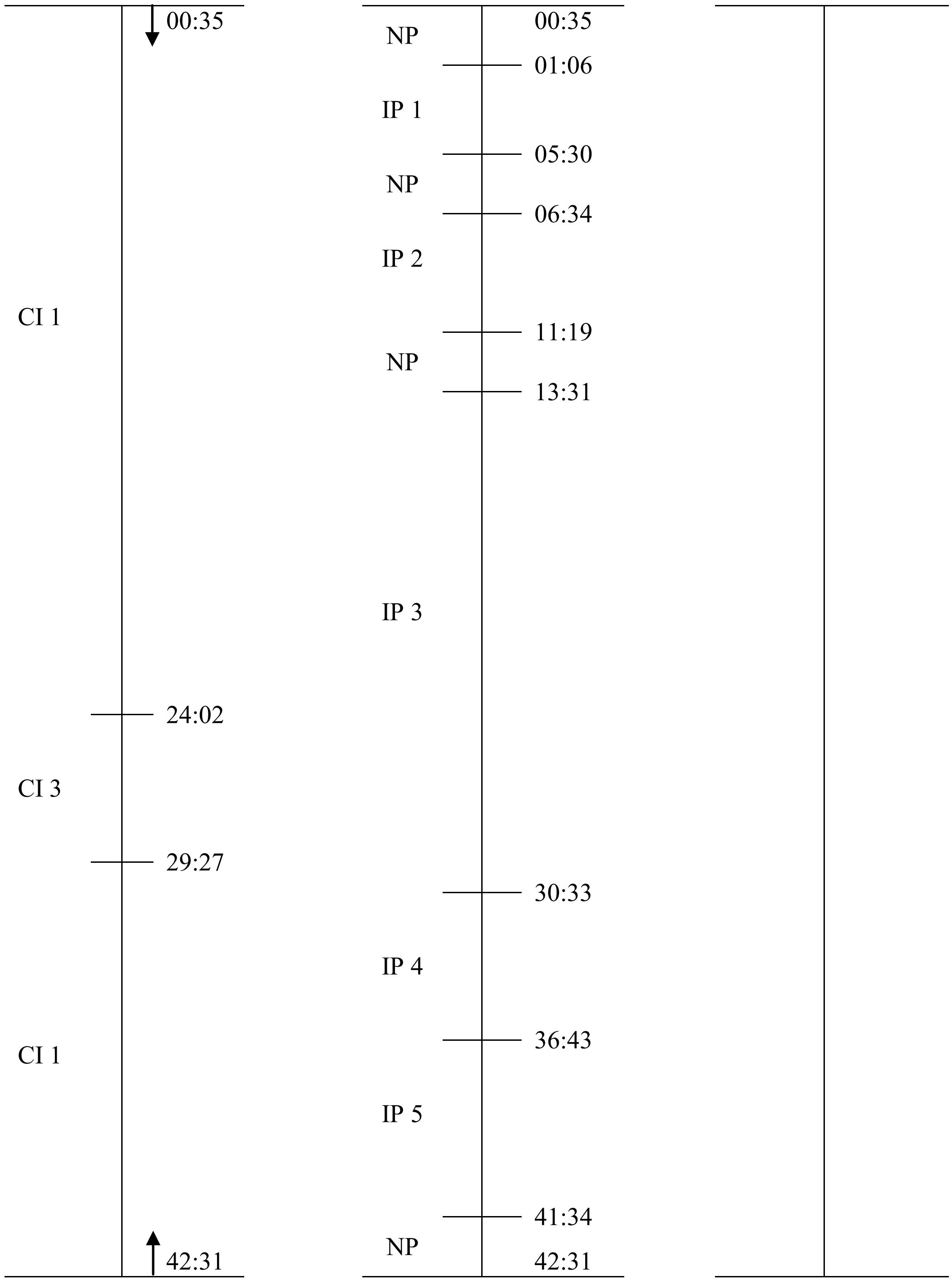
16.NA.DV


00:07
CI 1
13:54
CI 5
19:26
CI 1
34:58
CI 3
37:35
CI 1
39:16
CI 2
42:27
CI 1
44:34
00:07
NP
08:40
IP 1
11:25
IP 2
13:11
NP
13:48
CPSU
14:18
CPSW
19:26
CPCW
23:18
NP
24:18
IP 5
27:12
NP
29:03
IP 6
34:17
IP 7
38:53
NP
39:16
IP 8
42:27
NP
44:34
13:48
CP
3-4
CP 34
23:18

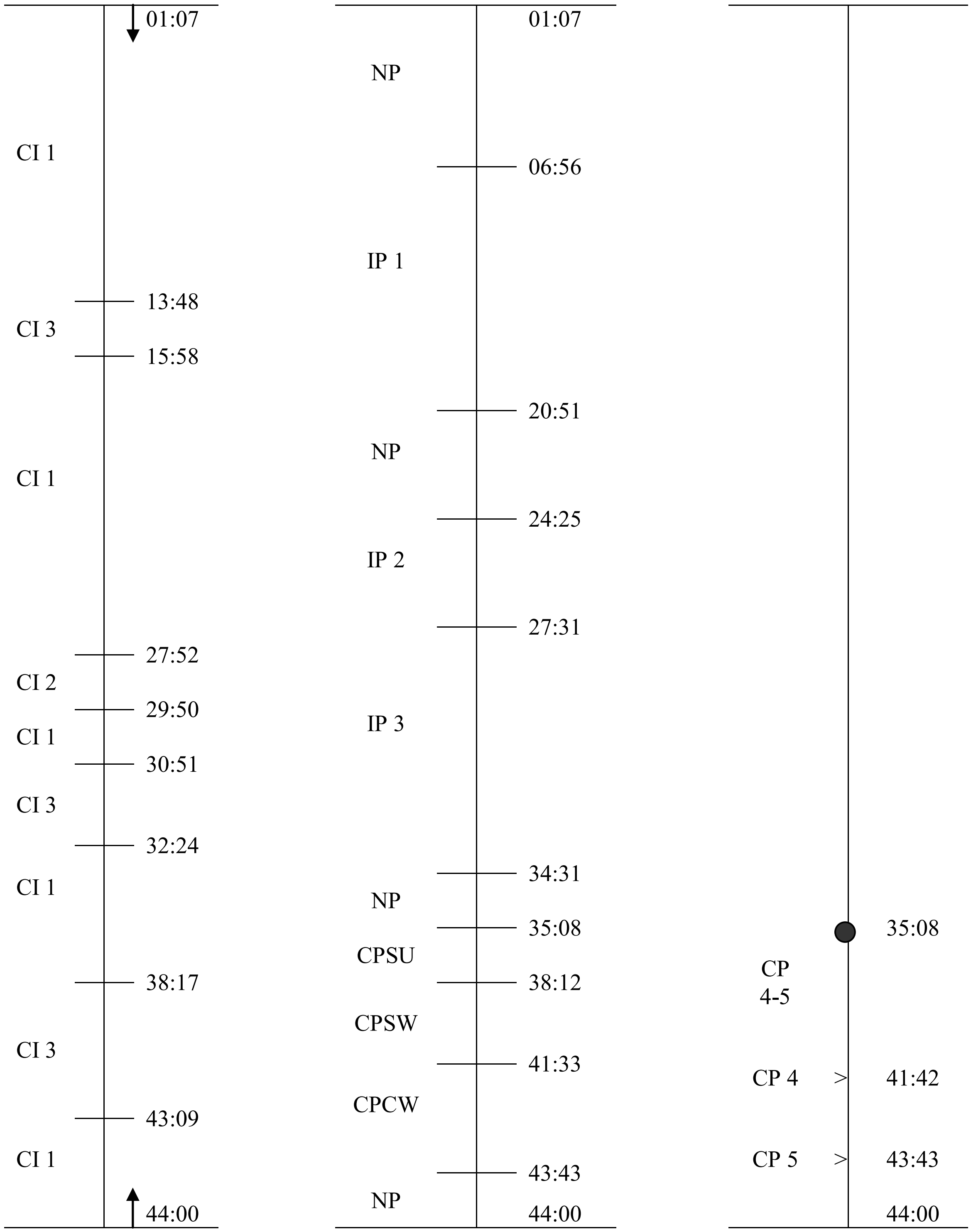
17.NA.TC


00:05
CI 1
17:52
CI 2
20:33
CI 1
40:01
CI 2
42:18
CI 1
46:23
00:05
NP
17:09
IP 1
23:46
IP 2
27:41
IP 3
38:42
NP
39:41
IP 4
45:05
AO ab
45:50
NP
46:23

18.SS.BS

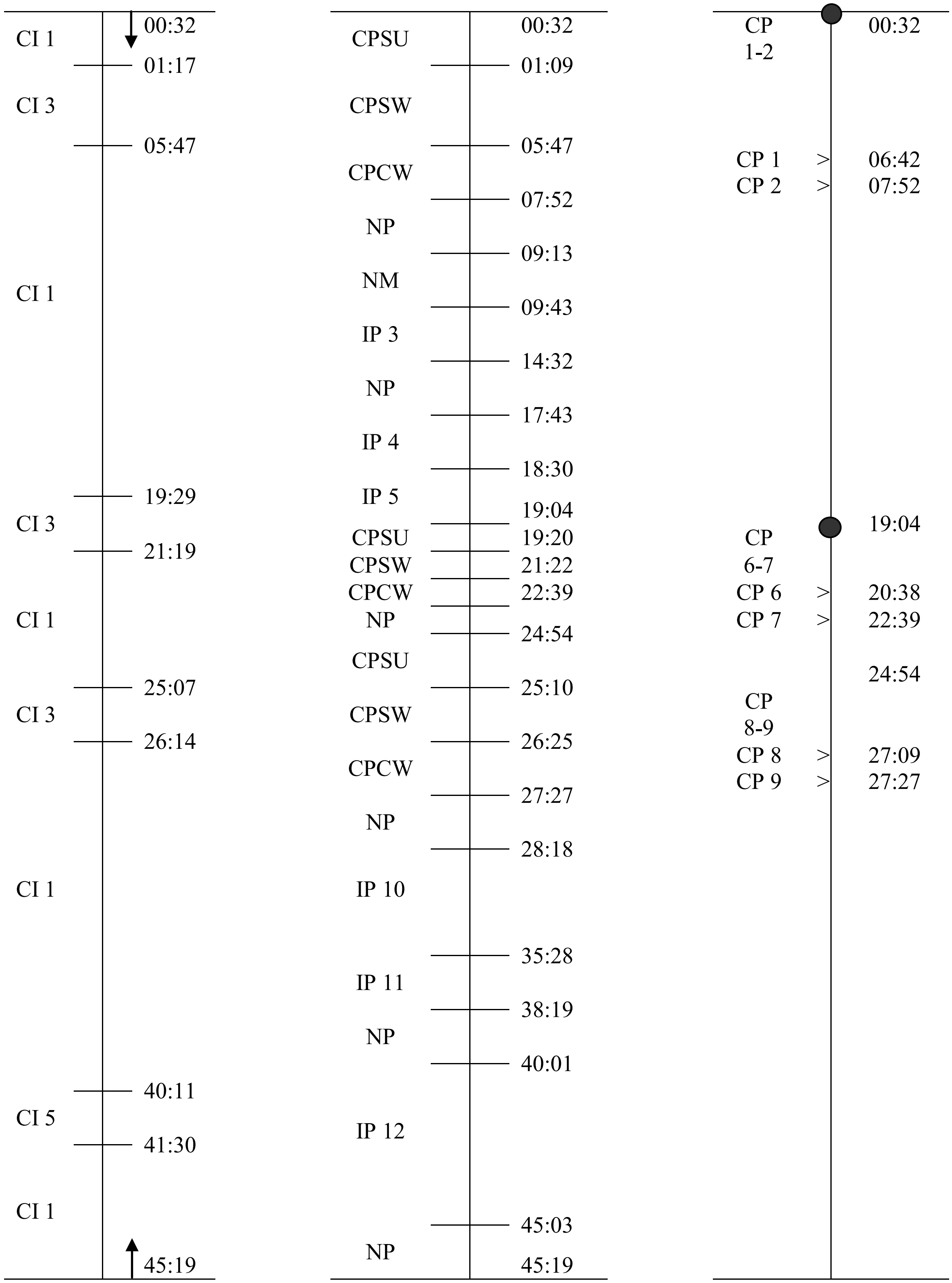

00:35
CI 1
24:02
CI 3
29:27
CI 1
42:31
NP
00:35
01:06
IP 1
05:30
NP
06:34
IP 2
11:19
NP
13:31
IP 3
30:33
IP 4
36:43
IP 5
41:34
NP
42:31

19.SS.QT1



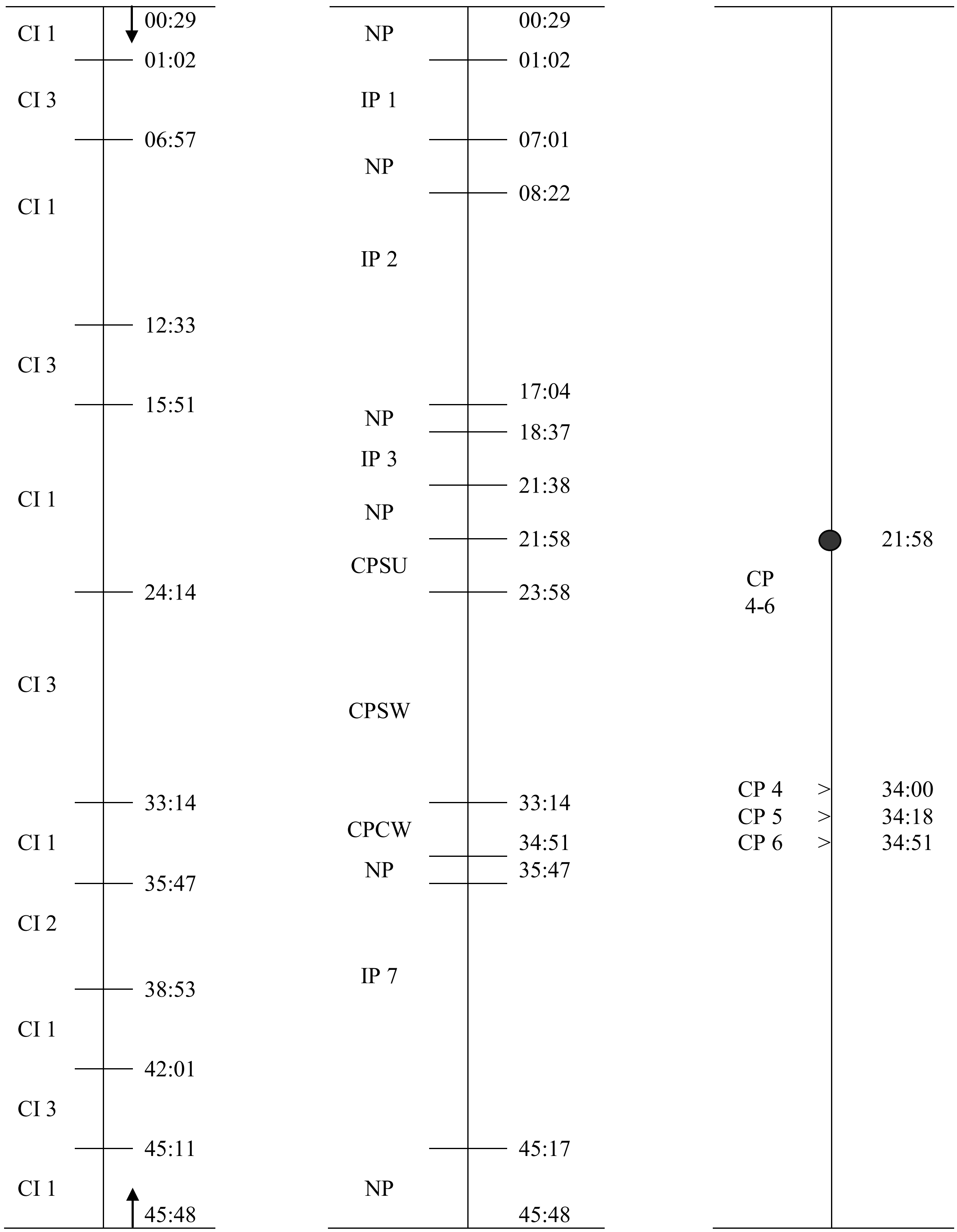
01:07
CI 1
13:48
CI 3
15:58
CI 1
27:52
CI 2
29:50
CI 1
30:51
CI 3
32:24
CI 1
38:17
CI 3
43:09
CI 1
44:00
01:07
NP
06:56
IP 1
20:51
NP
24:25
IP 2
27:31
IP 3
34:31
NP
35:08
CPSU
38:12
CPSW
41:33
CPCW
43:43
NP
44:00
35:08
CP
4-5
CP 4
41:42
CP 5
43:43
44:00

20.SS.QT2

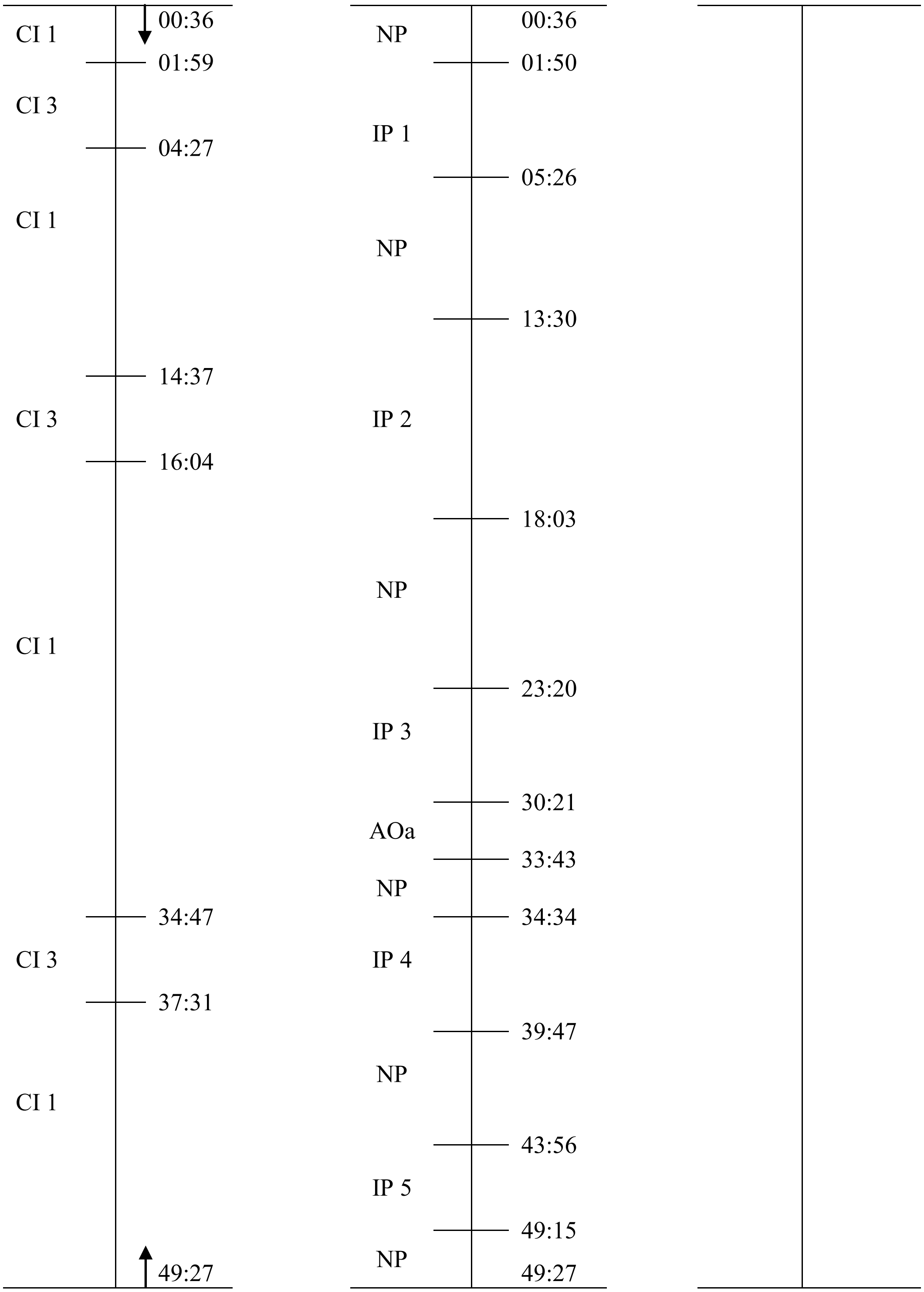


CI 1
00:32
01:17
CI 3
05:47
CI 1
19:29
CI 3
21:19
CI 1
25:07
CI 3
26:14
CI 1
40:11
CI 5
41:30
CI 1
45:19
CPSU
00:32
01:09
CPSW
05:47
CPCW
07:52
NP
09:13
NM
09:43
IP 3
14:32
NP
17:43
IP 4
18:30
IP 5
19:04
CPSU
19:20
CPSW
21:22
CPCW
22:39
NP
24:54
CPSU
25:10
CPSW
26:25
CPCW
27:27
NP
28:18
IP 10
35:28
IP 11
38:19
NP
40:01
IP 12
45:03
NP
45:19
CP 1-2
00:32
CP 1 > 06:42
CP 2 > 07:52
19:04
CP 6-7
CP 6 > 20:38
CP 7 > 22:39
24:54
CP 8-9
CP 8 > 27:09
CP 9 > 27:27

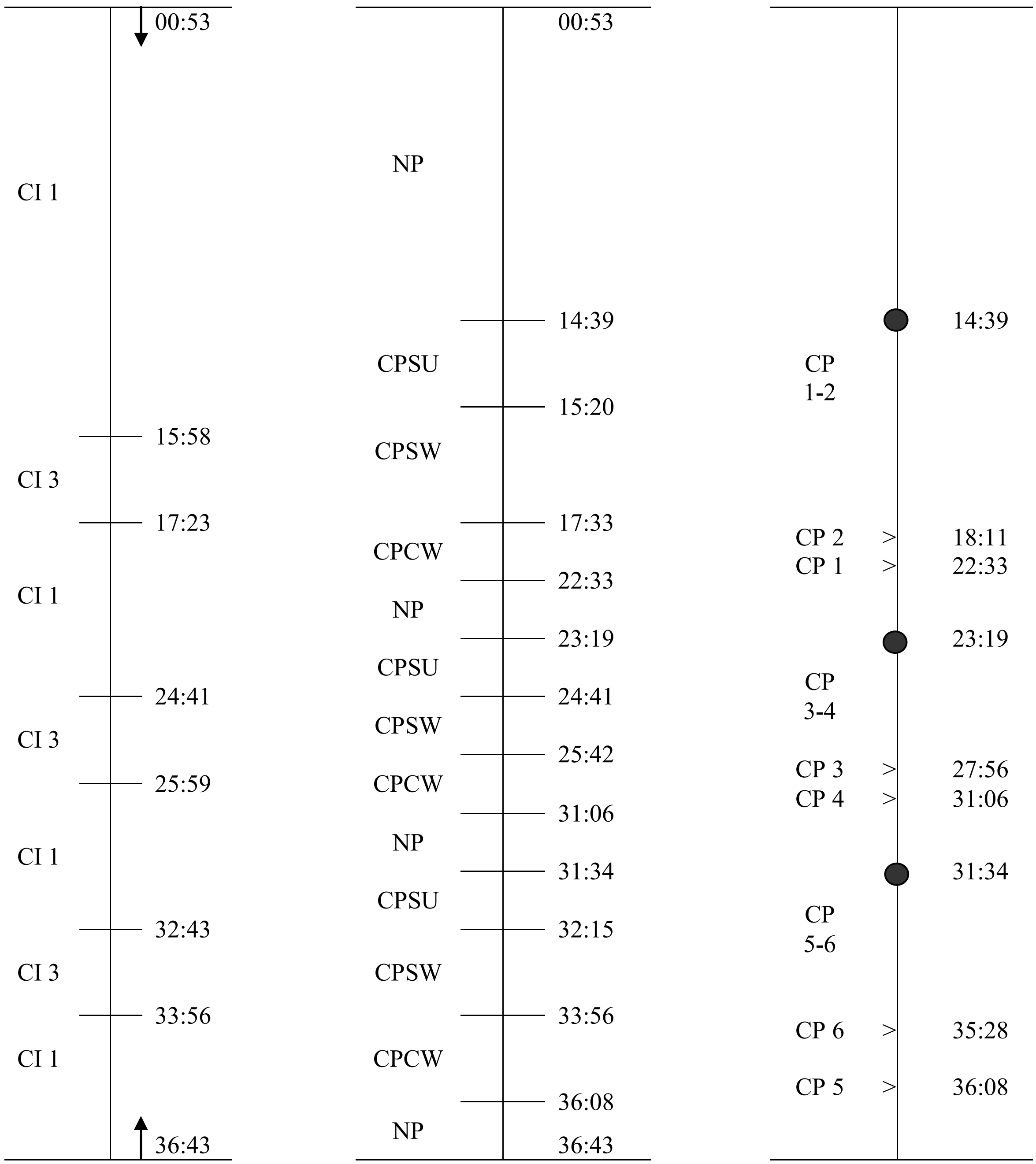
21.SS.TS


CI 1
00:29
01:02
CI 3
06:57
CI 1
12:33
CI 3
15:51
CI 1
24:14
CI 3
33:14
CI 1
35:47
CI 2
38:53
CI 1
42:01
CI 3
45:11
CI 1
45:48
NP
00:29
01:02
IP 1
07:01
NP
08:22
IP 2
17:04
NP
18:37
IP 3
21:38
NP
21:58
CPSU
23:58
CPSW
33:14
CPCW
34:51
NP
35:47
IP 7
45:17
NP
45:48
21:58
CP
4-6
CP 4
34:00
CP 5
34:18
CP 6
34:51

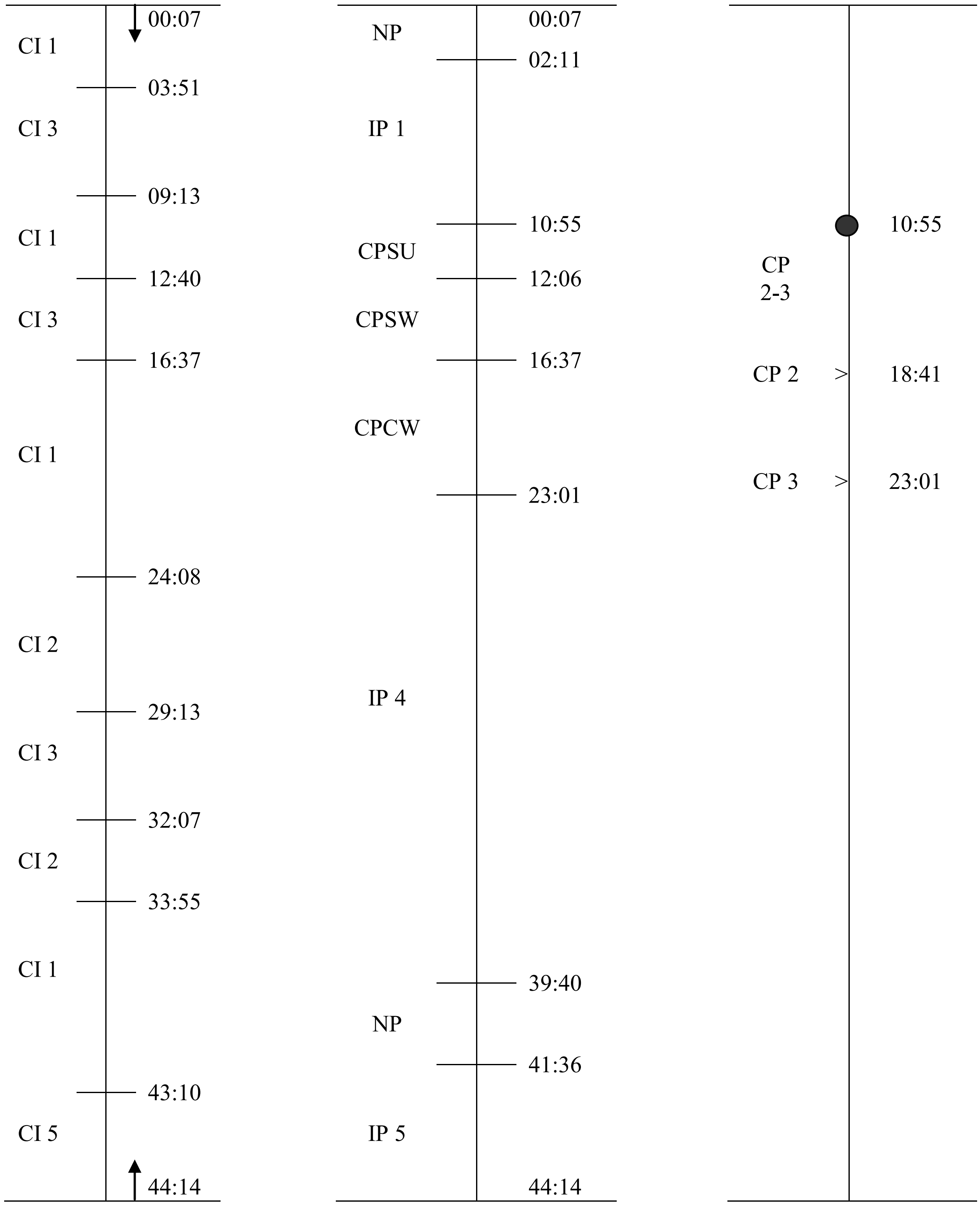
22.SS.ToS


CI 1
00:36
01:59
CI 3
04:27
CI 1
14:37
CI 3
16:04
CI 1
34:47
CI 3
37:31
CI 1
49:27
NP
00:36
01:50
IP 1
05:26
NP
13:30
IP 2
18:03
NP
23:20
IP 3
30:21
AOa
33:43
NP
34:34
IP 4
39:47
NP
43:56
IP 5
49:15
NP
49:27

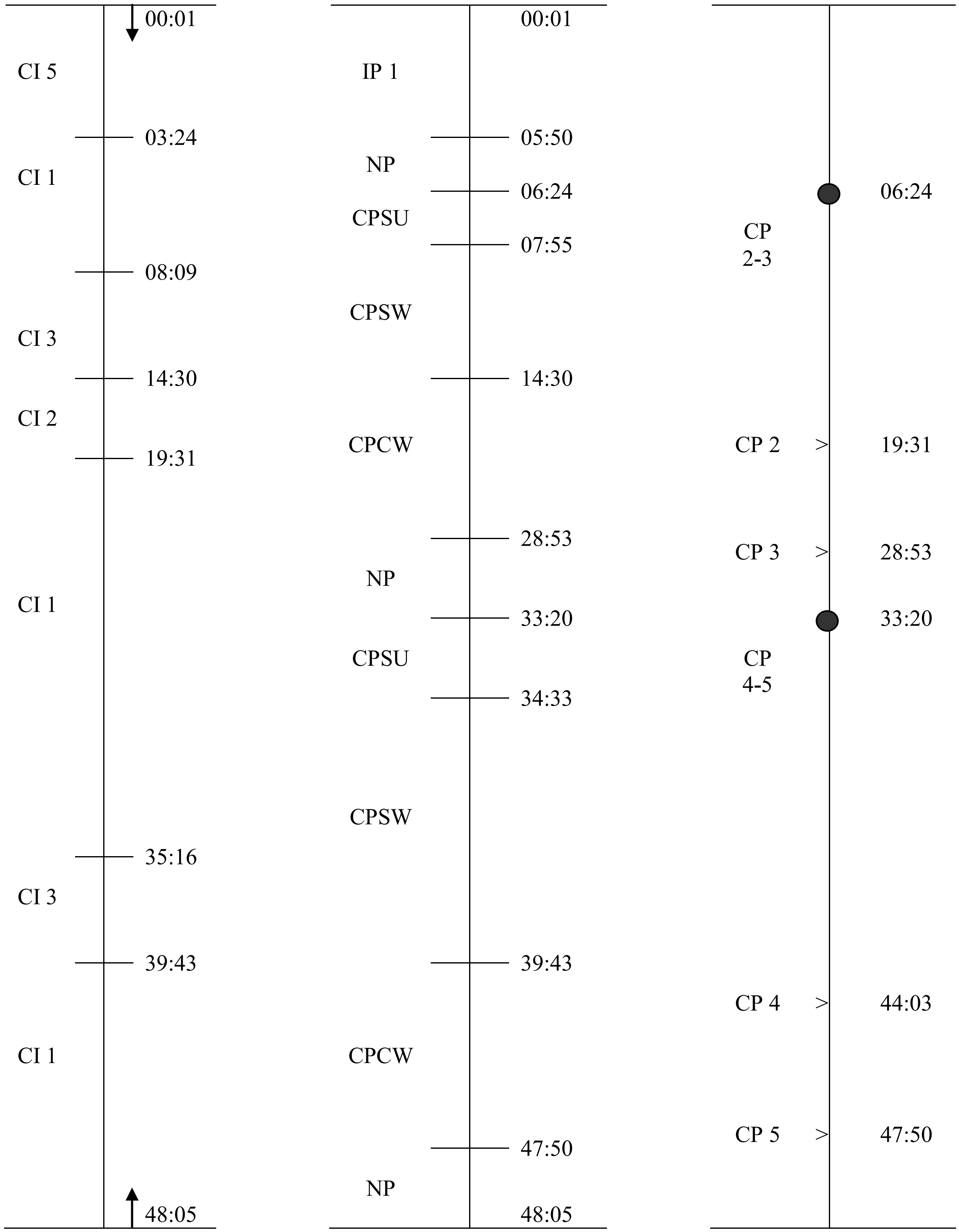
23.HN.PT


00:53
CI 1
15:58
CI 3
17:23
CI 1
24:41
CI 3
25:59
CI 1
32:43
CI 3
33:56
CI 1
36:43
00:53
NP
14:39
CPSU
15:20
CPSW
17:33
CPCW
22:33
NP
23:19
CPSU
24:41
CPSW
25:42
CPCW
31:06
NP
31:34
CPSU
32:15
CPSW
33:56
CPCW
36:08
NP
36:43
14:39
CP 1-2
CP 2 > 18:11
CP 1 > 22:33
23:19
CP 3-4
CP 3 > 27:56
CP 4 > 31:06
31:34
CP 5-6
CP 6 > 35:28
CP 5 > 36:08

24.HN.CG1

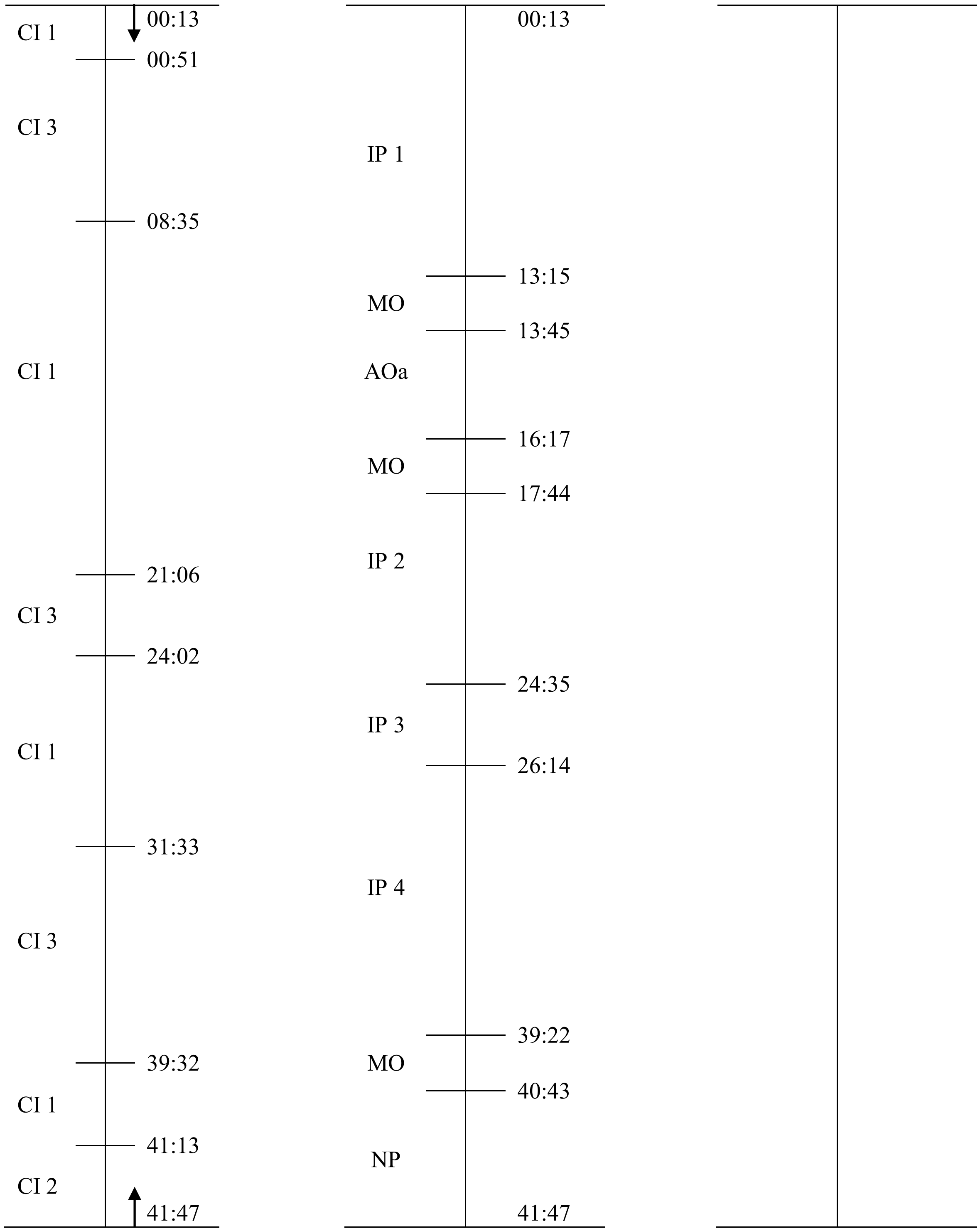

CI 1
00:07
03:51
CI 3
09:13
CI 1
12:40
CI 3
16:37
CI 1
24:08
CI 2
29:13
CI 3
32:07
CI 2
33:55
CI 1
43:10
CI 5
44:14
NP
00:07
02:11
IP 1
10:55
CPSU
12:06
CPSW
16:37
CPCW
23:01
IP 4
39:40
NP
41:36
IP 5
44:14
10:55
CP
2-3
CP 2
18:41
CP 3
23:01

25.HN.CG2

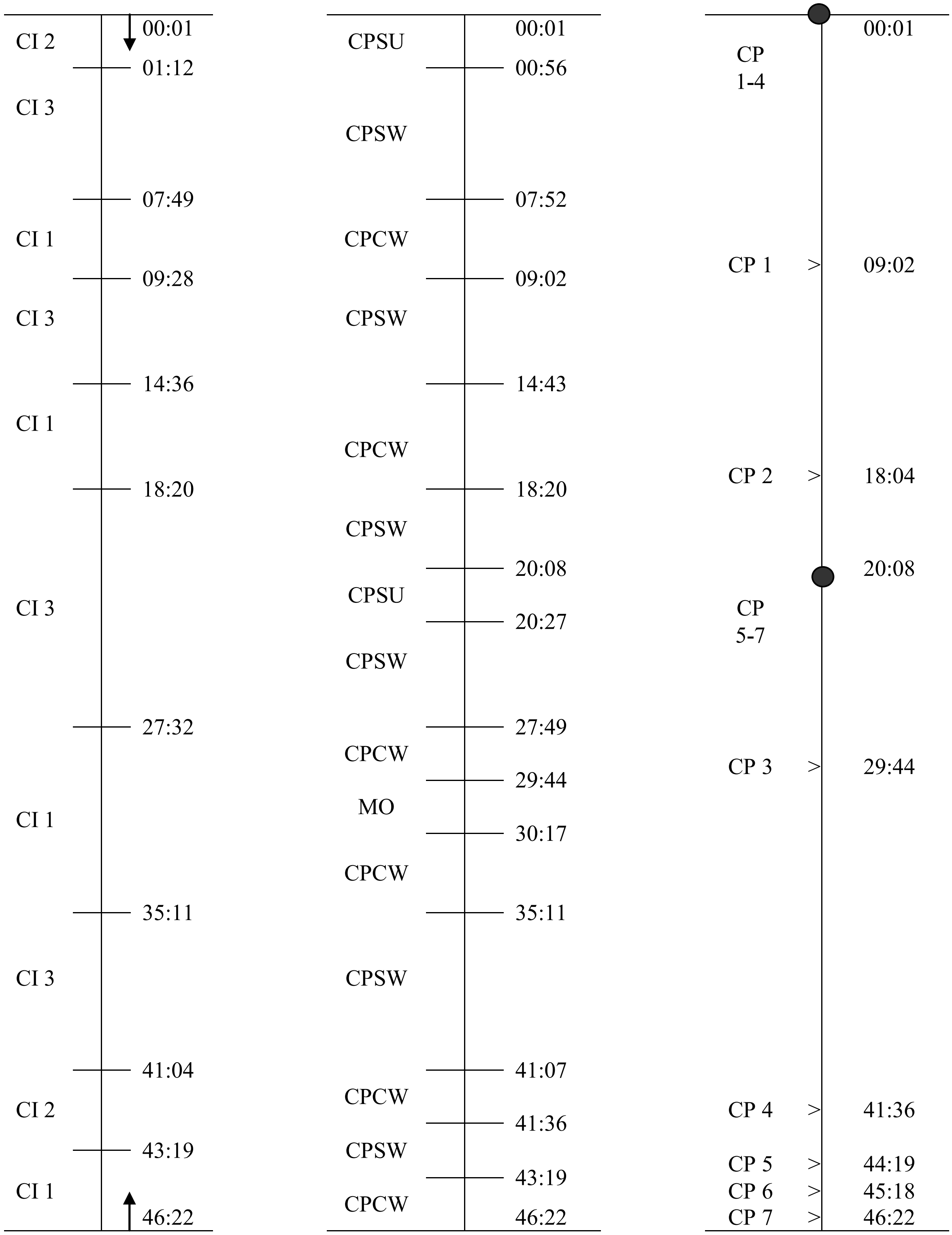


00:01
CI 5
03:24
CI 1
08:09
CI 3
14:30
CI 2
19:31
CI 1
35:16
CI 3
39:43
CI 1
48:05
00:01
IP 1
05:50
NP
06:24
CPSU
07:55
CPSW
14:30
CPCW
28:53
NP
33:20
CPSU
34:33
CPSW
39:43
CPCW
47:50
NP
48:05
06:24
CP
2-3
CP 2 >
19:31
CP 3 >
28:53
33:20
CP
4-5
CP 4 >
44:03
CP 5 >
47:50

26.HN.CG3


CI 1
00:13
00:51
CI 3
08:35
CI 1
21:06
CI 3
24:02
CI 1
31:33
CI 3
39:32
CI 1
41:13
CI 2
41:47
00:13
IP 1
13:15
MO
13:45
AOa
16:17
MO
17:44
IP 2
24:35
IP 3
26:14
IP 4
39:22
MO
40:43
NP
41:47

27.HN.CG4



CI 2
00:01
01:12
CI 3
07:49
CI 1
09:28
CI 3
14:36
CI 1
18:20
CI 3
27:32
CI 1
35:11
CI 3
41:04
CI 2
43:19
CI 1
46:22
CPSU
00:01
00:56
CPSW
07:52
CPCW
09:02
CPSW
14:43
CPCW
18:20
CPSW
20:08
CPSU
20:27
CPSW
27:49
CPCW
29:44
MO
30:17
CPCW
35:11
CPSW
41:07
CPCW
41:36
CPSW
43:19
CPCW
46:22
00:01
CP 1-4
CP 1 > 09:02
CP 2 > 18:04
20:08
CP 5-7
CP 3 > 29:44
CP 4 > 41:36
CP 5 > 44:19
CP 6 > 45:18
CP 7 > 46:22

APPENDIX D. Results of coding – Time of the lesson (LES)

Lessons	Beginning	End	LES
1.TH.TG	0:00:20	0:44:13	0:43:53
2.TH.HL	0:00:16	0:48:25	0:48:09
3.TH.HH	0:00:05	0:47:21	0:47:16
4.TH.TT	0:00:15	0:42:29	0:42:14
5.TH.NS1	0:00:01	0:47:36	0:47:35
6.TH.NS2	0:00:19	0:51:26	0:51:07
7.TH.QX	0:00:32	0:55:23	0:54:51
8.TH.TS	0:00:12	0:44:53	0:44:41
9.TH.TH	0:00:28	0:56:14	0:55:46
10.NA.ND	0:00:28	0:47:42	0:47:14
11.NA.HN	0:00:04	0:47:56	0:47:52
12.NA.CL	0:00:14	0:47:40	0:47:26
13.NA.NL	0:00:00	0:50:27	0:50:27
14.NA.V	0:00:07	0:45:10	0:45:03
15.NA.YT	0:00:17	0:45:33	0:45:16
16.NA.DV	0:00:07	0:44:34	0:44:27
17.NA.TC	0:00:05	0:46:23	0:46:18
18.SS.BS	0:00:35	0:42:31	0:41:56
19.SS.QT1	0:01:07	0:44:00	0:42:53
20.SS.QT2	0:00:32	0:45:19	0:44:47
21.SS.TS	0:00:29	0:45:48	0:45:19
22.SS.ToS	0:00:36	0:49:27	0:48:51
23.HN.PT	0:00:53	0:36:43	0:35:50
24.HN.CG1	0:00:07	0:44:14	0:44:07
25.HN.CG2	0:00:01	0:48:05	0:48:04
26.HN.CG3	0:00:13	0:41:47	0:41:34
27.HN.CG4	0:00:01	0:46:22	0:46:21
Average	**0:00:19**	**0:46:35**	**0:46:16**

APPENDIX E. Results of coding - Patterns of Public/Private Classroom Interaction (CI)

Lessons	Beginning	End	Time	Sum total				
1.TH.TG								
CI 1	0:00:20	0:33:16	0:32:56					
CI 3	0:33:16	0:34:32	0:01:16	CI 1	CI 2	CI 3	CI 4	CI 5
CI 1	0:34:32	0:39:33	0:05:01	0:40:00	0:01:27	0:01:16	0:00:00	0:01:10
CI 5	0:39:33	0:40:43	0:01:10					
CI 2	0:40:43	0:42:10	0:01:27					
CI 1	0:42:10	0:44:13	0:02:03					
			0:43:53					
2. TH.HL								
CI 1	0:00:16	0:01:45	0:01:29					
CI 3	0:01:45	0:04:16	0:02:31					
CI 1	0:04:16	0:08:36	0:04:20					
CI 5	0:08:36	0:09:56	0:01:20					
CI 2	0:09:56	0:11:41	0:01:45					
CI 3	0:11:41	0:14:51	0:03:10	CI 1	CI 2	CI 3	CI 4	CI 5
CI 1	0:14:51	0:18:27	0:03:36	0:22:10	0:10:20	0:13:06	0:00:00	0:02:33
CI 2	0:18:27	0:19:53	0:01:26					
CI 1	0:19:53	0:24:28	0:04:35					
CI 3	0:24:28	0:29:27	0:04:59					
CI 1	0:29:27	0:37:25	0:07:58					
CI 5	0:37:25	0:38:38	0:01:13					
CI 2	0:38:38	0:41:49	0:03:11					
CI 3	0:41:49	0:44:15	0:02:26					
CI 2	0:44:15	0:48:13	0:03:58					
CI 1	0:48:13	0:48:25	0:00:12					
			0:48:09					
3. TH.HH								
CI 1	0:00:05	0:21:23	0:21:18					
CI 3	0:21:23	0:26:05	0:04:42	CI 1	CI 2	CI 3	CI 4	CI 5
CI 1	0:26:05	0:34:19	0:08:14	0:33:47	0:01:19	0:12:10	0:00:00	0:00:00
CI 2	0:34:19	0:35:38	0:01:19					
CI 3	0:35:38	0:43:06	0:07:28					
CI 1	0:43:06	0:47:21	0:04:15					
			0:47:16					
4. TH.TT								
CI 1	0:00:15	0:12:12	0:11:57					
CI 2	0:12:12	0:14:53	0:02:41					
CI 1	0:14:53	0:20:51	0:05:58					
CI 2	0:20:51	0:22:54	0:02:03					
CI 1	0:22:54	0:27:11	0:04:17	CI 1	CI 2	CI 3	CI 4	CI 5
CI 5	0:27:11	0:29:08	0:01:57	0:27:50	0:05:53	0:04:33	0:00:00	0:03:58
CI 3	0:29:08	0:33:41	0:04:33					
CI 1	0:33:41	0:38:17	0:04:36					
CI 5	0:38:17	0:40:18	0:02:01					

CI 2	0:40:18	0:41:27	0:01:09					
CI 1	0:41:27	0:42:29	0:01:02					
			0:42:14					
5. TH.NS1								
CI 1	0:00:01	0:02:17	0:02:16					
CI 2	0:02:17	0:04:35	0:02:18					
CI 1	0:04:35	0:31:04	0:26:29					
CI 5	0:31:04	0:32:54	0:01:50	CI 1	CI 2	CI 3	CI 4	CI 5
CI 1	0:32:54	0:36:16	0:03:22	0:36:03	0:03:44	0:05:58	0:00:00	0:01:50
CI 2	0:36:16	0:37:42	0:01:26					
CI 3	0:37:42	0:43:40	0:05:58					
CI 1	0:43:40	0:47:36	0:03:56					
			0:47:35					
6. TH.NS2								
CI 1	0:00:19	0:04:15	0:03:56					
CI 2	0:04:15	0:09:44	0:05:29					
CI 3	0:09:44	0:14:21	0:04:37					
CI 1	0:14:21	0:20:28	0:06:07	CI 1	CI 2	CI 3	CI 4	CI 5
CI 2	0:20:28	0:29:19	0:08:51	0:17:09	0:17:03	0:16:55	0:00:00	0:00:00
CI 3	0:29:19	0:39:35	0:10:16					
CI 1	0:39:35	0:42:37	0:03:02					
CI 3	0:42:37	0:44:39	0:02:02					
CI 2	0:44:39	0:47:22	0:02:43					
CI 1	0:47:22	0:51:26	0:04:04					
			0:51:07					
7. TH.QX								
CI 1	0:00:32	0:02:00	0:01:28					
CI 3	0:02:00	0:03:02	0:01:02					
CI 1	0:03:02	0:06:29	0:03:27					
CI 2	0:06:29	0:09:29	0:03:00					
CI 1	0:09:29	0:10:39	0:01:10					
CI 3	0:10:39	0:16:17	0:05:38					
CI 1	0:16:17	0:32:49	0:16:32					
CI 3	0:32:49	0:34:15	0:01:26	CI 1	CI 2	CI 3	CI 4	CI 5
CI 2	0:34:15	0:35:16	0:01:01	0:30:55	0:08:30	0:15:26	0:00:00	0:00:00
CI 3	0:35:16	0:37:05	0:01:49					
CI 1	0:37:05	0:38:22	0:01:17					
CI 2	0:38:22	0:40:05	0:01:43					
CI 3	0:40:05	0:43:38	0:03:33					
CI 1	0:43:38	0:47:03	0:03:25					
CI 2	0:47:03	0:49:49	0:02:46					
CI 1	0:49:49	0:52:42	0:02:53					
CI 3	0:52:42	0:54:40	0:01:58					
CI 1	0:54:40	0:55:23	0:00:43					
			0:54:51					
8. TH.TS								
CI 1	0:00:12	0:13:36	0:13:24					
CI 2	0:13:36	0:16:35	0:02:59					

CI 1	0:16:35	0:18:41	0:02:06					
CI 2	0:18:41	0:19:51	0:01:10					
CI 1	0:19:51	0:33:33	0:13:42	CI 1	CI 2	CI 3	CI 4	CI 5
CI 5	0:33:33	0:35:17	0:01:44	0:33:41	0:06:07	0:03:09	0:00:00	0:01:44
CI 3	0:35:17	0:37:16	0:01:59					
CI 1	0:37:16	0:40:16	0:03:00					
CI 2	0:40:16	0:42:14	0:01:58					
CI 3	0:42:14	0:43:24	0:01:10					
CI 1	0:43:24	0:44:53	0:01:29					
			0:44:41					
9. TH.TH								
CI 1	0:00:28	0:24:22	0:23:54					
CI 3	0:24:22	0:25:29	0:01:07					
CI 1	0:25:29	0:32:40	0:07:11					
CI 2	0:32:40	0:34:24	0:01:44	CI 1	CI 2	CI 3	CI 4	CI 5
CI 1	0:34:24	0:45:14	0:10:50	0:46:37	0:01:44	0:07:25	0:00:00	0:00:00
CI 3	0:45:14	0:47:31	0:02:17					
CI 1	0:47:31	0:49:52	0:02:21					
CI 3	0:49:52	0:53:53	0:04:01					
CI 1	0:53:53	0:56:14	0:02:21					
			0:55:46					
10. NA.ND								
CI 1	0:00:28	0:30:04	0:29:36					
CI 2	0:30:04	0:31:39	0:01:35					
CI 3	0:31:39	0:33:29	0:01:50	CI 1	CI 2	CI 3	CI 4	CI 5
CI 1	0:33:29	0:35:53	0:02:24	0:42:25	0:01:35	0:03:14	0:00:00	0
CI 3	0:35:53	0:37:17	0:01:24					
CI 1	0:37:17	0:47:42	0:10:25					
			0:47:14					
11. NA.HN								
CI 1	0:00:04	0:00:54	0:00:50					
CI 3	0:00:54	0:04:23	0:03:29					
CI 1	0:04:23	0:24:34	0:20:11					
CI 5	0:24:34	0:25:34	0:01:00	CI 1	CI 2	CI 3	CI 4	CI 5
CI 1	0:25:34	0:28:00	0:02:26	0:39:35	0:02:48	0:04:29	0:00:00	0:01:00
CI 2	0:28:00	0:30:48	0:02:48					
CI 1	0:30:48	0:39:56	0:09:08					
CI 3	0:39:56	0:40:56	0:01:00					
CI 1	0:40:56	0:47:56	0:07:00					
			0:47:52					
12. NA.CL								
CI 1	0:00:14	0:15:15	0:15:01					
CI 3	0:15:15	0:19:03	0:03:48					
CI 1	0:19:03	0:25:19	0:06:16					
CI 3	0:25:19	0:27:07	0:01:48	CI 1	CI 2	CI 3	CI 4	CI 5
CI 1	0:27:07	0:28:59	0:01:52	0:36:05	0	0:11:21	0:00:00	0
CI 3	0:28:59	0:31:06	0:02:07					
CI 1	0:31:06	0:37:26	0:06:20					

CI 3	0:37:26	0:41:04	0:03:38					
CI 1	0:41:04	0:47:40	0:06:36					
			0:47:26					
13. NA.NL								
CI 1	0:00:00	0:00:26	0:00:26					
CI 3	0:00:26	0:04:40	0:04:14					
CI 1	0:04:40	0:16:21	0:11:41					
CI 3	0:16:21	0:21:01	0:04:40	CI 1	CI 2	CI 3	CI 4	CI 5
CI 1	0:21:01	0:28:57	0:07:56	0:35:07	0:03:41	0:11:39	0:00:00	0:00:00
CI 3	0:28:57	0:31:42	0:02:45					
CI 1	0:31:42	0:41:56	0:10:14					
CI 2	0:41:56	0:45:37	0:03:41					
CI 1	0:45:37	0:50:27	0:04:50					
			0:50:27					
14. NA.V								
CI 1	0:00:07	0:07:25	0:07:18					
CI 3	0:07:25	0:09:23	0:01:58					
CI 1	0:09:23	0:10:32	0:01:09					
CI 5	0:10:32	0:12:15	0:01:43					
CI 1	0:12:15	0:16:25	0:04:10					
CI 3	0:16:25	0:17:28	0:01:03					
CI 1	0:17:28	0:20:00	0:02:32	CI 1	CI 2	CI 3	CI 4	CI 5
CI 5	0:20:00	0:21:00	0:01:00	0:30:07	0:01:00	0:08:30	0:00:00	0:05:26
CI 1	0:21:00	0:23:06	0:02:06					
CI 3	0:23:06	0:24:07	0:01:01					
CI 1	0:24:07	0:26:25	0:02:18					
CI 3	0:26:25	0:29:20	0:02:55					
CI 1	0:29:20	0:30:37	0:01:17					
CI 5	0:30:37	0:31:55	0:01:18					
CI 1	0:31:55	0:35:36	0:03:41					
CI 3	0:35:36	0:37:09	0:01:33					
CI 1	0:37:09	0:38:38	0:01:29					
CI 2	0:38:38	0:39:38	0:01:00					
CI 1	0:39:38	0:40:59	0:01:21					
CI 5	0:40:59	0:42:24	0:01:25					
CI 1	0:42:24	0:45:10	0:02:46					
			0:45:03					
15. NA.YT								
CI 1	0:00:17	0:36:00	0:35:43	CI 1	CI 2	CI 3	CI 4	CI 5
CI 3	0:36:00	0:37:33	0:01:33	0:43:43	0	0:01:33	0:00:00	0
CI 1	0:37:33	0:45:33	0:08:00					
			0:45:16					
16. NA.DV								
CI 1	0:00:07	0:13:54	0:13:47					
CI 5	0:13:54	0:19:26	0:05:32					
CI 1	0:19:26	0:34:58	0:15:32	CI 1	CI 2	CI 3	CI 4	CI 5
CI 3	0:34:58	0:37:35	0:02:37	0:33:07	0:03:11	0:02:37	0:00:00	0:05:32
CI 1	0:37:35	0:39:16	0:01:41					

CI 2	0:39:16	0:42:27	0:03:11					
CI 1	0:42:27	0:44:34	0:02:07					
			0:44:27					
17. NA.TC								
CI 1	0:00:05	0:17:52	0:17:47					
CI 2	0:17:52	0:20:33	0:02:41					
CI 1	0:20:33	0:40:01	0:19:28	CI 1	CI 2	CI 3	CI 4	CI 5
CI 2	0:40:01	0:42:18	0:02:17	0:41:20	0:04:58	0	0:00:00	0
CI 1	0:42:18	0:46:23	0:04:05					
			0:46:18					
18. SS.BS								
CI 1	0:00:35	0:24:02	0:23:27					
CI 3	0:24:02	0:29:27	0:05:25	CI 1	CI 2	CI 3	CI 4	CI 5
CI 1	0:29:27	0:42:31	0:13:04	0:36:31	0	0:05:25	0	0
			0:41:56					
19. SS.QT1								
CI 1	0:01:07	0:13:48	0:12:41					
CI 3	0:13:48	0:15:58	0:02:10					
CI 1	0:15:58	0:27:52	0:11:54					
CI 2	0:27:52	0:29:50	0:01:58					
CI 1	0:29:50	0:30:51	0:01:01	CI 1	CI 2	CI 3	CI 4	CI 5
CI 3	0:30:51	0:32:24	0:01:33	0:32:20	0:01:58	0:08:35	0	0
CI 1	0:32:24	0:38:17	0:05:53					
CI 3	0:38:17	0:43:09	0:04:52					
CI 1	0:43:09	0:44:00	0:00:51					
			0:42:53					
20. SS.QT2								
CI 1	0:00:32	0:01:17	0:00:45					
CI 3	0:01:17	0:05:47	0:04:30					
CI 1	0:05:47	0:19:29	0:13:42					
CI 3	0:19:29	0:21:19	0:01:50					
CI 1	0:21:19	0:25:07	0:03:48	CI 1	CI 2	CI 3	CI 4	CI 5
CI 3	0:25:07	0:26:14	0:01:07	0:36:01	0	0:07:27	0	0:01:19
CI 1	0:26:14	0:40:11	0:13:57					
CI 5	0:40:11	0:41:30	0:01:19					
CI 1	0:41:30	0:45:19	0:03:49					
			0:44:47					
21. SS.TS								
CI 1	0:00:29	0:01:02	0:00:33					
CI 3	0:01:02	0:06:57	0:05:55					
CI 1	0:06:57	0:12:33	0:05:36					
CI 3	0:12:33	0:15:51	0:03:18					
CI 1	0:15:51	0:24:14	0:08:23	CI 1	CI 2	CI 3	CI 4	CI 5
CI 3	0:24:14	0:33:14	0:09:00	0:20:50	0:03:06	0:21:23	0	0
CI 1	0:33:14	0:35:47	0:02:33					
CI 2	0:35:47	0:38:53	0:03:06					
CI 1	0:38:53	0:42:01	0:03:08					
CI 3	0:42:01	0:45:11	0:03:10					

CI 1	0:45:11	0:45:48	0:00:37					
			0:45:19					
22. SS.ToS								
CI 1	0:00:36	0:01:59	0:01:23					
CI 3	0:01:59	0:04:27	0:02:28					
CI 1	0:04:27	0:14:37	0:10:10	CI 1	CI 2	CI 3	CI 4	CI 5
CI 3	0:14:37	0:16:04	0:01:27	0:42:12	0	0:06:39	0	0
CI 1	0:16:04	0:34:47	0:18:43					
CI 3	0:34:47	0:37:31	0:02:44					
CI 1	0:37:31	0:49:27	0:11:56					
			0:48:51					
23. HN.PT								
CI 1	0:00:53	0:15:58	0:15:05					
CI 3	0:15:58	0:17:23	0:01:25					
CI 1	0:17:23	0:24:41	0:07:18	CI 1	CI 2	CI 3	CI 4	CI 5
CI 3	0:24:41	0:25:59	0:01:18	0:31:54	0:00:00	0:03:56	0:00:00	0:00:00
CI 1	0:25:59	0:32:43	0:06:44					
CI 3	0:32:43	0:33:56	0:01:13					
CI 1	0:33:56	0:36:43	0:02:47					
			0:35:50					
24. HN.CG1								
CI 1	0:00:07	0:03:51	0:03:44					
CI 3	0:03:51	0:09:13	0:05:22					
CI 1	0:09:13	0:12:40	0:03:27					
CI 3	0:12:40	0:16:37	0:03:57					
CI 1	0:16:37	0:24:08	0:07:31	CI 1	CI 2	CI 3	CI 4	CI 5
CI 2	0:24:08	0:29:13	0:05:05	0:23:57	0:06:53	0:12:13	0:00:00	0:01:04
CI 3	0:29:13	0:32:07	0:02:54					
CI 2	0:32:07	0:33:55	0:01:48					
CI 1	0:33:55	0:43:10	0:09:15					
CI 5	0:43:10	0:44:14	0:01:04					
			0:44:07					
25. HN.CG2								
CI 5	0:00:01	0:03:24	0:03:23					
CI 1	0:03:24	0:08:09	0:04:45					
CI 3	0:08:09	0:14:30	0:06:21	CI 1	CI 2	CI 3	CI 4	CI 5
CI 2	0:14:30	0:19:31	0:05:01	0:28:52	0:05:01	0:10:48	0:00:00	0:03:23
CI 1	0:19:31	0:35:16	0:15:45					
CI 3	0:35:16	0:39:43	0:04:27					
CI 1	0:39:43	0:48:05	0:08:22					
			0:48:04					
26. HN.CG3								
CI 1	0:00:13	0:00:51	0:00:38					
CI 3	0:00:51	0:08:35	0:07:44					
CI 1	0:08:35	0:21:06	0:12:31	CI 1	CI 2	CI 3	CI 4	CI 5
CI 3	0:21:06	0:24:02	0:02:56	0:22:21	0:00:34	0:18:39	0:00:00	0:00:00
CI 1	0:24:02	0:31:33	0:07:31					
CI 3	0:31:33	0:39:32	0:07:59					

CI 1	0:39:32	0:41:13	0:01:41					
CI 2	0:41:13	0:41:47	0:00:34					
			0:41:34					
27. HN.CG4								
CI 2	0:00:01	0:01:12	0:01:11					
CI 3	0:01:12	0:07:49	0:06:37					
CI 1	0:07:49	0:09:28	0:01:39					
CI 3	0:09:28	0:14:36	0:05:08					
CI 1	0:14:36	0:18:20	0:03:44	CI 1	CI 2	CI 3	CI 4	CI 5
CI 3	0:18:20	0:27:32	0:09:12	0:16:05	0:03:26	0:26:50	0:00:00	0:00:00
CI 1	0:27:32	0:35:11	0:07:39					
CI 3	0:35:11	0:41:04	0:05:53					
CI 2	0:41:04	0:43:19	0:02:15					
CI 1	0:43:19	0:46:22	0:03:03					
			0:46:21					

APPENDIX F. Results of coding – Content Activities

Lessons	Beginning	End	Time
1. TH.TG			
NP	0:00:20	0:02:43	0:02:23
MO	0:02:43	0:03:25	0:00:42
NP	0:03:25	0:05:11	0:01:46
MO	0:05:11	0:08:01	0:02:50
IP1	0:08:01	0:15:52	0:07:51
NP	0:15:52	0:19:35	0:03:43
IP2	0:19:35	0:31:38	0:12:03
NP	0:31:38	0:36:14	0:04:36
MO	0:36:14	0:38:13	0:01:59
IP3	0:38:13	0:43:31	0:05:18
NP	0:43:31	0:44:13	0:00:42
			0:43:53
2. TH.HL			
NP	0:00:16	0:01:13	0:00:57
IP1	0:01:13	0:04:58	0:03:45
NP	0:04:58	0:08:18	0:03:20
IP2	0:08:18	0:17:35	0:09:17
NP	0:17:35	0:21:45	0:04:10
IP3	0:21:45	0:36:27	0:14:42
CPSU	0:36:27	0:37:25	0:00:58
SPSW	0:37:25	0:38:40	0:01:15
CPCW	0:38:40	0:41:49	0:03:09
CPSW	0:41:49	0:44:15	0:02:26
CPCW	0:44:15	0:48:14	0:03:59
NP	0:48:14	0:48:25	0:00:11
			0:48:09
3. TH.HH			
NP	0:00:05	0:10:57	0:10:52
IP1	0:10:57	0:15:55	0:04:58
NP	0:15:55	0:19:24	0:03:29
IP2	0:19:24	0:32:46	0:13:22
NP	0:32:46	0:34:19	0:01:33
CPSU	0:34:19	0:35:08	0:00:49
CPSW	0:35:08	0:43:06	0:07:58
CPCW	0:43:06	0:46:20	0:03:14
NP	0:46:20	0:47:21	0:01:01
			0:47:16
4. TH. TT			
NP	0:00:15	0:02:56	0:02:41
IP1	0:02:56	0:08:13	0:05:17
NP	0:08:13	0:12:08	0:03:55

IP2	0:12:08	0:20:36	0:08:28
CPSU	0:20:36	0:20:56	0:00:20
SCPSW	0:20:56	0:23:02	0:02:06
CPCW	0:23:02	0:27:11	0:04:09
CPSW	0:27:11	0:33:41	0:06:30
CPCW	0:33:41	0:37:20	0:03:39
NP	0:37:20	0:38:17	0:00:57
IP6	0:38:17	0:42:16	0:03:59
NP	0:42:16	0:42:29	0:00:13
			0:42:14
5. TH.NS1			
NP	0:00:01	0:01:46	0:01:45
IP1	0:01:46	0:08:44	0:06:58
NP	0:08:44	0:10:56	0:02:12
IP2	0:10:56	0:26:35	0:15:39
NP	0:26:35	0:31:04	0:04:29
IP3	0:31:04	0:36:00	0:04:56
IP4	0:36:00	0:47:07	0:11:07
NP	0:47:07	0:47:36	0:00:29
			0:47:35
6. TH.NS2			
NP	0:00:19	0:04:04	0:03:45
IP1	0:04:04	0:20:17	0:16:13
IP2	0:20:17	0:49:24	0:29:07
NP	0:49:24	0:51:26	0:02:02
			0:51:07
7. TH.QX			
NP	0:00:32	0:05:29	0:04:57
IP1	0:05:29	0:17:44	0:12:15
NP	0:17:44	0:22:19	0:04:35
IP2	0:22:19	0:30:09	0:07:50
IP3	0:30:09	0:34:24	0:04:15
IP4	0:34:24	0:38:11	0:03:47
IP5	0:38:11	0:45:19	0:07:08
NP	0:45:19	0:47:01	0:01:42
IP6	0:47:01	0:51:34	0:04:33
NP	0:51:34	0:55:23	0:03:49
			0:54:51
8. TH.TS			
NP	0:00:12	0:23:08	0:22:56
IP1	0:23:08	0:30:14	0:07:06
NP	0:30:14	0:32:45	0:02:31
IP2	0:32:45	0:39:18	0:06:33
NP	0:39:18	0:44:53	0:05:35
			0:44:41

9. TH.TH			
NP	0:00:28	0:44:26	0:43:58
IP1	0:44:26	0:49:46	0:05:20
IP2	0:49:46	0:52:46	0:03:00
IP3	0:52:46	0:55:15	0:02:29
NP	0:55:15	0:56:14	0:00:59
			0:55:46
10. NA. ND			
NP	0:00:28	0:03:18	0:02:50
IP1	0:03:18	0:14:00	0:10:42
NP	0:14:00	0:16:04	0:02:04
IP2	0:16:04	0:20:58	0:04:54
NP	0:20:58	0:31:14	0:10:16
CPSU	0:31:14	0:31:39	0:00:25
CPSW	0:31:39	0:33:31	0:01:52
CPCW	0:33:31	0:35:34	0:02:03
IP5	0:35:34	0:37:35	0:02:01
NP	0:37:35	0:41:33	0:03:58
IP6	0:41:33	0:45:12	0:03:39
NP	0:45:12	0:47:42	0:02:30
			0:47:14
11. NA.HN			
NP	0:00:04	0:00:45	0:00:41
IP1	0:00:45	0:05:32	0:04:47
NP	0:05:32	0:21:50	0:16:18
IP2	0:21:50	0:24:09	0:02:19
IP3	0:24:09	0:27:52	0:03:43
IP4	0:27:52	0:29:35	0:01:43
IP5	0:29:35	0:30:46	0:01:11
NP	0:30:46	0:33:42	0:02:56
IP6	0:33:42	0:35:44	0:02:02
IP7	0:35:44	0:38:45	0:03:01
CPSU	0:38:45	0:39:49	0:01:04
CPSW	0:39:49	0:40:54	0:01:05
CPCW	0:40:54	0:41:40	0:00:46
NP	0:41:40	0:44:26	0:02:46
IP10	0:44:26	0:45:32	0:01:06
IP11	0:45:32	0:46:04	0:00:32
NP	0:46:04	0:47:56	0:01:52
			0:47:52
12. NA.CL			
NP	0:00:14	0:12:17	0:12:03
IP1	0:12:17	0:14:10	0:01:53
IP2	0:14:10	0:19:52	0:05:42
NP	0:19:52	0:24:55	0:05:03

IP3	0:24:55	0:28:13	0:03:18
IP4	0:28:13	0:33:06	0:04:53
NP	0:33:06	0:34:20	0:01:14
IP5	0:34:20	0:46:59	0:12:39
NP	0:46:59	0:47:40	0:00:41
			0:47:26
13. NA.NL			
NP	0:00:00	0:01:06	0:01:06
IP1	0:01:06	0:07:28	0:06:22
NP	0:07:28	0:14:55	0:07:27
CPSU	0:14:55	0:15:36	0:00:41
CPCW	0:15:36	0:16:21	0:00:45
CPSW	0:16:21	0:21:01	0:04:40
CPCW	0:21:01	0:27:57	0:06:56
CPSU	0:27:57	0:28:57	0:01:00
CPSW	0:28:57	0:31:48	0:02:51
CPCW	0:31:48	0:39:02	0:07:14
NP	0:39:02	0:41:58	0:02:56
IP7	0:41:58	0:43:41	0:01:43
IP8	0:43:41	0:45:37	0:01:56
NP	0:45:37	0:50:27	0:04:50
			0:50:27
14. NA.V			
NP	0:00:07	0:00:52	0:00:45
IP1	0:00:52	0:02:22	0:01:30
NP	0:02:22	0:03:05	0:00:43
IP2	0:03:05	0:04:18	0:01:13
NP	0:04:18	0:07:06	0:02:48
IP3	0:07:06	0:09:41	0:02:35
NP	0:09:41	0:10:26	0:00:45
IP4	0:10:26	0:14:42	0:04:16
NP	0:14:42	0:16:11	0:01:29
IP5	0:16:11	0:18:34	0:02:23
NP	0:18:34	0:22:24	0:03:50
IP6-8	0:22:24	0:29:34	0:07:10
NP	0:29:34	0:30:37	0:01:03
CPSU	0:30:37	0:30:49	0:00:12
CPSW	0:30:49	0:31:35	0:00:46
CPCW	0:31:35	0:32:59	0:01:24
IP11	0:32:59	0:38:43	0:05:44
NP	0:38:43	0:40:14	0:01:31
CPSU	0:40:14	0:40:50	0:00:36
CPSW	0:40:50	0:42:21	0:01:31
CPCW	0:42:21	0:44:14	0:01:53
NP	0:44:14	0:45:10	0:00:56

			0:45:03
15. NA.YT			
NP	0:00:17	0:01:15	0:00:58
IP1	0:01:15	0:04:32	0:03:17
NP	0:04:32	0:45:33	0:41:01
			0:45:16
16. NA.DV			
NP	0:00:07	0:08:40	0:08:33
IP1	0:08:40	0:11:25	0:02:45
IP2	0:11:25	0:13:11	0:01:46
NP	0:13:11	0:13:48	0:00:37
CPSU	0:13:48	0:14:18	0:00:30
CPSW	0:14:18	0:19:26	0:05:08
CPCW	0:19:26	0:23:18	0:03:52
NP	0:23:18	0:24:18	0:01:00
IP5	0:24:18	0:27:12	0:02:54
NP	0:27:12	0:29:03	0:01:51
IP6-7	0:29:03	0:38:53	0:09:50
NP	0:38:53	0:39:16	0:00:23
IP8	0:39:16	0:42:27	0:03:11
NP	0:42:27	0:44:34	0:02:07
			0:44:27
17. NA.TC			
NP	0:00:05	0:17:09	0:17:04
IP1	0:17:09	0:23:46	0:06:37
IP2-3	0:23:46	0:38:42	0:14:56
NP	0:38:42	0:39:41	0:00:59
IP4	0:39:41	0:45:05	0:05:24
AO ab	0:45:05	0:45:50	0:00:45
NP	0:45:50	0:46:23	0:00:33
			0:46:18
18. SS.BS			
NP	0:00:35	0:01:06	0:00:31
IP1	0:01:06	0:05:30	0:04:24
NP	0:05:30	0:06:34	0:01:04
IP2	0:06:34	0:11:19	0:04:45
NP	0:11:19	0:13:31	0:02:12
IP3	0:13:31	0:30:33	0:17:02
IP4	0:30:33	0:36:43	0:06:10
IP5	0:36:43	0:41:34	0:04:51
NP	0:41:34	0:42:31	0:00:57
			0:41:56
19. SS.QT1			
NP	0:01:07	0:06:56	0:05:49
IP1	0:06:56	0:20:51	0:13:55

NP	0:20:51	0:24:25	0:03:34
IP2	0:24:25	0:27:31	0:03:06
IP3	0:27:31	0:34:31	0:07:00
NP	0:34:31	0:35:08	0:00:37
CPSU	0:35:08	0:38:12	0:03:04
CPSW	0:38:12	0:41:33	0:03:21
CPCW	0:41:33	0:43:43	0:02:10
NP	0:43:43	0:44:00	0:00:17
			0:42:53
20. SS.QT2			
CPSU	0:00:32	0:01:09	0:00:37
SPSW	0:01:09	0:05:47	0:04:38
CPCW	0:05:47	0:07:52	0:02:05
NP	0:07:52	0:09:13	0:01:21
NM	0:09:13	0:09:43	0:00:30
IP3	0:09:43	0:14:32	0:04:49
NP	0:14:32	0:17:43	0:03:11
IP4	0:17:43	0:18:30	0:00:47
IP5	0:18:30	0:19:04	0:00:34
CPSU	0:19:04	0:19:20	0:00:16
CPSW	0:19:20	0:21:22	0:02:02
CPCW	0:21:22	0:22:39	0:01:17
NP	0:22:39	0:24:54	0:02:15
CPSU	0:24:54	0:25:10	0:00:16
CPSW	0:25:10	0:26:25	0:01:15
CPCW	0:26:25	0:27:27	0:01:02
NP	0:27:27	0:28:18	0:00:51
IP10	0:28:18	0:35:28	0:07:10
IP11	0:35:28	0:38:19	0:02:51
NP	0:38:19	0:40:01	0:01:42
IP12	0:40:01	0:45:03	0:05:02
NP	0:45:03	0:45:19	0:00:16
			0:44:47
21. SS.TS			
NP	0:00:29	0:01:02	0:00:33
IP1	0:01:02	0:07:01	0:05:59
NP	0:07:01	0:08:22	0:01:21
IP2	0:08:22	0:17:04	0:08:42
NP	0:17:04	0:18:37	0:01:33
IP3	0:18:37	0:21:38	0:03:01
NP	0:21:38	0:21:58	0:00:20
CPSU	0:21:58	0:23:58	0:02:00
CPSW	0:23:58	0:33:14	0:09:16
CPCW	0:33:14	0:34:51	0:01:37
NP	0:34:51	0:35:47	0:00:56

IP7	0:35:47	0:45:17	0:09:30
NP	0:45:17	0:45:48	0:00:31
			0:45:19
22. SS.ToS			
NP	0:00:36	0:01:50	0:01:14
IP1	0:01:50	0:05:26	0:03:36
NP	0:05:26	0:13:30	0:08:04
IP2	0:13:30	0:18:03	0:04:33
NP	0:18:03	0:23:20	0:05:17
IP3	0:23:20	0:30:21	0:07:01
AO a	0:30:21	0:33:43	0:03:22
NP	0:33:43	0:34:34	0:00:51
IP4	0:34:34	0:39:47	0:05:13
NP	0:39:47	0:43:56	0:04:09
IP5	0:43:56	0:49:15	0:05:19
NP	0:49:15	0:49:27	0:00:12
			0:48:51
23. HN.PT			
NP	0:00:53	0:14:39	0:13:46
CPSU	0:14:39	0:15:20	0:00:41
CPSW	0:15:20	0:17:33	0:02:13
CPCW	0:17:33	0:22:33	0:05:00
NP	0:22:33	0:23:19	0:00:46
CPSU	0:23:19	0:24:41	0:01:22
CPSW	0:24:41	0:25:42	0:01:01
CPCW	0:25:42	0:31:06	0:05:24
NP	0:31:06	0:31:34	0:00:28
CPSU	0:31:34	0:32:15	0:00:41
CPSW	0:32:15	0:33:56	0:01:41
CPCW	0:33:56	0:36:08	0:02:12
NP	0:36:08	0:36:43	0:00:35
			0:35:50
24. HN.CG1			
NP	0:00:07	0:02:11	0:02:04
IP1	0:02:11	0:10:55	0:08:44
CPSU	0:10:55	0:12:06	0:01:11
CPSW	0:12:06	0:16:37	0:04:31
CPCW	0:16:37	0:23:01	0:06:24
IP4	0:23:01	0:39:40	0:16:39
NP	0:39:40	0:41:36	0:01:56
IP5	0:41:36	0:44:14	0:02:38
			0:44:07
25. HN.CG2			
IP1	0:00:01	0:05:50	0:05:49
NP	0:05:50	0:06:24	0:00:34

CPSU	0:06:24	0:07:55	0:01:31
CPSW	0:07:55	0:14:30	0:06:35
CPCW	0:14:30	0:28:53	0:14:23
NP	0:28:53	0:33:20	0:04:27
CPSU	0:33:20	0:34:33	0:01:13
CPSW	0:34:33	0:39:43	0:05:10
CPCW	0:39:43	0:47:50	0:08:07
NP	0:47:50	0:48:05	0:00:15
			0:48:04
26. HN.CG3			
IP1	0:00:13	0:13:15	0:13:02
MO	0:13:15	0:13:45	0:00:30
AO a	0:13:45	0:16:17	0:02:32
MO	0:16:17	0:17:44	0:01:27
IP2	0:17:44	0:24:35	0:06:51
IP3	0:24:35	0:26:14	0:01:39
IP4	0:26:14	0:39:22	0:13:08
MO	0:39:22	0:40:43	0:01:21
NP	0:40:43	0:41:47	0:01:04
			0:41:34
27. HN.CG4			
CPSU	0:00:01	0:00:56	0:00:55
CPSW	0:00:56	0:07:52	0:06:56
CPCW	0:07:52	0:09:02	0:01:10
CPSW	0:09:02	0:14:43	0:05:41
CPCW	0:14:43	0:18:20	0:03:37
CPSW	0:18:20	0:20:08	0:01:48
CPSU	0:20:08	0:20:27	0:00:19
CPSW	0:20:27	0:27:49	0:07:22
CPCW	0:27:49	0:29:44	0:01:55
MO	0:29:44	0:30:17	0:00:33
CPCW	0:30:17	0:35:11	0:04:54
CPSW	0:35:11	0:41:07	0:05:56
CPCW	0:41:07	0:41:36	0:00:29
CPSW	0:41:36	0:43:19	0:01:43
CPCW	0:43:19	0:46:22	0:03:03
			0:46:21

APPENDIX G. Results of coding – Purpose of different lesson segments

Lessons	Beginning	End	Time
1. TH.TG			
P1	0:00:20	0:03:06	0:02:46
P2	0:03:06	0:16:20	0:13:14
P3	0:16:20	0:18:36	0:02:16
P2	0:18:36	0:31:53	0:13:17
P3	0:31:53	0:44:13	0:12:20
			0:43:53
2.TH.HL			
P1	0:00:16	0:05:16	0:05:00
P2	0:05:16	0:21:41	0:16:25
P3	0:21:41	0:48:25	0:26:44
			0:48:09
3. TH.HH			
P1	0:00:05	0:04:22	0:04:17
P2	0:04:22	0:34:09	0:29:47
P3	0:34:09	0:47:21	0:13:12
			0:47:16
4. TH.TT			
P1	0:00:15	0:01:45	0:01:30
P2	0:01:45	0:12:08	0:10:23
P3	0:12:08	0:42:29	0:30:21
			0:42:14
5. TH.NS1			
P1	0:00:01	0:00:39	0:00:38
P2	0:00:39	0:26:42	0:26:03
P3	0:26:42	0:47:36	0:20:54
			0:47:35
6. TH.NS2			
P1	0:00:19	0:51:26	0:51:07
7. TH.QX			
P1	0:00:32	0:04:30	0:03:58
P2	0:04:30	0:19:35	0:15:05
P3	0:19:35	0:55:23	0:35:48
			0:54:51
8. TH.TS			
P1	0:00:12	0:03:54	0:03:42
P2	0:03:54	0:13:20	0:09:26
P3	0:13:20	0:16:35	0:03:15
P2	0:16:35	0:23:02	0:06:27
P3	0:23:02	0:30:14	0:07:12
P2	0:30:14	0:39:53	0:09:39
P3	0:39:53	0:44:53	0:05:00

			0:44:41
9. TH.TH			
P1	0:00:28	0:02:31	0:02:03
P2	0:02:31	0:04:08	0:01:37
P1	0:04:08	0:11:40	0:07:32
P2	0:11:40	0:17:27	0:05:47
P3	0:17:27	0:21:01	0:03:34
P2	0:21:01	0:27:33	0:06:32
P3	0:27:33	0:28:44	0:01:11
P2	0:28:44	0:44:14	0:15:30
P3	0:44:14	0:56:14	0:12:00
			0:55:46
10. NA.ND			
P1	0:00:28	0:01:50	0:01:22
P2	0:01:50	0:14:00	0:12:10
P3	0:14:00	0:20:58	0:06:58
P2	0:20:58	0:29:55	0:08:57
P3	0:29:55	0:39:59	0:10:04
P2	0:39:59	0:46:19	0:06:20
P3	0:46:19	0:47:42	0:01:23
			0:47:14
11. NA.HN			
P1	0:00:04	0:05:32	0:05:28
P2	0:05:32	0:11:15	0:05:43
P3	0:11:15	0:16:21	0:05:06
P1	0:16:21	0:17:13	0:00:52
P2	0:17:13	0:21:40	0:04:27
P3	0:21:40	0:31:46	0:10:06
P2	0:31:46	0:33:42	0:01:56
P3	0:33:42	0:47:56	0:14:14
			0:47:52
12. NA.CL			
P1	0:00:14	0:02:25	0:02:11
P2	0:02:25	0:05:48	0:03:23
P3	0:05:48	0:09:30	0:03:42
P2	0:09:30	0:12:13	0:02:43
P3	0:12:13	0:21:00	0:08:47
P2	0:21:00	0:24:45	0:03:45
P3	0:24:45	0:34:20	0:09:35
P2	0:34:20	0:47:40	0:13:20
			0:47:26
13. NA.NL			
P1	0:00:00	0:50:27	0:50:27
14. NA.V			
P1	0:00:07	0:05:22	0:05:15

P2	0:05:22	0:10:22	0:05:00
P3	0:10:22	0:14:52	0:04:30
P2	0:14:52	0:16:03	0:01:11
P3	0:16:03	0:20:56	0:04:53
P2	0:20:56	0:27:51	0:06:55
P3	0:27:51	0:32:59	0:05:08
P2	0:32:59	0:45:10	0:12:11
			0:45:03
15. NA.YT			
P1	0:00:17	0:04:50	0:04:33
P2	0:04:50	0:08:22	0:03:32
P3	0:08:22	0:12:24	0:04:02
P2	0:12:24	0:16:26	0:04:02
P3	0:16:26	0:28:45	0:12:19
P2	0:28:45	0:34:32	0:05:47
P3	0:34:32	0:45:33	0:11:01
			0:45:16
16. NA.DV			
P1	0:00:07	0:04:37	0:04:30
P2	0:04:37	0:13:46	0:09:09
P3	0:13:46	0:24:11	0:10:25
P2	0:24:11	0:39:12	0:15:01
P3	0:39:12	0:44:34	0:05:22
			0:44:27
17. NA.TC			
P1	0:00:05	0:27:41	0:27:36
P2	0:27:41	0:46:23	0:18:42
			0:46:18
18. SS.BS			
P1	0:00:35	0:05:03	0:04:28
P2	0:05:03	0:30:33	0:25:30
P3	0:30:33	0:42:31	0:11:58
			0:41:56
19. SS.QT1			
P1	0:01:07	0:05:49	0:04:42
P2	0:05:49	0:27:33	0:21:44
P3	0:27:33	0:44:00	0:16:27
			0:42:53
20. SS.QT2			
P1	0:00:32	0:07:59	0:07:27
P2	0:07:59	0:24:54	0:16:55
P3	0:24:54	0:27:27	0:02:33
P2	0:27:27	0:35:28	0:08:01
P3	0:35:28	0:45:19	0:09:51
			0:44:47

21. SS.TS			
P1	0:00:29	0:07:17	0:06:48
P2	0:07:17	0:18:13	0:10:56
P3	0:18:13	0:45:48	0:27:35
			0:45:19
22. SS.ToS			
P1	0:00:36	0:05:26	0:04:50
P2	0:05:26	0:11:32	0:06:06
P3	0:11:32	0:18:03	0:06:31
P2	0:18:03	0:34:34	0:16:31
P3	0:34:34	0:41:59	0:07:25
P2	0:41:59	0:43:53	0:01:54
P3	0:43:53	0:49:27	0:05:34
			0:48:51
23. HN.PT			
P1	0:00:53	0:36:43	0:35:50
24. HN.CG1			
P1	0:00:07	0:44:14	0:44:07
25. HN.CG2			
P1	0:00:01	0:48:05	0:48:04
26. HN.CG3			
P1	0:00:13	0:41:47	0:41:34
27. HN.CG4			
P1	0:00:01	0:46:22	0:46:21

APPENDIX H. Results of coding – Pedagogical Features

Lessons	AH	GS	HB	OI	SL	RLNP
1. TH.TG	1	1			1	1
2. TH.HL	1	1			1	
3. TH.HH	1	1			1	
4. TH.TT	1	1				
5. TH.NS1	1	1			1	
6. TH.NS2	1	1			1	
7. TH.QX	1	1		1		1
8. TH.TS	1	1			1	
9. TH.TH	1	1			1	
10. NA.ND		1			1	
11. NA.HN	1	1				1
12. NA.CL	1	1		1	1	
13. NA.NL	1	1	1		1	
14. NA.V	1	1				
15. NA.YT	1	1			1	
16. NA.DV	1	1			1	
17. NA.TC	1	1				
18. SS.BS		1			1	
19. SS.QT1	1	1			1	
20. SS.QT2	1	1			1	
21. SS.TS	1	1				
22. SS.ToS	1	1				1
23. HN.PT	1	1				
24. HN.CG1		1				
25. HN.CG2	1					
26. HN.CG3	1	1				
27. HN.CG4	1					
Number of Lessons	24	25	1	2	15	4
Percentage	89	93	4	7	56	15

APPENDIX I. Results of coding – Resources used during the lesson

Lessons	CH	PRO	TV	TXW	SMM	RWO	CALC	COMP
1. TH.TG	1	1		1	1			1
2. TH.HL	1	1		1	1			1
3. TH.HH	1	1		1	1			1
4. TH.TT	1			1	1			
5. TH.NS1	1			1	1			
6. TH.NS2	1			1	1			
7. TH.QX	1	1		1	1			1
8. TH.TS	1			1	1			
9. TH.TH	1			1	1			
10. NA.ND	1			1	1			
11. NA.HN	1			1	1			
12. NA.CL	1			1	1			
13. NA.NL	1	1		1				1
14. NA.V	1	1		1	1			1
15. NA.YT	1			1	1			
16. NA.DV	1			1	1			
17. NA.TC	1	1		1	1			1
18. SS.BS	1			1	1			
19. SS.QT1	1			1	1			
20. SS.QT2	1	1		1				1
21. SS.TS	1			1	1			
22. SS.ToS	1	1		1				1
23. HN.PT	1			1	1			
24. HN.CG1	1			1	1			
25. HN.CG2	1			1	1			
26. HN.CG3	1			1	1			
27. HN.CG4	1			1	1			
Number of Lessons	27	9	0	27	24	0	0	9
Percentage	100	33	0	100	89	0	0	33

APPENDIX K. Results of coding – Teacher and students participated in the CI1 and CI2

Teacher			Teacher and Students			Students		
1. TH.TG								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:02:43	0:11:58	0:09:15	0:00:20	0:02:43	0:02:23	0:20:16	0:21:25	0:01:09
0:15:52	0:20:16	0:04:24	0:11:58	0:15:52	0:03:54	0:36:20	0:37:34	0:01:14
0:21:25	0:27:28	0:06:03	0:27:28	0:28:35	0:01:07	0:38:34	0:39:33	0:00:59
0:28:35	0:29:26	0:00:51	0:29:26	0:31:38	0:02:12			
0:31:38	0:33:16	0:01:38	0:42:10	0:43:31	0:01:21			
0:34:32	0:36:20	0:01:48						
0:37:34	0:38:34	0:01:00						
0:40:43	0:42:10	0:01:27						
0:43:31	0:44:13	0:00:42						
		0:27:08			0:10:57			0:03:22
2. TH.HL								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:04:16	0:08:36	0:04:20	0:00:16	0:01:45	0:01:29			
0:18:27	0:19:53	0:01:26	0:09:56	0:11:41	0:01:45			
0:44:15	0:45:58	0:01:43	0:14:51	0:18:27	0:03:36			
			0:19:53	0:24:28	0:04:35			
			0:29:27	0:37:25	0:07:58			
			0:38:38	0:41:49	0:03:11			
			0:45:58	0:48:25	0:02:27			
		0:07:29			0:25:01			
3. TH.HH								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:05:38	0:07:23	0:01:45	0:00:05	0:01:05	0:01:00	0:01:05	0:02:17	0:01:12
0:09:00	0:11:12	0:02:12	0:02:17	0:05:38	0:03:21	0:07:23	0:09:00	0:01:37
0:16:41	0:17:48	0:01:07	0:11:12	0:16:41	0:05:29			
			0:17:48	0:21:23	0:03:35			
			0:26:05	0:34:19	0:08:14			
			0:34:19	0:35:38	0:01:19			
			0:43:06	0:47:21	0:04:15			
		0:05:04			0:27:13			0:02:49
4. TH. TT								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:02:12	0:04:40	0:02:28	0:00:15	0:02:12	0:01:57			
0:10:59	0:12:12	0:01:13	0:04:40	0:10:59	0:06:19			
0:12:12	0:14:53	0:02:41	0:14:53	0:18:03	0:03:10			
0:18:03	0:19:18	0:01:15	0:19:18	0:20:51	0:01:33			
0:20:51	0:22:54	0:02:03	0:22:54	0:27:11	0:04:17			
0:36:50	0:38:17	0:01:27	0:33:41	0:36:50	0:03:09			
0:40:18	0:41:27	0:01:09	0:41:27	0:42:29	0:01:02			
		0:12:16			0:21:27			
5. TH.NS1								
Begin	End	Time	Begin	End	Time	Begin	End	Time

0:02:17	0:04:35	0:02:18	0:00:01	0:02:17	0:02:16			
0:28:05	0:29:16	0:01:11	0:04:35	0:28:05	0:23:30			
0:30:27	0:31:04	0:00:37	0:29:16	0:30:27	0:01:11			
			0:32:54	0:36:16	0:03:22			
			0:36:16	0:37:42	0:01:26			
			0:43:40	0:47:36	0:03:56			
		0:04:06			0:35:41			
6. TH.NS2								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:02:52	0:04:15	0:01:23	0:00:19	0:02:52	0:02:33			
0:16:37	0:18:10	0:01:33	0:04:15	0:09:44	0:05:29			
0:49:24	0:51:26	0:02:02	0:14:21	0:16:37	0:02:16			
			0:18:10	0:20:28	0:02:18			
			0:20:28	0:29:19	0:08:51			
			0:39:35	0:42:37	0:03:02			
			0:44:39	0:47:22	0:02:43			
			0:47:22	0:49:24	0:02:02			
		0:04:58			0:29:14			
7. TH.QX								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:03:02	0:06:29	0:03:27	0:00:32	0:02:00	0:01:28			
0:06:29	0:09:29	0:03:00	0:18:25	0:21:31	0:03:06			
0:09:29	0:10:39	0:01:10	0:23:07	0:29:50	0:06:43			
0:16:17	0:18:25	0:02:08	0:31:04	0:32:49	0:01:45			
0:21:31	0:23:07	0:01:36	0:38:22	0:40:05	0:01:43			
0:29:50	0:31:04	0:01:14	0:47:03	0:49:49	0:02:46			
0:34:15	0:35:16	0:01:01						
0:37:05	0:38:22	0:01:17						
0:43:38	0:47:03	0:03:25						
0:49:49	0:52:42	0:02:53						
0:54:40	0:55:23	0:00:43						
		0:21:54			0:17:31			
8. TH.TS								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:00:12	0:01:19	0:01:07	0:01:19	0:03:41	0:02:22			
0:03:41	0:06:25	0:02:44	0:06:25	0:07:36	0:01:11			
0:07:36	0:08:36	0:01:00	0:08:36	0:09:37	0:01:01			
0:09:37	0:11:07	0:01:30	0:11:07	0:13:36	0:02:29			
0:13:36	0:14:36	0:01:00	0:14:36	0:16:35	0:01:59			
0:16:35	0:18:41	0:02:06	0:18:41	0:19:51	0:01:10			
0:22:53	0:24:23	0:01:30	0:19:51	0:22:53	0:03:02			
0:26:40	0:27:46	0:01:06	0:24:23	0:26:40	0:02:17			
0:28:57	0:33:33	0:04:36	0:27:46	0:28:57	0:01:11			
0:38:45	0:40:16	0:01:31	0:37:16	0:38:45	0:01:29			
0:40:16	0:42:14	0:01:58						
0:43:24	0:44:53	0:01:29						
		0:21:37			0:18:11			
9. TH.TH								

Begin	End	Time	Begin	End	Time	Begin	End	Time
0:01:45	0:06:18	0:04:33	0:00:28	0:01:45	0:01:17			
0:08:15	0:09:13	0:00:58	0:06:18	0:08:15	0:01:57			
0:11:14	0:12:25	0:01:11	0:09:13	0:11:14	0:02:01			
0:15:28	0:19:04	0:03:36	0:12:25	0:15:28	0:03:03			
0:22:05	0:24:22	0:02:17	0:19:04	0:22:05	0:03:01			
0:28:18	0:30:37	0:02:19	0:25:29	0:28:18	0:02:49			
0:34:24	0:38:23	0:03:59	0:30:37	0:32:40	0:02:03			
0:39:56	0:42:22	0:02:26	0:32:40	0:34:24	0:01:44			
0:44:10	0:45:14	0:01:04	0:38:23	0:39:56	0:01:33			
			0:42:22	0:44:10	0:01:48			
			0:47:31	0:49:52	0:02:21			
			0:53:53	0:56:14	0:02:21			
		0:22:23			0:25:58			
10. NA.ND								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:01:45	0:03:53	0:02:08	0:00:28	0:01:45	0:01:17			
0:06:26	0:08:17	0:01:51	0:03:53	0:06:26	0:02:33			
0:11:55	0:13:29	0:01:34	0:08:17	0:11:55	0:03:38			
0:20:32	0:22:17	0:01:45	0:13:29	0:20:32	0:07:03			
0:24:13	0:26:48	0:02:35	0:22:17	0:24:13	0:01:56			
0:27:48	0:30:04	0:02:16	0:26:48	0:27:48	0:01:00			
0:37:17	0:38:55	0:01:38	0:30:04	0:31:39	0:01:35			
			0:33:29	0:35:53	0:02:24			
			0:38:55	0:47:42	0:08:47			
		0:13:47			0:30:13			
11. NA.HN								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:00:04	0:00:54	0:00:50	0:06:46	0:09:52	0:03:06			
0:04:23	0:06:46	0:02:23	0:11:35	0:17:13	0:05:38			
0:09:52	0:11:35	0:01:43	0:18:25	0:24:34	0:06:09			
0:17:13	0:18:25	0:01:12	0:25:34	0:28:00	0:02:26			
0:30:48	0:32:20	0:01:32	0:28:00	0:30:48	0:02:48			
			0:32:20	0:39:56	0:07:36			
			0:40:56	0:47:56	0:07:00			
		0:07:40			0:34:43			
12. NA.CL								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:02:08	0:03:57	0:01:49	0:00:14	0:02:08	0:01:54			
0:09:12	0:11:00	0:01:48	0:03:57	0:09:12	0:05:15			
0:14:07	0:15:15	0:01:08	0:11:00	0:14:07	0:03:07			
0:20:03	0:21:44	0:01:41	0:19:03	0:20:03	0:01:00			
0:33:06	0:36:01	0:02:55	0:21:44	0:25:19	0:03:35			
			0:27:07	0:28:59	0:01:52			
			0:31:06	0:33:06	0:02:00			
			0:36:01	0:37:26	0:01:25			
			0:41:04	0:47:40	0:06:36			
		0:09:21			0:26:44			

13. NA.NL								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:00:00	0:00:26	0:00:26	0:04:40	0:07:28	0:02:48			
0:07:28	0:09:24	0:01:56	0:09:24	0:13:11	0:03:47			
0:13:11	0:15:11	0:02:00	0:15:11	0:16:21	0:01:10			
0:27:57	0:28:57	0:01:00	0:21:01	0:27:57	0:06:56			
0:33:48	0:35:14	0:01:26	0:31:42	0:33:48	0:02:06			
0:38:58	0:40:14	0:01:16	0:35:14	0:38:58	0:03:44			
0:45:37	0:50:27	0:04:50	0:40:14	0:41:56	0:01:42			
			0:41:56	0:45:37	0:03:41			
		0:12:54			0:25:54			
14. NA.V								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:05:02	0:07:25	0:02:23	0:00:07	0:05:02	0:04:55			
0:21:00	0:23:06	0:02:06	0:09:23	0:10:32	0:01:09			
0:24:07	0:26:25	0:02:18	0:12:15	0:16:25	0:04:10			
0:38:38	0:39:38	0:01:00	0:17:28	0:20:00	0:02:32			
0:39:38	0:40:59	0:01:21	0:29:20	0:30:37	0:01:17			
			0:31:55	0:35:36	0:03:41			
			0:37:09	0:38:38	0:01:29			
			0:42:24	0:45:10	0:02:46			
		0:09:08			0:21:59			
15. NA.YT								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:04:48	0:10:12	0:05:24	0:00:17	0:04:48	0:04:31			
0:20:08	0:21:32	0:01:24	0:10:12	0:20:08	0:09:56			
0:22:46	0:25:29	0:02:43	0:21:32	0:22:46	0:01:14			
0:29:51	0:30:59	0:01:08	0:25:29	0:29:51	0:04:22			
0:34:00	0:36:00	0:02:00	0:30:59	0:34:00	0:03:01			
0:37:33	0:40:20	0:02:47	0:40:20	0:45:33	0:05:13			
		0:15:26			0:28:17			
16. NA.DV								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:04:38	0:09:34	0:04:56	0:00:07	0:04:38	0:04:31			
0:19:26	0:24:46	0:05:20	0:09:34	0:13:54	0:04:20			
0:27:03	0:29:58	0:02:55	0:24:46	0:27:03	0:02:17			
			0:29:58	0:34:58	0:05:00			
			0:37:35	0:39:16	0:01:41			
			0:39:16	0:42:27	0:03:11			
			0:42:27	0:44:34	0:02:07			
		0:13:11			0:23:07			
17. NA.YT								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:00:05	0:02:28	0:02:23	0:05:00	0:06:40	0:01:40	0:02:28	0:05:00	0:02:32
0:06:40	0:12:31	0:05:51	0:12:31	0:17:52	0:05:21			
0:17:52	0:20:33	0:02:41	0:20:33	0:27:17	0:06:44			
0:27:17	0:31:46	0:04:29	0:31:46	0:33:19	0:01:33			
0:33:19	0:37:25	0:04:06	0:37:25	0:40:01	0:02:36			

0:40:01	0:42:18	0:02:17						
0:42:18	0:46:23	0:04:05						
		0:25:52			0:17:54			0:02:32
18. SS.BS								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:04:32	0:09:50	0:05:18	0:00:35	0:01:52	0:01:17	0:01:52	0:04:32	0:02:40
0:11:41	0:13:47	0:02:06	0:09:50	0:11:41	0:01:51			
0:20:03	0:24:02	0:03:59	0:13:47	0:20:03	0:06:16			
0:29:27	0:31:59	0:02:32	0:31:59	0:36:00	0:04:01			
0:36:00	0:39:57	0:03:57	0:39:57	0:41:31	0:01:34			
0:41:31	0:42:31	0:01:00						
		0:18:52			0:14:59			0:02:40
19. SS.QT1								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:04:56	0:11:47	0:06:51	0:01:07	0:04:56	0:03:49			
0:20:21	0:24:24	0:04:03	0:11:47	0:13:48	0:02:01			
0:26:09	0:27:52	0:01:43	0:15:58	0:20:21	0:04:23			
0:27:52	0:29:50	0:01:58	0:24:24	0:26:09	0:01:45			
0:29:50	0:30:51	0:01:01	0:33:33	0:34:33	0:01:00			
0:32:24	0:33:33	0:01:09	0:35:33	0:38:17	0:02:44			
0:34:33	0:35:33	0:01:00						
0:43:09	0:44:00	0:00:51						
		0:18:36			0:15:42			
20. SS.QT2								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:00:32	0:01:17	0:00:45	0:05:47	0:06:55	0:01:08	0:41:30	0:43:40	0:02:10
0:06:55	0:10:05	0:03:10	0:10:05	0:14:42	0:04:37			
0:14:42	0:15:46	0:01:04	0:15:46	0:19:29	0:03:43			
0:21:19	0:22:55	0:01:36	0:22:55	0:23:55	0:01:00			
0:23:55	0:25:07	0:01:12	0:28:34	0:30:10	0:01:36			
0:26:14	0:28:34	0:02:20	0:32:00	0:34:49	0:02:49			
0:30:10	0:32:00	0:01:50	0:35:49	0:40:11	0:04:22			
0:34:49	0:35:49	0:01:00	0:43:40	0:45:19	0:01:39			
		0:12:57			0:20:54			0:02:10
21. SS.TS								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:00:29	0:01:02	0:00:33	0:09:52	0:12:33	0:02:41	0:38:53	0:41:01	0:02:08
0:06:57	0:09:52	0:02:55	0:17:20	0:18:23	0:01:03			
0:15:51	0:17:20	0:01:29	0:19:38	0:21:38	0:02:00			
0:18:23	0:19:38	0:01:15	0:22:47	0:24:14	0:01:27			
0:21:38	0:22:47	0:01:09	0:37:40	0:38:53	0:01:13			
0:33:14	0:35:47	0:02:33	0:41:01	0:42:01	0:01:00			
0:35:47	0:37:40	0:01:53						
0:45:11	0:45:48	0:00:37						
		0:12:24			0:09:24			0:02:08
22. SS.ToS								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:07:14	0:10:47	0:03:33	0:00:36	0:01:59	0:01:23			

0:21:29	0:23:24	0:01:55	0:04:27	0:07:14	0:02:47			
0:39:47	0:40:54	0:01:07	0:10:47	0:14:37	0:03:50			
0:41:58	0:44:12	0:02:14	0:16:04	0:21:29	0:05:25			
			0:23:24	0:34:47	0:11:23			
			0:37:31	0:39:47	0:02:16			
			0:40:54	0:41:58	0:01:04			
			0:44:12	0:49:27	0:05:15			
		0:08:49			0:33:23			
23. HN.PT								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:00:53	0:03:49	0:02:56	0:03:49	0:13:27	0:09:38			
0:13:27	0:15:58	0:02:31	0:17:23	0:22:33	0:05:10			
0:22:33	0:23:41	0:01:08	0:23:41	0:24:41	0:01:00			
0:35:27	0:36:43	0:01:16	0:25:59	0:32:43	0:06:44			
			0:33:56	0:35:27	0:01:31			
		0:07:51			0:24:03			
24. HN.CG1								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:00:07	0:01:07	0:01:00	0:01:07	0:02:07	0:01:00			
0:02:07	0:03:51	0:01:44	0:16:37	0:17:37	0:01:00			
0:09:13	0:12:40	0:03:27	0:21:10	0:22:10	0:01:00			
0:17:37	0:21:10	0:03:33	0:24:08	0:26:24	0:02:16			
0:22:10	0:24:08	0:01:58	0:27:24	0:29:13	0:01:49			
0:26:24	0:27:24	0:01:00	0:32:07	0:33:55	0:01:48			
0:33:55	0:43:10	0:09:15						
		0:21:57			0:08:53			
25. HN.CG2								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:03:24	0:04:42	0:01:18	0:04:42	0:05:50	0:01:08			
0:05:50	0:08:09	0:02:19	0:14:30	0:19:31	0:05:01			
0:19:31	0:35:16	0:15:45	0:39:43	0:44:04	0:04:21			
0:44:04	0:48:05	0:04:01						
		0:23:23			0:10:30			
26. HN.CG3								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:00:13	0:00:51	0:00:38	0:25:07	0:26:14	0:01:07			
0:08:35	0:21:06	0:12:31	0:27:14	0:31:33	0:04:19			
0:24:02	0:25:07	0:01:05						
0:26:14	0:27:14	0:01:00						
0:39:32	0:41:13	0:01:41						
0:41:13	0:41:47	0:00:34						
		0:17:29			0:05:26			
27. HN.CG4								
Begin	End	Time	Begin	End	Time	Begin	End	Time
0:00:01	0:01:12	0:01:11	0:16:34	0:18:20	0:01:46			
0:07:49	0:09:28	0:01:39	0:31:17	0:33:55	0:02:38			
0:14:36	0:16:34	0:01:58	0:43:19	0:44:19	0:01:00			
0:27:32	0:31:17	0:03:45						

0:33:55	0:35:11	0:01:16						
0:41:04	0:43:19	0:02:15						
0:44:19	0:46:22	0:02:03						
		0:14:07			0:05:24			
Sum		6:30:39			9:28:42			0:15:41

APPENDIX L. Percentage of Vietnamese lessons marked at each 10 percent interval of the lessons

	Percent interval (time) of the lessons										
	Beginning					Midpoint					End
	0	10	20	30	40	50	60	70	80	90	100
Review	100	70	33	30	30	30	30	26	26	26	26
Introduction of new content	0	30	59	44	37	41	33	37	19	15	11
Practice of new content	0	0	7	26	33	30	37	37	56	59	63
Public interaction	93	74	74	74	78	85	59	67	56	48	85
Optional, teacher presents information	4	7	0	4	11	7	11	4	7	11	7
Optional, student presents information	0	19	22	22	7	7	30	22	30	30	0
Private interaction	4	0	4	0	4	0	0	7	7	11	7
Mathematical organization	0	0	0	0	4	0	0	0	0	0	0
Non-problem	85	37	44	37	30	26	15	22	15	15	81
Concurrent problem set-up	7	0	0	0	4	4	0	7	4	4	0
Concurrent problem classwork	0	0	4	0	11	22	15	11	7	7	11
Concurrent problem seatwork	0	7	4	11	7	7	11	15	15	15	0
Answered-only problems	0	0	0	0	0	0	0	0	0	0	0
Independent problem 1	7	52	30	26	7	4	4	0	4	0	0
Independent problem 2-5	0	4	15	26	37	37	52	44	48	48	7
Independent problem 6-10	0	0	0	0	0	0	4	0	7	11	0