Doctoral Dissertation

REGIONAL DIFFERENCES IN QUALITY OF PRIMARY EDUCATION IN CAMBODIA: FOCUSING ON INSTRUCTIONAL PROCESS IN URBAN AND RURAL SCHOOLS

SOPHEAK SONG

2014

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DISSERTATION

Submitted in Partial Fulfillment of the Requirements

for the Degree of

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GRADUATE SCHOOL OF EDUCATION

HIROSHIMA UNIVERSITY

March, 2014

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ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to the following individuals and institutions for their assistance and support, without which the completion of this dissertation would not have been possible.

I am most grateful to my advisor Professor Yutaka Otsuka for his great patience, immense knowledge, and hard questions. His guidance helped me in all the phases of research and writing of this dissertation. The whole project has been extremely thoughtful and rewarding to me.

I would like to extend my special thanks to the other two members of my dissertation committee: Professor Kazukiyo Kono for his insightful comments which helped improve the conceptualization of the problem investigated in this study and Professor Hirotoshi Yamasaki for his invaluable statistical advice.

I am also indebted to the principals, teachers, and pupils of the primary schools in Angk Snuol and Preah Netr Preah districts for spending their precious time participating in this study and for providing me access to their classrooms. My deepest thank goes to the pupils and teachers of the four videotaped classrooms for their persistent endurance with my frequent intrusions on their classroom life.

I owe a very important debt to the Japanese people through their government for granting me financial support for pursuing my study in Japan and through daily encounters for their friendliness and kindness. My thanks go to my labmates for their kindly listening to my presentations and interesting discussions over the years. Last but not least, I would like to show my greatest appreciation to Hiroshima University for providing me a comfortable and resourceful place to study.

Hiroshima, January 24, 2014

Sopheak Song

ABSTRACT

The main purpose of this study is to examine the quality of education in Cambodian primary schools by attempting to link an array of factors to pupils' academic achievement. These factors include characteristics of classroom instruction, school resources, and context variables such as teaching and learning policy and the socio-economic conditions of pupils' families. The study aims to answer the following four research questions: (1) What school and family factors are associated with pupils' achievement?; (2) What is the effect of student-centered approach policy on teachers' classroom practices?; (3)What is the relationship between instructional process and pupils' achievement? (4) Are there any regional differences in resources, instructional process, and pupils' achievement in primary schools?

The data on which this study is based were obtained through three times of fieldwork, each of which lasted for about two months. Four types of instruments were employed to collect these data including questionnaire surveys with principals, teachers, and pupils; achievement tests for pupils; interviews with teachers; and video-recoding of classroom teaching. A total of 1080 sixth-grade pupils from 32 schools (16 from each area) participated in the questionnaire survey and took test in math and Khmer language. The achievement test was jointly constructed by teachers, head teachers of the respective subjects in the target schools, and the researcher. Information about school resources and teaching and learning conditions was also collected from the school principals and teachers in charge of those pupils. Thirty sixth-grade teachers were involved in interviews. In addition, 391 teachers from the two districts completed questionnaires on their beliefs and implementation with regard to the newly-reformed pedagogy of student-centered approach. Twelve mathematics lessons given by four teachers (three lessons per teacher) were video-taped by the researcher.

School resources were found to have a considerable effect on learning of primary school pupils in Cambodia. After controlling for pupil background characteristics, school accounted for at least 35% of the variation in achievement scores. This finding provides additional support for policies aimed at improving school resources to raise pupils' academic achievement. Specifically, the study identified three important aspects of school resources that were significantly correlated to pupil achievement: teacher experience, teacher guides and instructional time. Pupils performed better in schools with more experienced teachers, higher availability of guidebooks for teachers and longer annual instructional time than in schools with less of these resources. As an out-of-school academic activity, private tutoring was found to exert a robust influence on academic achievement. At the teaching and learning (process) level, two key dimensions of instruction, i.e., classroom tasks (assignments or problems worked out by pupils during classes) and teacher-pupil verbal interaction were investigated and linked to pupils' achievement. The results clarified that high-achieving students were more likely to study with a teacher who gave them more tasks to do per lesson and who presented the tasks in a variety of forms including numerical symbols, concrete objects, and stories. In addition, the effective teacher tended to get his or her pupils involved in elaborating their opinions or solutions of a problem. The effective teachers also asked more high-level questions than the less effective teachers.

With respect to the relationship between policy and its implementation, it became clear that student-centered approach innovation had only a limited effect on teachers' classroom practices. Teachers only picked up some superficial aspects of student-centered approach and adopted them into their existing practices. While there was an emphasis on pupils' thinking skills in the policy, teachers' utilization of the new pedagogy was limited to the behavioral changes in their teaching practice. Teachers allowed pupils to do more activities and introduced more materials into classroom, but

hardly did these activities and materials challenge pupils to think harder.

Educational outcome as measured by pupils' achievement test scores exhibited a clear regional difference. Pupils in the urban area scored significantly higher than their rural peers. This superior performance of urban pupils could be attributed to the fact that school resources such as instructional time and materials as well as teachers' experience, which had been shown to be significantly associated with pupils' achievement, were more abundant in urban schools. Another explanation for this educational advantage of urban pupils was related to the fact that they had more opportunity to take private tutoring, also shown to be a significant determinant of achievement, as their families were generally more affluent than those living in rural areas.

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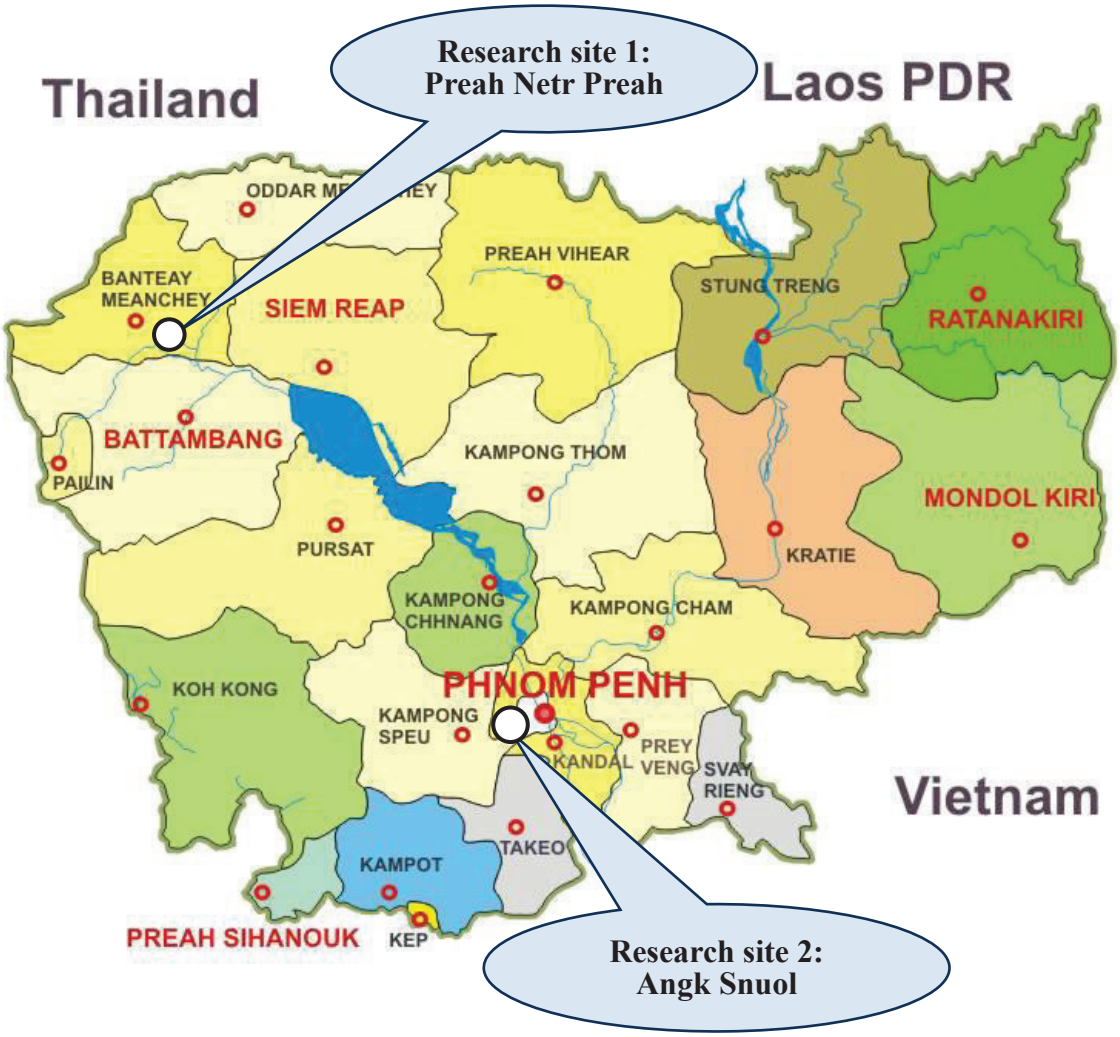
Map of Cambodia



Introduction

1. Research background and objectives

Since near-universal enrollment in primary education has been attained by many developing countries, improving educational quality has become an imperative for these societies. Quantity of education (years of schooling) alone is insufficient for genuine learning to take place. It is through the provision of quality education that one gain skills and knowledge needed to better one's life and society. Goal 2 of the Dakar Framework for Action (UNESCO, 2000) commits nations to the provision of primary education of 'good quality', and goal 6 includes commitments to improve all aspects of education quality so that recognized and measurable learning outcomes are achieved by all, especially in literacy, numeracy and essential life skills. Quality education as set out by the framework requires desirable characteristics of learners (healthy, motivated pupils), processes (competent teachers using active pedagogies), content (relevant curricula) and systems (good governance and equitable resource allocation) (UNESCO, 2005). However, providing such conditions usually poses a real challenge for impoverished countries, which have already been pressured by efforts to improve educational access. As more and more children enter schools, the resource-strained education systems might not have enough capacity to accommodate them. The teacher might not be sufficiently prepared to cope with those children. Instructional resources and supplies might not be adequate. In fact, universal access to education is more likely to be achieved by expanding enrollments in existing schools, by packing more pupils into existing classrooms, by moving from full-day to half-day programs and by expanding the teacher force by hiring less qualified teachers (Smith & Motivans, 2007).

This study is designed to examine the quality of primary education in

Cambodia, a country characterized by rapid expansion of enrollment but inadequate educational resources. The conceptualization of the problem of concern is guided by a growing body of educational effectiveness research. Generally, the task of educational effectiveness research is to identify and investigate into which factors in teaching, curriculum and learning environments can directly or indirectly explain measured differences in the outcomes of pupils (Creemers, Kyriakides & Sammons, 2010). Although no general theory as to what determines the quality of education has been validated by empirical research (UNESCO, 2005), educational effectiveness studies of a wide range of traditions have shown that academic learning as measured by achievement test scores is affected not only by the factors within a school such as class size and teaching behaviors but also by the social context of the school such as pupils' family backgrounds, community characteristics, as well as educational policy.

The purpose of this study is to explore the influence of a web of factors at classroom, school and beyond-school (context) levels on academic learning of pupils in primary schools. The study aims to answer the following four research questions:

1. What school and family factors are associated with pupils' achievement?
2. What is the effect of student-centered approach (SCA) policy on teachers' classroom practices?
3. What is the relationship between instructional process and pupils' achievement?
4. Are there any regional differences in resources, instructional process, and pupils' achievement in primary schools?

2. Review of previous studies

Since educational effectiveness has received due attention from educational researchers

for more than half a century, a large body of literature has been accumulating. A number of terms are used to denote research on educational effectiveness. These include, to mention a few, school effects (Konstantopoulos, 2005), effective schools (Purkey & Smith, 1983), teacher effectiveness (Muijs & Reynolds, 2000), teaching effectiveness (Seidel & Shavelson, 2007), instructional effectiveness (Fraser, 1989), and effective classroom (Creemers, 1994). These terms are used so inconsistently in the literature that, often, the task to define and distinguish between one and the other is almost impossible. Yet, all of these studies are interrelated and can be placed under the umbrella of educational effectiveness research (Creemers, Kyriakides & Sammons, 2010). The term 'educational effectiveness research' is used to refer to an overarching theme that links together a conglomerate of research in different areas, including research on teacher behaviour and its impacts; curriculum; pupil grouping procedures; school organization; and educational policy (Creemers, Kyriakides & Sammons, 2010, p.3). Educational effectiveness research is concerned with the functioning of the education system as a whole.

Aspired by their disciplinary perspectives, researchers on educational effectiveness use different models to conceptualize their problems of concern. Over the years, two major paradigms appeared to be most frequently employed by educational effectiveness research, namely the input-output model and process-product approach. In the input-output model, also called education production function, the studies are designed to measure the influence of school input factors such as school expenditure, class size, teacher education, and teaching and learning resources on pupils' academic achievement. Often, the influence of school resources on achievement is considered in comparison to that of pupil's family attributes like family socio-economic status (SES). The studies in this tradition follow an economic perspective and treat schooling as analogous to manufacturing, assuming that the quality of the products (pupils'

achievement) depends a great deal on the quality of raw materials (school resources). However, the input-output studies, though prolific, fail to find a consensus on whether school resources or family factors have the largest impact on pupils' learning. While the earliest study (Coleman, 1966) claims that school resources play minimal roles in affecting pupils learning and the problems of school learning lie outside schools, Heyneman and Loxley (1983) find that school resources accounted for most of the variation in pupil achievement in less developed countries. Later analyses (Baker *et al.*, 2002) tend to confirm that Coleman's finding still holds for both developed and low-income countries even though they find a greater influence of school resources on academic achievement than did the original finding.

Partly upset by the controversial conclusions of the input-output studies, many researchers utilizing approaches based more on educational theory than on economic perspectives, focus instead on process variables such as teaching styles and classroom behaviors (Riddel, 2008), which they consider as direct and most proximal causes of pupils' learning (Doyle, 1983; Muijis & Reynolds, 2002). Scholarly known as process-product research, the studies of this tradition focus on characteristics at classroom level (Bellack, 1966; Bennett, 1976; Galton *et al.*, 1980) which are strongly related to pupils' achievement. Process-product studies stress the primacy of classroom level factors and hypothesize that what really matters is what happens in classroom (Creemers, 1994). As Bloom (1972, p.339) asserts, "It is the teaching, not the teacher, that is the key to learning of pupils. That is, it is not what teachers are like but what they do in interacting with pupils that determines what pupils learn …" The studies of this tradition have shown a consistent and substantial effect of classroom instruction on pupils' academic achievement. For instance, in a synthesis of 179 studies, Wang and colleagues (1990) found that classroom management, quality of instruction, and classroom interaction are among the six variables to have the most effect on learning. In

a review of process-product research, Brophy and Good (1986) listed the following teacher behaviors as significant to pupils learning: quantity and pacing of instruction; whole class as opposed to small group instruction; structuring of information; questioning pupils; reacting to pupils' responses; and handling seatwork and homework assignments. In respect to teaching pedagogy, studies have consistently shown that direct instruction (Rosenshine, 1979), also called active teaching (Reynolds, 1998), is of most importance to pupils' cognitive improvement, especially in basic skills. In this pedagogical approach, the teaching should be conducted according to six instructional functions proposed by Rosenshine (1983, pp.737-738): (1) daily review, checking previous day homework, and reteaching; (2) Presenting new content/skills; (3) Initial pupil practice; (4) Feedback and correctives; (5) independent practice; (6) Weekly and monthly reviews. Direct instruction has its strongest impact on pupils from low-SES backgrounds (Sammons, 2007). Muijs and Reynolds (2005) and Chall (2000) found that direct instruction is more effective in improving the performance of disadvantaged pupils than the constructivist learner-centered approaches.

Teddlie (1994) notes that most teacher effectiveness (process-product) studies have been dominated only by investigations on the processes that occur within classrooms, to the exclusion of school-wide factors, whereas most school effectiveness (input-output) studies have involved phenomena that occur throughout the school with little emphasis on particular teaching behaviors within individual classrooms. Besides the studies in these two traditions which tend to polarize in terms of conception as one focuses mainly on school inputs while the other is concerned with the teaching and learning process, there is also some educational effectiveness research attempting to adopt a conceptualization that spans over and beyond those of the input-output and process-product traditions (e.g., Brookover *et al.*, 1979; Rutter *et al.*, 1979). These studies examine factors both within and beyond school levels. In addition to school and

teaching variables, they also incorporate factors at macro level such as political and educational context of schools; for example, educational guidelines and national education systems. However, such studies were comparatively few during the prolific period of educational effectiveness research in the 1970s and 1980s. More recently, educational effectiveness research once again attempt to conceptualize factors explaining difference in academic achievement in a more integrated model (Sammons *et al.*, 1997; Teddlie and Stringfield, 1993). The reason behind this motive is that research reviews (Scheerens and Bosker, 1997; Teddlie and Reynolds, 2000) have discerned numerous correlates for effective classrooms, schools, and above-school levels. For example, Teddlie and Reynolds (2000, p.142) in their review identified countless of the correlates of effective schools and grouped them into 9 interrelated areas: effective leadership; effective teaching; focus on learning; positive school culture; high expectations for pupil achievement; emphasis on pupil responsibility and rights; monitoring progress at all levels; staff development; and parental involvement.

The literature reviewed so far suggests that the interrelation between school factors, classroom factors, pupil achievement, and other variables is very complex that any study attempting to measure educational effects on pupils' learning which neglects teaching and learning process variables is subject to enormous flaw. Conversely, specifying only a link of factors at classroom level with pupils' achievement will probably underestimate school effects. Therefore, a comprehensive model is needed so that various factors operating from different sources can be accounted for.

3. Research methodology

3.1. Conceptual framework

Viewing academic learning as a product of a multitude of factors operating from

different sources, this study adopt a comprehensive model which takes into account various classroom, school, and context variables. Figure 1 displays the groups of variables and their relationship with pupils learning.

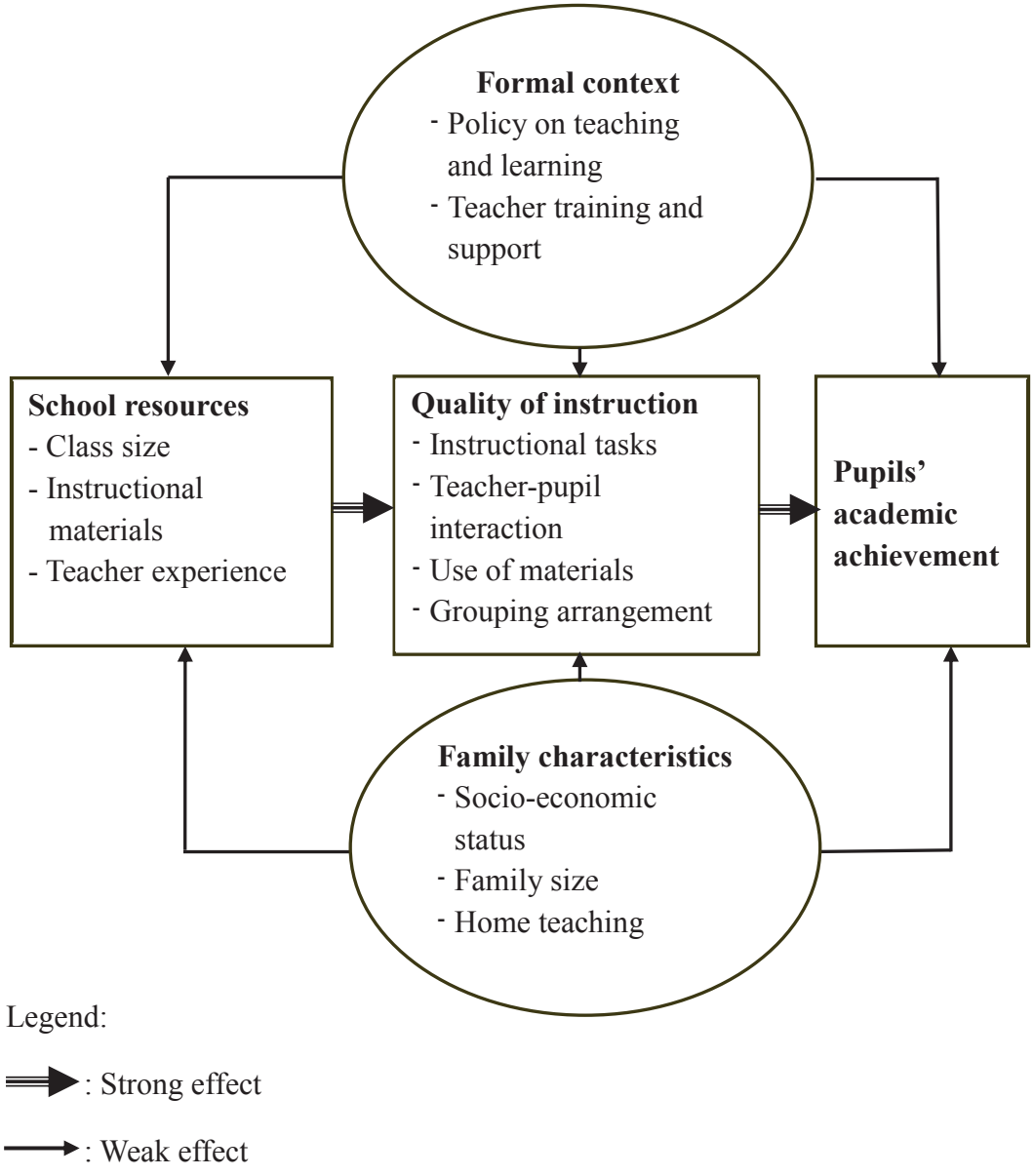


Figure 1 A conceptual framework of educational effectiveness

Under each group some promising factors of educational effectiveness are

listed. A key assumption of the study is that factors at the classroom level, collectively called 'quality of instruction', are most critical in bringing about changes in pupils' learning achievement because, as supported by Doyle (1983), Muijs and Reynolds (2002) and other research, these factors are direct and most proximal causes of pupils' learning. These factors are called process variables and include grouping arrangement, use of materials, instructional tasks and teacher-pupil interaction. School inputs are categorized under 'school resources' and include, among others, class size, instructional materials, and teacher experience. Variables beyond classroom and school level are considered as context variables. These include 'family characteristics' such as SES and family size and 'formal context' variables such as educational policy and programs launched by the government. With all these factors included, this conceptualization can be described as a 'context-input-process-output' model.

This study poses three major hypotheses with respect to the relationships between these variables and pupils' academic learning: (1)quality of instruction is a major determinant of academic achievement; (2) school inputs may exert independent effect on academic learning or may function as conditions for quality of instruction; (3) As context variables, family characteristics and formal context variables such as teaching and learning policy may also have independent effect on academic achievement or function as conditions for quality of instruction and better school resources.

3.2. Research settings

The surveys for collecting primary data for this study were conducted in one rural district called Preah Netr Preah in Bantey Meanchey province and one semi-urban district called Angk Snuol in Kandal province (See map on page xiii). Angk Snuol district is located about 15 kilometers west of Phnom Penh and is a center for economic

activities as evident in the presence of economic zones an garment factories which provide jobs for thousands of people while Preah Netr Preah is about 360 kilometers north-west of Phnom Penh and is still predominantly characterized by farming in terms economic activities. Only 4% of the households in Preah Netr Preah as compared to 30% in Angk Snuol had access to electricity. In Preah Netr Preah, almost all families (98%) had their main occupation as rice farmers, 1 % of the families were involved in trading and services, and almost none (less than 1%) of the families had a member employed as private company staff or worker while the figures for the same indicators in Angk Snuol were 83%, 11%, and 40% respectively (National Committee for Sub-National Democratic Development [NCDD], 2009a, 2009b).

3.3. Research instruments and data

The data on which this study is based was collected through three times of fieldwork, each of which lasted for about two months. Various instruments were employed to collect these data including questionnaire surveys with pupils (Appendix A), teachers (Appendix B), and principals (Appendix C); interviews with teachers (Appendix E); achievement tests with pupils (Appendix F); and video-recoding of classroom teaching. A total of 1080 sixth-grade pupils from 32 schools (16 from each area) participated in the questionnaire survey and took test in math and Khmer language. The test was jointly made by experienced teachers in the field and the researcher based on the contents which teachers reported to have covered. Information about school resources and teaching conditions were also collected from the school principals and teachers in charge of those pupils. Thirty sixth-grade teachers were involved in semi-structured interviews, during which they were asked about their teaching methods and their perception about their effects on pupils' learning. In another questionnaire survey (Appendix D), 391 teachers from the two districts were asked about their familiarity,

beliefs and implementation with regard to the newly-reformed pedagogy of student-centered approach. Chapter 1, Chapter 2, and Chapter 3 are mainly based on these questionnaires, interviews, and test data.

Video-recording of 12 mathematics lessons given by four sixth-grade teachers was taken by the researcher. The lessons given by each teacher (three lessons per teacher) were video-recorded at an interval of one week. The pupils taught by the four teachers were tested in mathematics (Appendix G) and test results were compared to see the effects of classroom instruction. The video-recording comprises the data for Chapter 4, Chapter 5, and Chapter 6.

4. Organization of the dissertation

This dissertation contains six chapters divided into two parts. These fundamental parts are preceded by an introduction and followed by a conclusion. The introduction delineates the background, objectives and methodology of the study. The first half of the dissertation (Chapter One through Three) covers social and political context of pupils' learning at primary education level in Cambodia. Chapter One provides general description of educational provision, participation, and outcomes at primary education level. Chapter Two seeks to investigate school and family factors that improve learning achievement. In Chapter Three, policy concerning student-centered approach in Cambodian primary school is reviewed and its impact on teachers and their classroom practices is explored. The second half of the dissertation (Chapter Four through Six) is devoted to the analyses of classroom instruction in action using video-recording. Chapter Four describes various aspects of instructional organization which includes arrangement of classroom space, pupils' grouping, and instructional materials and the organization of mathematics contents into classroom tasks. Chapter Five addresses

classroom verbal communication by focusing on three main areas: the balance between pupil talk and teacher talk, patterns of classroom verbal exchanges and cognitive levels of teachers' questions. Chapter Six attempts to link the features of instructional process with pupils' achievement in mathematics. The conclusion summarizes the findings of the study and suggests ways for improvements.

Part One: Context of Primary Schooling

Chapter One: Primary Education in Cambodia

1. Recent development of primary education in Cambodia

1.1. Educational development since 1979

The current education system in Cambodia has a rather short history. It is a little more than 30 years old. It was born after the devastating civil war in the 1970s, during which almost all physical and institutional infrastructures such as roads, schools, and hospitals were abandoned or destroyed. Under the rule of the Khmer Rouge (1975-1979), formal education was abolished, and only short-term literacy program and productive work comprised the educational agenda of the regime. School buildings were demolished or turned into barns for keeping cows or storing rice produce. Books and equipment were burnt out. The highly educated were targeted, tortured, or executed. It was estimated that about 90% of all teachers were killed under the Khmer Rouge regime. Only 50 of the 725 university instructors, 207 of the 2300 secondary school teachers, and 2717 of the 21311 primary school teachers survived (Headley, 1990, p.128).

When the war ended in 1979, the new academic year was opened with the slogan, "those who know more teach those who know less." This meant that people who had some education could be a teacher and no qualifications or licenses were required. Throughout the country there were a number of pre-schools, primary schools, lower secondary schools, and only one upper secondary school in Phnom Penh. The Ministry of Education, Youth, and Sport (MoEYS), which was reestablished on 15 February 1979, about a month after the war ended, was able to collect 22,098 former teachers and volunteers to provide some kind of education to about 900,000 students[1]. Classes were held in wooden buildings, bamboo huts, or under trees. Teachers were located from the villages and provided with only short-term training ranging from 3 weeks to a month,

usually by unqualified trainers. As observed by Ayres (2000), the nation's teachers were poorly trained and remunerated, while teacher-training facilities were staffed by former teachers whose credentials should have often failed to gain them employment as the teachers they were charged with training (p.143). The environment of teaching and learning was in poor condition. UNICEF (1990) reported that, "Many building have leaking roofs, earthen floors, and no windows and doors. They are usually ill-equipped as regards furniture and teaching aids… Waters and sanitations are also problems in all education facilities and many schools have no potable drinking water and latrines..." The education children received was of poor quality because a large number of teachers were unqualified and there was no standardized curriculum, texts, and facilities (Duggan, 1996).

The conditions became better in the 1990s when aids and NGO assistance from Western countries as well as Japan started to flow in after the collapse of the Soviet Union[2]. Several factors which helped revive the international assistance and cooperation included peace agreement reached in 1991 between the country's warring factions, the promulgation of the new Constitution whose Article 56 states that 'Cambodia shall adopt free market economy', and the UN-sponsored election in 1993. By 1994, some 50 international organizations were financing and staffing education programs throughout Cambodia and external assistance to primary education amounted to US$4 per pupil per annum (Duggan, 1997). Primary education enrollment continued to grow from 1.5 million in 1992 to about 2.2 million in 1999 (MoEYS, 2000). However, the problem of quality provision was still a major problem as observed in a statement made by UN representatives to Cambodia in 1994, "the school system is inadequate both in qualitative and quantitative terms and is stressed by the dramatic growth of the school aged population which adds 400,000 children a year" (quoted in Duggan, 1996). Also, pupils' learning did not appear to improve much. A UNICEF survey on pupil

competencies revealed very little progress of pupils' development in both the Khmer language and mathematics during the course of primary school (ADB, 1996, p.113).

International assistance was briefly strained over 1997-1998 when political tension between the two ruling parties grew, which finally resulted in a military clash in July 1997[3]. While not much improvement in pupils' learning was seen, the international aids and assistance in the 1990s did much to build the groundwork on which further development of education in Cambodia rested. The education sector was intensively studied by ADB (1994), whose recommendations were incorporated in the MoEYS' *Education Investment Plan 1995-2000.* There was also an opportunity to pilot the Priority Action Program with the overall aim to improve access, quality, and efficiency in the education sector.

Further reforms and commitment were made by the government to improve the education sector in the 2000s, mainly in response to international calls such as the Dakar Framework for Action and the UN Millennium Development Goals. The government established the Education Strategic Plan (ESP) 2001-2005 and the Education Sector Support Programs (ESSP), and abolished admission fee to primary schools in 2001. The progress made in improving educational access over the periods since 1979 is truly remarkable. Figure 2 shows pupil enrollments in primary schools since the end of the civil war in 1979. After a sharp increase for a few years immediately following the end of the civil war, the number of pupils in primary schools declined throughout the 1980s, possibly due to the very low quality of education during the period. Over the 1990s, enrollment increased gradually as Cambodia was in peace and external assistance to education was revived. Then, there was a surge in 2001 as a response to the abolishment of entrance fee to primary schools. Total enrollment in primary school continued to expand for another two year to a peak of 2,747,411 pupils in 2003 and started to decline gradually as the result of the decrease in the

primary-school-age population. Currently, the number of enrollments at primary schools stood at 2,173,384 pupils, with a net enrollment ratio of 97% (MoEYS, 2013).

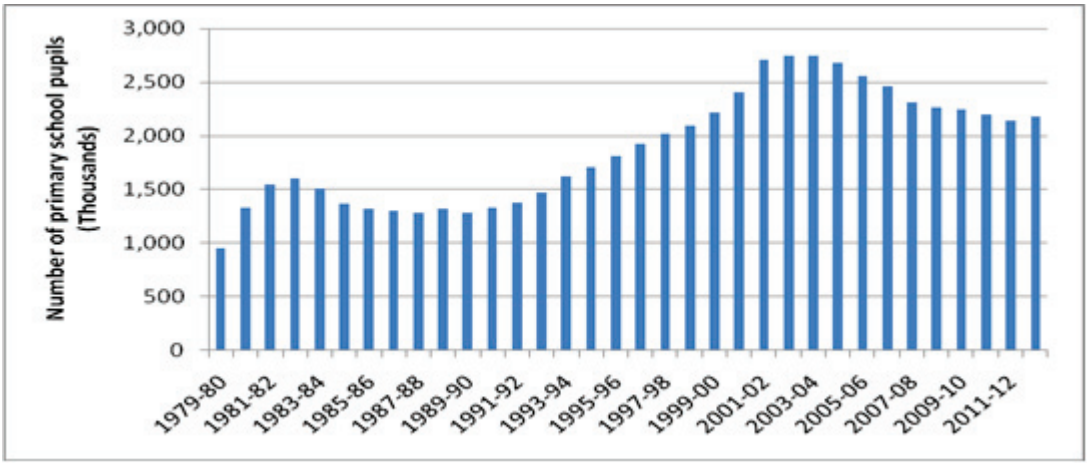


Figure 2 Number of pupils enrolled in primary schools from 1979 to 2012 (MoEYS, 2013)

1.2. Educational provision in the last decade

Table 1 shows some indicators of educational provision in academic years 2002-2003 and 2012-2013. The two academic years were chosen to show how, for over ten years, the educational inputs have changed from the time when the number of enrollments in primary school peaked at about 2.7 million pupils in 2003 to the present when the number of pupils is about 2.2 million (570,000 pupils fewer). Table 1 also shows how the changes are different between urban and rural areas. Over the last ten years, about 1,000 new schools have been built, mainly in rural areas. This increase in the number of school establishments, despite the declining enrollment, reflects the government effort to improve access to primary education favoring children in rural areas. There was notable reduction in class sizes (Pupils : Class ratio) and pupil-teacher ratios from 45.87 and 56.73 in 2003 to 36.94 to 48.47 in 2013 respectively although the teachers in rural areas still have to take care of more pupils than their urban counterparts. The numbers

of teachers and classes have declined with the decrease in enrollments in both urban and rural areas. However, compared to ten years ago, the class-teacher ratios tend to get better for teachers in urban areas but worse for teachers in rural areas. Teachers in rural areas are still very likely to be in charge of more than one class (Class : Teacher = 1.42 : 1), while teachers in the city teach only one class or do not teach at all (Class : Teacher = 0.94 : 1).

Table 1 Indicators of Schools, teachers, and pupils

	2002-2003			2012-2013		
	Urban	Rural	Total	Urban	Rural	Total
Schools	626	5,289	5,915	671	6,239	6,910
Classes	10,205	49,692	59,897	9,349	49,488	58,837
Teachers	10,301	38,132	48,433	9,970	34,870	44,840
Pupils	448,149	2,299,262	2,747,411	333,118	1,840,266	2,173,384
Pupil:Class ratio	43.91	46.27	45.87	35.63	37.19	36.94
Pupil:Teacher ratio	43.51	60.30	56.73	33.41	52.78	48.47
Class:Teacher ratio	0.99	1.30	1.24	0.94	1.42	1.31

Source: Ministry of Education Youth and Sports, EMIS 2002-2003, 2012-2013

This uneven distribution of teachers is caused by the changes in teacher recruitment policy adopted by the MoEYS to cope with the changes in pupil enrollments within the last ten-or-so years. At the turn of the century, Cambodian education system faced a big challenge as more and more people, especially those in remote and former conflict areas, demanded an education for their children. The higher demand for education coupled with the abolishment of school fee in 2001 led to a surge in enrollment up to 2003. To cope with the jump in pupil enrollments, the Ministry of

Education, Youth and Sport had to depend on a system of double-shift teaching and contract teaching. These practices were most prevalent in rural and remote areas where the shortage of teachers was more acute. Though the figure for teachers working double shifts was not available at that time, they still made up of 19.5 % of primary school teachers in 2011-20012 (MoEYS, 2012a). Contract teachers comprised 20% or more of the teaching forces in rural and remote areas in 2001 (Geeves and Bredenberg, 2005, p.23). Contract teachers were of low quality and ineffective because most of them were recruited from among people with little education themselves and no teaching background. For this reason, the MoEYS has tried to cut back the number of contract teachers when the number of pupils started to decline in 2003. Yet, even as recent as 2011, contract teachers still numbered 1,862 (MoEYS, 2012a). As the number of contract teachers was reduced, the MoEYS had to rely more on double-shift teaching in rural areas, making the class-teacher ratio in rural areas increase from 1.30 in 2003 to 1.42 in 2013 (Table 1). This means that the burden which used to be shouldered by contract teachers has fallen on regular teachers' back. However, teachers in urban areas enjoy better working conditions as they tend to teach only one class per day, usually with fewer pupils. Teachers in rural areas are charged with heavier workload but they are often less educated and trained. This raises a big question on the quality of education in rural areas, where 85% of primary school pupils reside.

2. The schools, the teachers and their working conditions

The remainder of this chapter aims to describe the contemporary status of primary education in Cambodia. All the statistics, except those indicated otherwise, are based on the surveys of the current study.

The schools

Cambodian primary schools are usually spacious. The average school size is about 13000 square meters. A primary school has about 470 pupils taught by 9 teachers in 10 classrooms. Because of the lack of teachers and classrooms, most of the primary schools have to run on a two-shift system. Based on the researcher's observation, the shortage of teachers is the most prevalent factor, which makes the two-shift system necessary.

In most cases, primary schools are managed by a male principal in his fifties. On average, he has been working as a principal for 10 years. It is surprising that the principal levels of general education are very low. The survey of this study shows that almost four fifths (79%) of the principals have only primary or lower secondary education. This is even lower than the educational levels of the teachers whom they supervise. These principals are usually senior teachers who started their career in the post-civil war years when little qualification was required and were promoted chiefly based on their seniority. That is why their educational levels are generally lower than the younger teachers who entered the teaching service in more recent years.

About three-fourths of the schools have a small library, which opens for 4 hours per day. Each library holds about 500 books, most of which are story books. Where the library opens, there are about 86 pupil visitors per day. Virtually all the schools surveyed have toilets, but in many cases they are usually locked and pupils cannot use them easily. The shortage of water supply is one of the factors that prevent the pupils from using the toilets. Due to the inexistence of running water supply, many schools have to rely on the school ponds, whose water is available only in rainy season. Most of the schools in Preah Netr Preah, the rural district, have a pumping well donated by NGOs or Cambodian individuals who live in other countries. However, in some schools, the water from the wells is also accessible only in rainy season.

The teachers and their working conditions

The majority of Cambodian teachers are young. On average, primary school teachers are 36 years old. Most of them come from the local community, that is, from the villages within close proximity to the school they teach. Teaching has long been a male-dominated profession and it is still so in Cambodia. Male teachers comprise 55% of all the teaching staff in primary schools (MoEYS, 2009).

Overall, teachers' levels of education are low. About 30% of them have merely completed lower secondary education while only 25% are holding or studying towards a bachelor degree. With regard to teacher training and development, it is remarkable that almost all the teachers hold a teaching certificate of some kind (97%). There are, however, very few opportunities for additional professional development. The MoEYS rarely organizes any further training for teachers. Since the establishment of cluster schools in 1994, the in-service training is supposed to be carried out by the schools within a cluster, which meet once a month. This is the only opportunity for teachers to develop their capacity.

Primary school teachers have to work with very limited teaching resources. Teachers acknowledge that pupils find their teaching difficult and boring because they do not have the materials to help them understand better. They lack even simple materials such as pictures or word cards to help them in their teaching. Talking about his teaching, one teacher said, "We don't have enough materials. If we have pictures, it would be easier for me to elicit pupils' response." Some teachers go on to criticize on their teaching that, "Our teaching is so abstract. We just dictate the theory to the pupils. We don't have materials for doing experiment."

In spite of constrains of resources and support, teachers' burden is heavy and expectations imposed on them are high. They have to be responsible for an average of 54 pupils. In an extreme case, however, a teacher has to teach 118 pupils. Teachers are

expected to apply the ambitious student-centered approach to teaching and learning, which has been introduced for more than a decade, to their classrooms. However, some of them see student-centered approach not as an improvement but as an impediment to pupils' learning. Commenting on student-centered teaching, one of the teachers observes, 'during group work, only the smarts pupil will do the task; but, we have to give them all equal marks.' The teacher feels that getting marks without effort has a negative effect on the pupils because it prevents them from working hard. Teachers are also expected, or even pressured, to produce high level of pupils' achievement, which they find unrealistic, considering the unfavorable conditions of their teaching. Teachers are required to promote 90 to 95 percent of their pupils to higher grades, even though their real judgment would tell them otherwise. Therefore, in their monthly score report, they have to make sure at least 90 percent of the pupils pass the grade, usually by manipulating pupils scores on tests. This kind of manipulated promotion rather than true achievement has caused a big problem for the teachers in the higher grades, where the number of weak pupils tends to be high due to the accumulating effects of the promotion without achievement. The ability of the pupils varies so greatly as their grade levels increase that teachers find it very difficult to teach. One sixth-grade teacher stated, "The most critical factor is poor prior knowledge (knowledge from lower grades). Some of my pupil can't even read the characters."

3. The pupils, their schooling, and their lives

According to the national data, as of 2009 some 2.3 million children are attending primary schools in Cambodia. About 47% of this cohort are girls. This number of enrollees far surpasses the number of children in the 6-11 age group, which is about 1.9 million. The age-grade distortion is a common feature of enrollments in Cambodian

schools at all levels. The survey of this study shows that a mere 28% of the children had attended pre-schools before they entered primary schools. However, the pre-school enrollment ratio was much lower (about15% of children aged 3-5 years old) in the national report[4]. About 80% of the pupils reported that they had been taught at home prior to school entry. Seeing such a low pre-school enrollment ratio, one cannot help questioning how ready Cambodian children are upon entering schools and how difficult the teachers of earlier grades in primary schools are in dealing with those children.

Cambodian children attend schools either in the morning or the afternoon. They have half a day at their disposal. It should be noted that the opportunity to be educated at home is also scarce. The pupils reported that on average they were taught twice per month by their family members. Table 2 shows the amount of time primary school pupils spend on some out-of-school activities. From the five options provided, the pupils indicated that they spent the least amount of their out-of-school time on private tutoring but the most time on working at home. In rural areas where people live on subsistent economic system, children are valuable asset for the family. They can help at home to spare time for adults or join hands with their parents in the fields. Children do not only help but they are also a source of income. They may harvest crops for other people for wages. In Preah Netr Preah district, children can earn some money by catching grasshoppers or hunting for rats and sell them. Based on casual conversations with some of the children, they can earn about 4000Riel (1 US dollar) on their good days. Though little as it is, this can be an attractive amount to rural families due to their generally low income. Such work is seasonal and sometimes overlaps with schooling. Though it is impossible to measure the effects those work activities have on pupils' schooling, most of the teachers interviewed consider children's work to have a profound impact. Work causes frequent absenteeism, as one of the teachers complained, "Children are often withdrawn from schools to help at home." Work takes most of the

children's time. Even they are able to come to school, they never have time for homework or self-study. To quote a teacher, "Some pupils at night would go to the field to hunt for rats. They don't study. They stay in the field until 3 or 4 in the morning." Sometimes, work means prolonged absence or a complete withdrawal from school. One of the teachers in Angk Snuol district reported that four of her pupils that year dropped out of school and went to work in garment factories and construction sites.

Table 2 Time primary school pupils spend on out-of-school activities

On a normal school day, how much time do you spend before or after school doing each of these things?*	**N (pupils)**	**Mean**	**Std. Deviation**
Watching television/videos	1068	2.45	0.738
Playing and talking with friends	1061	2.40	0.737
Helping or working at home	1066	3.27	0.967
Attending private tutoring	1065	2.15	1.148
Doing homework	1067	2.52	0.608

**Scale: 1. No time; 2. Less than one hour; 3. One to two hours; 4. Three to four hours; 5. Five or more hours*

4. Curriculum

Cambodia adopts the 6+3+3 school system, which comprises of 6 years of primary education and 3 years each of lower and upper secondary education. The entry age to the first grade of primary schools is officially set at 6 years or at least 70 months on the date of the beginning of the school year.

The school year is divided into two semesters. The 1st semester starts in October and ends in February and the 2nd semester starts in March and ends in July, leaving a two-month vacation between each school year. The pupils do not have a between-semester holiday but, instead, they have a half-a-month vacation for Khmer New Year in April.

The Policy for Curriculum Development 2005-2009 determines the amount of learning time for both primary and secondary education per year. Based on this curriculum framework, each school year is comprised of 38 weeks with six school days per week. In primary schools, each week consists of 27 to 30 periods, each lasting 40 minutes. In total, intended instructional time in primary schools is between 684 to 760 hours per year. The curriculum consists of five academic subjects and Local Life Skill Program (Table 3). Local Life Skill Program aims to provide space for children to participate in extra-curricular activities and to provide space for the community to participate in training specific life skills relevant to the pupils. Some examples of local life skills are cooking, farming, gardening, repairing machines, and carpentry.

Table 3 Standard number of class hours per week

<table>
<tr><th colspan="2" rowspan="2">Subjects</th><th colspan="6">Grade</th><th rowspan="2">Total</th><th rowspan="2">%</th></tr>
<tr><th>1st</th><th>2nd</th><th>3rd</th><th>4th</th><th>5th</th><th>6th</th></tr>
<tr><td rowspan="5">Academic subjects</td><td>Khmer Language</td><td>13</td><td>13</td><td>13</td><td>10</td><td>8</td><td>8</td><td>65</td><td>36.0%</td></tr>
<tr><td>Mathematics</td><td>7</td><td>7</td><td>7</td><td>6</td><td>6</td><td>6</td><td>39</td><td>21.7%</td></tr>
<tr><td>Science</td><td rowspan="2">3</td><td rowspan="2">3</td><td rowspan="2">3</td><td>3</td><td>4</td><td>4</td><td rowspan="2">34</td><td rowspan="2">18.9%</td></tr>
<tr><td>Social studies</td><td>4</td><td>5</td><td>5</td></tr>
<tr><td>Physical education</td><td>2</td><td>2</td><td>2</td><td>2</td><td>2</td><td>2</td><td>12</td><td>6.7%</td></tr>
<tr><td colspan="2">Local Life Skill Program</td><td>2-5</td><td>2-5</td><td>2-5</td><td>2-5</td><td>2-5</td><td>2-5</td><td>12-30</td><td>16.7%</td></tr>
<tr><td colspan="2">Total</td><td>27-30</td><td>27-30</td><td>27-30</td><td>27-30</td><td>27-30</td><td>27-30</td><td>162-180</td><td>100%</td></tr>
</table>

Source: Policy for Curriculum Development 2005 – 2009, pp.9-10.

Table 4 An example of a timetable for Grade 5 and 6 (Morning shift)

Time	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
7:00-7:10	National Anthem Salutation					
7:10-7:50	Physical education	Khmer	Khmer	Remedial class and Local life skills	Physical education	Khmer
7:50-8:30	Khmer	Khmer	Khmer		Khmer	Khmer
8:30-8:45	Recess				Recess	
8:45-9:25	Math	Math	Math		Math	Math
9:25-9:40	Recess				Recess	
9:40-10:20	Science	Math	Science		Science	Social studies
10:20-11:00	Social studies	Social studies	Social studies		Social studies	Science

Source: Document retrieved from one of the sample schools.

Table 4 shows a timetable for grade 5 and 6 in one of the sample schools. Strictly complied with the national curriculum, there are 8 classes for Khmer language, 6 classes for mathematics, 4 classes for science, 5 classes for social studies, and 2-5 classes on Thursday for local life skills. Thursday is also reserved for remedial instruction for slow pupils. Though not designated in the curriculum framework, remedial instruction has been a prevalent practice in primary schools for the last several years.

5. Instruction

5.1. Instructional resources and techniques

Classroom instruction in Cambodia is conducted with textbooks as the main or only materials. Pupils have little or no access to other resources that may enrich their understanding. In urban areas, some teacher may have access to basic supplies such as blank paper, color paper, cardboard, and others. But in rural schools such supplies are rarely available. Table 5 shows the frequency of teaching materials utilization in

classrooms. It is clear that comparing to other types of materials, textbooks assume a predominant role in classrooms. Textbooks are used by teachers in every lesson. Teachers are also likely to use real objects, picture cards and drawings on the blackboard as teaching aids although they are significantly less common than textbooks. However, teachers are less likely to bring in large posters or to supplement the textbooks with other documents. Computers are completely non-existent in the classrooms.

Table 5 Instructional materials used by primary school teachers

How often do you use the following materials when you teach? **(N=32 teachers)**	**Mean**	**Std. Deviation**
Textbooks	4.72	0.68
Real objects	3.25	1.02
Drawings on blackboard	3.09	1.17
Picture cards	2.94	0.98
Supplementary materials/documents	2.56	1.05
Maps	2.47	1.05
Posters	2.31	1.03
Computers	1.00	0.00

**Scale:1=Never, 2=Rarely, 3= Sometimes, 4=In almost every lesson, 5= In every lesson*

Table 6 shows the result of teacher self-reports on pupils' classroom activities. From the limited options provided in the survey, listening to and observing teachers' presentation and answering questions testing recall appear to be widespread. Pupils' involvement in hands-on activities and use of real objects is rare. This latter result tends to conflict with the result on teachers' utilization of teaching materials presented above,

which shows a higher likelihood of real objects being used in the classrooms. These conflicting results might be interpreted to mean that teachers start to bring in real objects into classroom as they are more aware of the important role that real objects play as material to help pupils' learning. Nevertheless, these brought-in materials are mainly for the teachers' own use in their presentation of the lesson while pupils remain passive observers. By looking across all the pupils' activities in Table 6, there seems to appear a general line of division which shows that activities that are individualized (answering questions testing recall, working out problems on blackboard, and doing individual seat work) and receptive (listening to or observing teachers presentation, reading textbooks, copying from blackboard) are more prevalent than those that are more interactive (asking questions to peer, discussing with peers, discussing with teacher, and presenting own assignment to class) and creative (answering open-ended questions and creating problems for peers to solve), as indicated by shaded and no-shaded rows respectively. This division suggests that pupils generally take a passive role in classroom instruction.

Table 6 Classroom practices reported by primary school teachers

How often did your pupils do the following activities?* **(N=32 teachers)**	**Mean**	**Std. Deviation**
Listen to or observe teachers presentation	4.72	0.634
Answer questions testing recall	4.72	0.581
Read textbooks	4.59	0.712
Copy from blackboard	4.25	0.984
Work out problems on blackboard	4.16	0.767
Do individual seat work	4.16	0.884

Ask questions to peer	3.78	1.07
Discussion mainly with peer	3.75	0.984
Discussion with teacher	3.5	1.107
Present own assignment to class	3.44	1.014
Computation drill	3.41	1.103
Answer open-ended questions	3.25	0.95
Create problems for peer to solve	3.09	1.228
Recite past lessons	3	0.916
Use hands-on materials or real objects	2.91	1.174

**Scale: 1=Never, 2=Rarely, 3=Sometimes, 4=In almost every lesson, 5=In every lesson*

In summary, it is not an exaggeration to say that Cambodian classroom instruction is resource-strained and is largely characterized by teacher-centered pedagogy which emphasizes rote learning. The chance for pupils to get involved in hands-on activities and to be creative is still desperately low.

5.2. Learning assessment

> "The evaluation is based on our daily teaching, monthly tests and semester test and oral test. Every month we have to test them on all the 11 subjects and skills. So the test is almost every day and we also give them homework."
>
> (A sixth-grade teacher in Angk Snuol)

This excerpt shows a typical case of evaluation of pupils' learning in Cambodian primary schools.

Summative assessment

The frequency of testing is high in Cambodian classrooms. It is about once every two or

three days. Teachers test pupils on all subjects or skills taught. For example, in Khmer (national language) subject for sixth grade, pupils are tested in dictation, writing paragraph, speaking, reading, and listening. Every month, though there might be some variation among teachers, the number of subjects and skills to be tested is about twelve. In addition, pupils have to sit semester tests for these subjects and skills, making the total number of tests per year to about 130 (i.e., 12 subjects/skills X [9 months + 2 semesters]). Monthly and semester tests are the most common forms of evaluation in primary schools. The results of these tests bear great significance since they are reported to the pupils in the form of ranking lists, to the parents through communication booklets, and to the local educational administrators through school reports. For some pupils, the marks they obtained are probably the most important reward they receive in their school life. Every month they look forward to seeing their names being ranked order and displayed in front of their classmates. Teachers also honor outstanding pupils by displaying their names and, when available, photos in the classroom. Promotion decision is also made based on the results of these monthly and semester tests. To be promoted pupils have to obtain at least 50% of the total score of all the tests they have taken throughout the academic year.

Formative assessment

Teachers are engaged in assessing pupils' learning much more than we expect. Earlier, it was shown that teachers on a somewhat regular basis test pupils roughly 130 times every year. However, this is just a small part of their evaluation on pupils' learning. Most of the evaluation takes place on a constant basis in the day-to-day classroom teaching. In every lesson, teachers simultaneously teach and evaluate if and how much pupils understand their instruction. After presenting the new lesson to the pupils, teachers set tasks for pupils to do and, at the same time, observe and assess pupils'

performance. Cambodian teachers like to use tasks from textbooks. For example, pupils are normally assigned to answer questions following the reading text or work on math exercises following the presentation part in the textbooks.

Teachers evaluate their pupils' performance through various kinds of tasks they get their pupils to complete. The most common types are *seat work, work on the blackboard, and work on slates*. Seat work refers to assignments that pupils are required to work individually at their seats to write the answers to questions or exercises in their notebooks or on a piece of paper. The product of their work may be submitted to the teacher for correction. Work on the blackboard simply means solving exercises on the blackboard. Teachers usually call for volunteers to come to the blackboard and solve some exercises and, then, appoint other pupils. Teachers believe that work on the blackboard helps build pupils' courage and prevent pupils from cheating. Unlike seat work, when on the blackboard, a pupil has no ways to cheat, simply because all eyes are on him/her. Therefore, teachers tend to think that work on the blackboard is an effective way to check on pupils' real ability. Work on slates is prized for its efficiency and is mostly used for quick practice such as calculation or spelling. For such work, the teacher does not have to rely on textbooks for the problems to give to the pupils. The teacher creates and calls out the tasks rapidly to the whole class, and quickly checks on the pupils' responses on slates as they are raised to him/her in chorus.

Drawing from pupils' performance on these three types of classroom tasks, teachers can learn how good their pupils are in reading, writing and calculation and what they should do next with the pupils. Unlike summative tests which aim to assess what pupil have already learnt and are subject to publicity such as reporting to parents or higher authority, such assessment provides no marks but immediate feedback for teachers to improve their pupils' learning. For immediate feedback, pupils are rewarded with marks or punished in the case of unsatisfactory performance. The most popular

forms of punishment are standing up, repeated writing and corporal punishment. This kind of daily assessment also informs teachers of the topics their pupils need improvements and, therefore, helps them plan for remedial classes, which they are required, and additionally paid, to give on every Thursday to help the weak pupils.

6. Differences in learning achievement

This section considers inequality of educational achievement as measured by pupil test scores with regards to region, gender, and socioeconomic status. The test scores derived from an achievement test (Appendix F) which was jointly developed by the researcher and the teachers in the research sites and administered to sixth-grade pupils in 32 primary schools in the two districts.

Inequality of achievement by region, gender, and SES

Table 7 shows the results of *t*-tests conducted to compare mean scores of pupil groups in each dimension of region, gender, and socioeconomic status (SES). SES in this analysis is represented by pocket money the children receive from their parents per day. In Cambodia, the practice of providing pocket money to children is prevalent. Children use their pocket money to buys snacks, ice cream, or even meals at schools. They also pay for their private tutoring with their pocket money.

On average, pupils living in the affluent area (Angk Snuol) score higher than those living in disadvantageous area (Preah Netr Preah) with a difference of 4.7 points (The full score is 100 points). This difference is significant at $p<.01$. This finding indicates that the achievement of rural pupils is lower than their counterparts living in better-developed areas.

Table 7 Differences in achievement by district, gender, SES

		N	Mean Score	Mean Difference	*t* (df)
DISTRICT	Angk Snuol	607	53.65	4.700	3.041(1078)**
	Preah Netr Preah	473	48.95		
GENDER	Boys	522	49.31	-4.418	-2.877 (1078)**
	Girls	558	53.72		
POCKET	<1000R	566	47.54	-8.806	-5.792(1071)***
MONEY	=>1000R	507	56.34		

**p<01, ***p<001

As shown in Table 7, girls tend to outperform boys with the average scores of 53.72 and 49.31 respectively. This is a surprising finding as girls have always been targeted for affirmative measures by both government and other development agencies. Judging from the fact that girls have over the years achieved equal, or even better, access to primary education and that girls perform better than boys as shown here, it is fair to conclude that Cambodian boys are now at the disadvantaged end.

Using children's pocket money as proxy of their families' SES, Table 7 shows that children who receive an amount of 1000 Riel[5] or higher as pocket money, perform much better than their counterparts who possess less than 1000 Riel per day. This suggests that children of richer families, which can afford higher amount of pocket money for their offspring, tend to have higher test scores. It is also remarkable that the gap in test scores associated with pupils' SES is relatively large (8.8 points), implying a strong positive relationship between pupils' SES and their academic achievement. To ascertain the relationship between SES and achievement scores, the researcher also uses the number of mobile phones owned by the child's family as another proxy of family wealth. The analysis shows similar result though the effect is smaller (mean

difference=-5.8, p<.000).

Interaction between region, gender, and SES

Table 8 shows the relationship between gender and test scores split by regions. While Table 7 above shows that there is a significant difference by gender, Table 8 shows that such difference tends to concentrate in Preah Netr Preah, the rural area. There is no clear evidence that the gender disparity in test scores also exists in Angk Snuol, the urban area. This finding implies that gender gap in pupils' achievement is an issue of concern only in the rural area. Table 8 further shows that boys in the rural district have the lowest scores while girls in the urban district have the highest scores.

Table 8 Relationships between gender, SES, and test scores by region

		Angk Snuol			Preah Netr Preah		
		N	Mean Score	Mean Difference	N	Mean Score	Mean Difference
GENDER	Boys	306	51.91	**-3.513**	216	45.63	**-6.114****
	Girls	301	55.42		257	51.74	
POCKET MONEY	<1000R	243	47.91	**-9.843*****	323	47.25	**-5.692***
	=>1000R	358	57.76		149	52.95	

*p<05, **p<01, ***p<001

There are clear differences in achievement scores by SES groups in both areas. However, the gap seems to be larger in Angk Snuol than in Preah Netr Preah, implying that the effect of SES on pupils' achievement is greater in the urban area. By way of conclusion, there seems to appear from Table 8 that three groups of the pupils are most disadvantageous in terms of their learning achievement. These pupils (indicated by the shaded cells of Table 8) are the rural boys, the rural poor, and the urban poor.

Chapter Two: School Effects on Academic Achievement

1. Introduction

After more than two decades of increase, primary education enrollment levels in Cambodia began to decline in 2003, mainly due to a shrinking population of primary-school-age children. In 2010, Cambodian primary schools had 2,191,192 pupils - a 20% decrease in total enrollment compared to levels from eight years ago (Ministry of Education Youth and Sports [MoEYS], 2003, 2011). Along with the declining enrollment, Cambodia has made great improvements to educational access and equity. In 2010, the net enrollment rate in primary education reached 95.2%, with enrollment growth showing negligible differences across gender and regions (MoEYS, 2011). Primary school completion rates have also improved. From 1999 to 2006, primary school completion rate doubled to 87% while the percentage of pupils having to repeat grades was nearly halved from 25% to 13% (World Bank, 2008). These trends suggest positive overall performance outcomes of Cambodian education system.

However, school dropout remains a common problem in Cambodia, where poverty and family expectations for child labor are high. Table 9 shows pupil flow rates, which are considered to be indicators of education quality, at primary school level for the recent 5 years. Two observations can be made from this table. First, there was a gradual increase in the percentage of pupils being promoted to higher grades over the years, and there were declining rates of both repeaters and dropouts, suggesting a better overall performance of Cambodian education system. Second, though there was an improvement in the percentage of pupils who persisted in school up to grade 6, the last grade of primary education, the survival rate remained as low as 61.2 percent in 2010, meaning that almost 40 percent of the pupils dropped out of school before completing

the primary cycle.

Table 9 Pupil flow rates at primary education level in recent years

	2005/2006	2006/2007	2007/2008	2008/2009	2009/2010
Promotion rate	77.3	78.4	80.2	82.7	84.3
Repetition rate	10.7	9.8	9.6	8.9	7.8
Dropout rate	12.1	11.9	10.2	8.4	7.9
Survival rate to grade 6	49.3	52.5	59.3	61.7	61.2

Source: Ministry of Education Youth and Sports, EMIS 2006-2011

Researchers found that school quality is related to primary school pupils' dropout decision (Hanushek *et al.*, 2008; Harbinson & Hanushek, 1992; Lockheed & Verspoor, 1991). For instance, Hanushek *et al.* (2008) showed that pupils attending low quality school are less likely to remain in that school compared to pupils attending higher quality school, holding constant pupil abilities and achievements. Following this research, this author argues that, with a nearly 40% drop-out rate by the end of sixth grade, primary school quality in Cambodia is abnormally low. A survey of nationally representative sample found that two-thirds of third-grade Cambodian pupils received 'non-proficient' status on assessment tests, while 'non-proficient' pupils made up only one quarter of sixth- grade pupils (Marshall *et al.*, 2009). The better performance of sixth-grade pupils was in part the result of poorly-performing pupils dropping out, rather than fundamental changes in school quality. Learning, not just attendance in school, is what pupils and their parents consider when making decisions about schooling. Even if pupils are promoted to higher grades, they may drop out if they perceive that the school is not contributing to their learning.

The discussion so far highlighted two important points which motivate this

current study. First, decreasing school age population reduces pressure on the government to expand educational access but school quality and pupil learning needs dramatic improvement. Second, there is a hypothesis that improved learning leads to grade advancement, thus reducing educational resource waste resulting from repeating grades and dropouts. This study seeks to investigate school factors that improve learning achievement. More specifically the study answers the two following questions:

1. How much is the variance in academic achievement explained by school factors as compared to home factors?
2. What school factors are associated with higher academic achievement?

The answers to these questions will hopefully contribute to the thin body of literature about Cambodian educational quality and academic achievement. This work also seeks to inform policymakers about educational resources that effectively raise pupil performance.

2. Theoretical background

The 1966 Coleman Report found that schools had little effect on academic achievement while family and social forces accounted for much of the variation in a child's learning (Coleman *et al.*, 1966). The Coleman Report's surprising conclusion drew much attention from educators and generated interests in identifying determinants of pupil's performance in both developing and industrialized countries. Since then, scholars from various disciplines have extensively studied and debated the factors that influence learning. Although studies investigating the influences on pupil achievement take a variety of forms, the most common research approach is the so-called education production function (EPF) paradigm, also known as the input-output model. By 1994, the United States alone published nearly 400 of these studies in books and scholarly

journals (Hanushek, 1997), and a survey of research literature also found over 100 similar studies within developing country contexts over the same period (Fuller & Clark, 1994).

The underlying framework behind these analyses was the assumption that the output of educational process (i.e., the achievement of individual pupils) was directly related to a series of inputs to education, including those from families, peers, and schools (Hanushek, 1989). EPF was different from other types of approaches because results of the analyses contributed directly to the policy process through identification of school-related factors that tended to boost learning achievement (Hanushek, 2010). The arguments in EPF studies centered on two major themes: the debate between home and school and the relative importance among school inputs.

2.1. The debate between home and school

The most frequently discussed question in the EPF studies was whether home or school was most important to academic achievement rather than the more policy-oriented one of which school inputs were of most relevance to pupil learning. In sharp contrast to research findings in the United States (e.g., Coleman *et al.*, 1966), Heyneman and Loxley (1983), using achievement data sets from 13 industrialized and 16 developing countries, found that the overall proportion of variance in pupil achievement in low-income countries was largely associated with school resources as compared to family background characteristics. For instance, they found that in India 90% of achievement variance was due to teachers and schools. This finding was further corroborated by reviews of research in developing countries (Fuller, 1987; Fuller & Clark, 1994; Lockheed & Hanushek, 1988). Similarly, Mohammadpour (2012) found that student-level factors accounted for only 23.40% of the variance in mathematics achievement of Singaporean eighth-graders, while the rest was attributable to

classroom- and school-level differences. However, Riddell (1997), reviewing more recent studies that employed multilevel regression analyses, found that differing levels of school resources accounted for an average of only 46% in the variation of primary school pupils' achievement. In line with this result, a study of 13 countries in Latin America found that school resources explained 43.5% and 54.3% of achievement variances in language and mathematics respectively (Willms & Somers, 2001). In a recent study, Baker *et al.* (2002), using data from the Third International Study of Mathematics and Science (TIMSS) and method comparable to those of Heyneman and Loxley (1983), found that family background variables were much more significant predictors of pupils' achievement than were school resources variables regardless of national income. Studies in Turkey (Engin-Demir, 2009) and the Philippines (Huang, 2010) showed that schools accounted very little (4 – 9%) for variation in achievement score. Although the debate on the importance of home and school into learning achievement is ongoing, one conclusion can be made of almost half a century of EFP research: the effects of home as well as school on learning achievement were not uniform across societies. Generally, the effect of school was considerably larger in developing countries than in developed countries (Scheerens, 2001).

2.2. The relative importance among school inputs

Previous studies have consistently shown that availability of basic instructional materials such as textbooks and school libraries had a strong effect on pupils' performance in developing countries, where such resources were relatively scarce compared to industrialized nations (Fuller & Clark, 1994; Fuller & Heyneman, 1989; Hanushek, 1995, 2003; Lockheed & Verspoor, 1991). Heyneman *et al.* (1981) demonstrated that, in comparison to the other school inputs, availability of textbooks showed the most consistent association with higher achievement in developing

countries. Closely related to textbooks was the availability of school library, which was also shown to have a positive relationship with achievement outcome (Willms & Somers, 2001). Another important teaching material to have significant relationship with pupil achievement, but often overlooked by research, was teacher guides (Fuller and Clark, 1994). Lockheed and Verspoor (1991) argued that teacher guides, especially those that were well integrated with the textbook and other instructional materials could have a positive impact on pupil achievement.

Class size was the most frequently used measure in the studies of the effect of school resources on achievement. However, only a small minority of the studies found enough evidence to support the expected result of negative relationship between class size and achievement (Fuller & Clark, 1994; Hanushek & Luque, 2003). In some cases, the class size effect even pointed in the unexpected direction (Woessmann, 2003).

Previous studies showed mixed results on the effects of teacher education and experience on pupil performance. Fuller's (1987) review revealed that less than half of the studies supported the conventional notion that the more education the teachers had, the better their pupils' performance was. Yet, a review of studies conducted in Latin America indicated more support for teacher education (Harbinson & Hanushek, 1992). Similarly, there was no consistent effect of teacher experience on academic achievement across countries.

Research from a variety of countries showed that the amount of time available for teaching and learning was consistently related to how much children learn while they were in school (Lockheed & Verspoor, 1991). Nevertheless, in developing countries, it has been found that significant amount of time was lost due to informal school closures, teacher absenteeism, delays, early departures, and poor use of classroom time (Abadzi, 2009). Even though the average length of official school year was about 200 days, Abadzi (2007) estimated that the number of days that pupils were

engaged in learning was 148 days in Tunisia, 145 in Morocco, 126 days in Pernambuco and 76 days in Ghana.

3. Method

3.1. Data and sample

The data used in this chapter were based on a survey with 1080 sixth-grade pupils conducted by the researcher in February and March 2011. The survey covered 32 randomly-selected public primary schools in one rural district called Preah Netr Preah and one semi-urban district called Angk Snuol (16 schools from each area).

The sampled schools ranged in sizes from 204 to 1946 in terms of pupil enrollments and had an average number of 470 pupils. There was no segregation or tracking of any form in public primary schools and virtually all the pupils came from the school catchment area[6]. Most of the schools had only one sixth-grade class and all the pupils of that class participated in the survey. In four cases, however, there were two sixth-grade classes at each school and one of the two classes was selected by means of coin flipping. On average, 38 sixth-grade pupils from each school were selected. The pupils were tested in mathematics and Khmer (national language) and attended another session in which they answered a questionnaire containing questions about themselves and their families (see Appendix A for the Pupil Questionnaire and Appendix F for the achievement test). Information on various school inputs was provided by the principals of the 32 schools based on the Principal Questionnaire (Appendix C) developed by the researcher.

3.2. Variables

Academic achievement

Because there was no standard test available in Cambodia, achievement test in mathematics and Khmer was developed by the researcher with the help of teachers in the research sites. After reviewing the curriculum framework, sixth-grade syllabus, textbooks, and teacher guides, the researcher met with three highly experienced teachers to discuss test items, formats and difficulty. The contents of the test were based on the sixth-grade lessons that the pupils had studied by the time of testing, which was at the end of the first semester. Pupils were asked to write their answers on the space provided for each item. This mode of testing, similar to that of the monthly tests frequently given by the homeroom teachers, was more familiar to the pupils than multiple-choice formats. Previous studies in Cambodia (e.g., Cambodia Education Support Sector Program [CESSP], 2006; Save the Children Norway [SCN], 2008) have shown that one of the reasons rural pupils scored low on standardized tests was that they had not been exposed to the formats adopted by those tests.

The initial draft of the test had 10 items (five for mathematics and five for Khmer) and was piloted with 45 pupils in two classrooms (one from each research area). Based on the researcher's observation, test results, and comments from the teachers of the piloted classes, the number of test items was maintained but two of the items were modified because they were so difficult that only very few pupils could answer. In the finalized version of the test, the mathematics section contained one item on word numbers, three items on number operation, and one word problem. As an example, the word problem item read, "Uncle Chan had 20000 Riels. He gave each of his five children 3600 Riels. How much money was left? Write your solution in the space provided." The Khmer section contained a reading text of about 190 words followed by five questions: one question on main idea, two questions on specific information, one question on word definition, and one on implied information. For instance, the specific

information question asked, “Based on the text, what do Cambodian people do during Khmer New Year?” (See Appendix F)

The test was administered to pupils in the sampled schools by the researcher. Pupils were allowed 40 minutes, which was in line with a period of their classes, to complete the 10-item test. Test results yielded a mean score of 5.15 with a range of 0 to 10, a standard deviation of 2.53 and an acceptable reliability estimate (Cronbach’s Alpha =.76). Reliability coefficient could not be obtained for each subject area because there were too few items to produce a reliable estimate. The distribution of achievement test scores was approximately symmetric with a measure of skewness = -.263 and kurtosis = .695.

Pupil characteristics

Pupil characteristics included in the study were gender, age, and after-school time use. As shown earlier, Cambodia closed the gender gap in primary school enrollment. However, academic achievement does not appear to be evenly distributed across gender. National data consistently show that girls’ promotion rates are higher than those of boys, signaling better academic performance among girls but previous studies (Marshall *et al.*, 2009, 2012) found that girls’ achievement are significantly lower than that of boys in both Khmer language and mathematics. Pupil age also deserved attention. Late school entry is prevalent in Cambodia, similar to other developing countries. Coupled with pupils also repeating grades, this could result in pupils from a wide age range studying in the same grade level.

Breaking from previous EPF researches, the current study employed four measures of after-school time use: work, tutoring, homework, and leisure. Pupils were asked to indicate how much they spend their after-school time on each activity on a scale from 1 to 5 (1 = No time; 2 = less than 1 hour; 3 = 1 to 2 hours; 4 = 3 to 4 hours; 5

= 5 or more hours). School hours in Cambodia are short. Children attend school only half a day and extracurricular activities are rarely provided. Children spend most of their time outside school and this study analyzes if how they spend time outside of school also influences their educational achievement. Some studies found that more time spent on tutoring and homework was associated with better grades, while time spent on work, including household chores, and leisure activities was related with poorer educational performance (Cooper *et al.*, 1999; Smith, 1990).

Family characteristics

Family background variables in the analyses included family size, represented by number of siblings, parental education, and books at home. Additionally, the researcher used pupil's *pocket money* as a proxy for socioeconomic status (SES). Commonly used measures of SES are parental education, occupation, and income. Yet, such measures have been shown to be only weakly correlated with academic achievement (Sirin, 2005; White, 1982). Giving children daily pocket money is common practice in Cambodia. A household survey conducted in 2004 showed that pupil's pocket money was the largest single schooling expenditure in Cambodia (Bray & Seng, 2005). Pocket money is important for Cambodian school children. The pocket money is used for food purchases, tutoring, or sometimes informal fees charged by teachers. Pocket money is also a symbol of status as children from richer families tend to come to school with more money in their pocket. A preliminary correlation analysis showed a significant relationship between pocket money and test scores (r=.206, p<.001), suggesting that pocket money is a good predictor of academic achievement. A final and less often used variable is *home teaching* as a measure of family social capital. The level of human capital such as parent's education level is believed to have a strong impact on a child's intellectual development, but if human capital is not complemented by social capital as

embodied in family relations, it is irrelevant to the child's educational growth (Coleman, 1988). The current study used home teaching to capture the scholarly relationship within the family, operationalized as the frequency at which the pupils were taught at home by their parents or older siblings, including homework assistance.

School characteristics

School-related variables in this study consisted of four indicators of material resources (textbooks, teacher guides, library books, and class size), two indicators of teacher quality (teachers' education and experience) and an indicator of the length of instructional program (instructional time loss). Textbooks was a composite variable of the availability of textbooks for mathematics and Khmer, rated by the principals on a 5-point scale (1 = none of the pupils has; 2 = some pupils have; 3 = half of the pupils have; 4 = almost all the pupils have; 5 = all of the pupils have). Similarly, teacher guides was a composite variable of the availability of teachers' guidebooks for mathematics and Khmer rated on a 5-point scale (1 = none of the teachers has; 2 = some teachers have; 3 = half of the teachers have; 4 = almost all the teachers have; 5 = all of the teachers have). Library books variable denoted the existence of a library as well as the number of books in the library and consisted of three categories (0 = no books or library; 1 = less than 500 books; 2 = 500 or more books). Five hundred books was approximately the average number of books in the schools where a library existed.

The current study used the school percentage of teachers with at least 12 years of general schooling to denote teacher education and the school percentage of teachers with 10 years of teaching to denote teacher experience. These were aggregate variables denoting teacher quality of the whole school rather than variables indicating only the quality of teachers whose pupils took part in the survey. At the final year of primary education, pupils' learning is an accumulated product of a number of teachers to whom

they have been exposed while they are in school, and not merely that of their sixth-grade teachers. Instructional time loss was a measure of the time available for instruction. Again, reported by the principals, this variable showed the amount of instructional time loss on a percentage scale (1 = 0%; 2 = less than 5%; 3 = 5 – 9%; 4 = 10 – 19%; 5 = 20% or more). Table 10 provides descriptive statistics for all variables used in this study.

Table 10 Definitions of variables, means, and standard deviations

Variables	Definition/measurement	Mean	SD
Academic achievement	Scores on achievement tests on math and Khmer language with a range of 0 to 10	5.16	2.53
Individual characteristics			
Gender	Gender of the pupil (0=Male; 1=Female)	.52	.50
Age	Age of the pupil in years	13.11	1.16
Work	Time spent on work including housework (1=No time; 2=less than 1 hour; 3=1 to 2 hours; 4=3 to 4 hours; 5=5 or more hours)	3.27	.97
Tutoring	Time spent on private tutoring (1=No time; 2=less than 1 hour; 3=1 to 2 hours; 4=3 to 4 hours; 5=5 or more hours)	2.15	1.15
Homework	Time spent on homework (1=No time; 2=less than 1 hour; 3=1 to 2 hours; 4=3 to 4 hours; 5=5 or more hours)	2.52	.61
Leisure	Time spent on TV, play, talk (1=No time; 2=less than 1 hour; 3=1 to 2 hours; 4=3 to 4 hours; 5=5 or more hours)	2.43	.58
Family characteristics			
Siblings	Number of siblings with at least one parent in common	3.99	1.76
Parental education	Highest level of education of either the mother or the father (1=None; 2=Primary school not completed; 3=Primary school completed; 4=Junior high school; 5=High school or higher education)	3.28	1.20
Books at home	Number of books at home (1=None; 2=1 – 5 books; 3=6 – 10 books; 4=11 – 20 books; 5=21 – 50 books; 6=51 or more books)	3.18	1.69
Home teaching	Frequency of being taught at home by family members (1=never; …; 5=every day)	3.20	1.42
Pocket money	Amount of pocket money received from parents per day (Unit=Riels) (1=None; 2=100 to 400; 3=500 to 900; 4=1000 to 1900; 5= 2000 to 4900; 6= 5000 or more)	3.49	.93

School characteristics			
Textbooks	Proportion of pupils who have textbooks for math and Khmer language (1=None of the pupils has; …; 5=all the pupils have)	3.93	.56
Teacher guides	Proportion of Teachers who have guidebooks for math and Khmer language (1=None of the teachers has; …; 5=all the teachers have)	3.49	1.24
Teacher education	Percentage of teachers with secondary education or higher	37.65	22.64
Teacher experience	Percentage of teacher with more than 10 years of experience	66.87	23.367
Class size	Average number of pupils per class	44.91	4.80
Time loss	Percentage of instructional time lost in a year (1=0%; 2=less than 5%; 3=5 – 9%; 4=10 – 19%; 5=20% or more)	2.32	.86
Library books	Number of books in library (0=No library or books; 1=less than 500 books; 2=500 or more books)	1.08	.83

3.3. Method of analysis

This study employed the Ordinary Least Squares (OLS) regression with pupils as units of analysis. Information on various school inputs provided by the principals was merged with pupils' test scores and information derived from the Pupil Questionnaire. Each pupil was assigned the values of inputs of the school he or she attended.

As this study used multi-stage cluster sampling, there may exist similarities of observations within clusters (schools) that would lead to underestimation of population variance (Hox, 1998 as cited in Hahs-Vaughn, 2005). The intra-class correlation coefficient (the degree to which there exists similarity within clusters) of the outcome variable of this study was ICC = .26[7]. This value is substantially above .05, indicating the existence of clustering effects and a heightened risk of committing Type I errors (Thomas & Heck, 2001). Therefore, the evaluation criterion had to be set to a more stringent level (alpha <.01). There was no issue of multiconllinearity since most of the correlations between the predictors used were low and the highest correlation was between teacher education and teacher experience (r = -.46).

This study conducted the OLS regression analyses under three models with

achievement test scores as outcome variable. The first model had only variables comprising pupil characteristics. The second model added family background variables. Finally, the third model incorporated all variables including school characteristics. All analyses were run with SPSS/PAWS 18.

Table 11 Standardized regression coefficients (β) with academic achievement as outcome variable

	Model I	Model II	Model III
Individual			
characteristics			
Gender	.063 (.316, .156)[a]	.054 (.268, .162)	.049 (.241, .158)
Age	-.149** (-.322, .066)	-.132** (-.290, .074)	-.137** (-.301, .071)
Work	-.025 (-.064, .081)	-.053 (-.135, .084)	-.027 (-.067, .082)
Tutoring	.163** (.358, .067)	.136** (.293, .074)	.124** (.267, .073)
Homework	.021 (.088, .127)	.042 (.171, .130)	.016 (.063, .127)
Leisure	-.097* (-.425, .133)	-.078* (-.342, .140)	-.045 (-.196, .137)
Family characteristics			
Siblings		-.062 (-.086, .045)	-.061 (-.085, .044)
Parental education		.039 (.081, .074)	.001 (.001, .072)
Books at home		-.021 (-.031, .052)	-.054 (-.080, .052)
Home teaching		.066 (.117, .060)	.031 (.054, .060)
Pocket money		.144** (.384, .090)	.061 (.161, .093)
School inputs			
Textbooks			-.024 (-.104, .154)
Teacher guides			.124** (.250, .070)
Teacher education			.080 (.009, .004)

Teacher experience			.254** (.027, .004)
Class size			.002 (.001, .017)
Time loss			-.132** (-.378, .095)
Library books			.029 (.088, .106)
Multiple *R*	.278	.359	.445
R-Squared	.078	.129	.198

[a]Numbers in parentheses are unstandardized coefficients (*B*) and standard errors (*SE*)

**p*<01, ***p*<001

4. **Results**

Table 11 shows the results of the OLS regression analyses of the effects on academic achievement. Model I showed that age had a negative relationship with academic achievement, indicating that younger pupils outperformed their elder counterparts in the same grade. Time spent on tutoring had the strongest positive relationship (β =.163, p<001) with learning as compared to other individual characteristics. Expectedly, time spent on leisure activities such as watching TV, play, or talk with friends was negatively correlated to academic achievement although the strength of the relationship was weak (β =.097, p<01).

Model II showed that pocket money was highly significant and had the largest magnitude of effect on achievement (β =.144, p<001) among individual and family characteristics.

Model III assessed the relative influences of all factors on academic achievement. It was evident that when school variables were added to the regression analyses, there was a slight change in the magnitude of the effect of individual characteristics but a notable reduction in significance level and the strength of the

relationship between family factors and academic achievement. For instance, pocket money, which was most influential factor to affect educational achievement in Model II, was no longer a significant predictor when school inputs were accounted for in Model III and its effect was only minimal (β =.061, p>01). This suggested that school inputs played an important role in mediating the social inequality of educational achievement. Model III showed that the significant variables with notable effects on academic achievement included age, tutoring, teacher guides, teacher experience, and time loss. Age of the pupils and schooling time loss perceived by the principals were negatively correlated to test scores, while time spent on tutoring, teacher guides and teacher experience tended to have positive effects on achievement.

Table 11 also provides the values of variance (*R*-squared) in academic achievement explained by different regression models. The bottom row of Table 11 shows that all variables measured by this study accounted for 19.8% of the variation in academic achievement (Model 3), meaning that a large part of achievement variance remained unexplained. This is understandable since achievement was also a product of many other factors which were not counted in this study. Within this 19.8% of explained variance, 12.9% was accounted for by the home factors (i.e., pupil and family characteristics as shown in Model II) and 6.9% was uniquely attributed to school inputs (the difference between *R*-squared in Model III and *R*-squared in Model II). To put it another way, as a percentage of the total explained variance, family and school accounted for 65.2% ([12.9/19.8]X100) and 34.8% ([6.9/19.8]X100), respectively, of the variation in academic achievement. Yet, this result warrants caution. The home factors, by virtue of being entered first into the regressions, may subsume the achievement variance which may otherwise be attributed to school factors. Therefore, the proportion of variance accounted for by schools as shown here should be considered as a lower limit estimate.

5. Discussion

The results of OLS regression analyses presented a considerable effect of school resources on pupil learning in Cambodia. After controlling for pupil background characteristics, school accounted for at least 35% of the variation in achievement scores. This is a relatively low effect as compared to that documented by the seminal work of Heyneman and Loxley (1983) and early EFP studies reviewed by Fuller (1987). However, this finding of school effect is on par with more recent literature in developing countries (Riddell, 1997; Willms & Somers, 2001) and indicates greater school effect on academic achievement than that found in industrialized countries. The finding provides additional support for policies aimed at improving school resources to raise pupils' academic achievement. The remainder of this paper will discuss school-specific factors that significantly contributed to pupil learning.

The first significant correlate of academic achievement is teacher experience. The analysis showed that, controlling for other factors, schools with a higher percentage of experienced teachers had a higher proportion of pupils that performed successfully on achievement tests. Compared to the other predictors, teacher experience had the highest magnitude of effect on academic achievement. While consistent with commonly held beliefs, this finding conflicts with the results of studies in other developing countries (Harbinson & Hanushek, 1992; Huang, 2010; Luschei, 2012; Willms and Somers, 2001) which documented that there was no significant relationship between teacher experience and pupils' academic achievement. Further analysis of the survey data showed that schools with high levels of teacher experience were concentrated in urban and high-SES areas. The imbalance of teacher experience can be explained by two reasons. First, urban schools generally have been longer in existence and so have

their teachers. Some of rural schools were established in the last decade and so most of teachers were newly recruited. Second, it is a product of rural-to-urban migration of teachers who start their teaching in rural areas and later move into urban zones, where the advantage to earn additional income from private tutoring or moonlighting is higher than the special benefits provided by the government for teaching in underserved areas. The current teacher deployment system allows teachers to change their posting a few years after their initial assignment. Teachers, except for those living in local areas, tended to move to more affluent or urban areas after this initial stage, thus widening the rural-urban imbalance of experienced teachers. Currently, the government depends on local recruitment for teachers in disadvantaged areas. Though this strategy identifies teachers with strong ties to schools in their own communities and thus likely to remain teaching there longer, there is usually a shortage of teacher recruits in those areas and recruitment standards are often lowered. For example, the government sets a quota for teacher recruitment for a particular disadvantaged area and then lowers entry requirements for teacher training college in order to have more teacher candidates. Of course, this initiative improves education access in underserved areas but still leaves an achievement gap between pupils in rural and urban areas. This study recommends that policies to improve pupil's achievement should not only consider recruitment of local teachers but also the reassignment of experienced teachers to rural schools.

Another significant finding was that the availability of teacher guides was positively correlated with academic achievement. Interestingly, there are numerous studies on textbooks availability and other pupil resources but teacher guides have been little explored as a school input. For example, only one of over 100 studies reviewed by Fuller and Clark (1994) included teacher guides as a predictor of achievement. This study also included textbook availability in the regression, but found it was not significantly related to achievement. This finding suggests that textbook availability is

no longer an issue in Cambodian primary schools and most pupils had access to textbooks. However, the study found that some teachers were teaching without any teaching guides, let alone other teaching resources. Teaching in Cambodia relies a great deal on textbooks and teachers rarely introduce extra materials into their classrooms. Also, teachers are expected to follow the child-centered approach, which was introduced in 1996. Nevertheless, the teachers have not been adequately trained to apply this pedagogy to their own classrooms. Therefore, teacher guides have been valuable resources for teachers in addition to textbook. Teacher guides present guidelines as well as references that teachers can consult when they have difficulty in their daily teaching. A review of teacher guides for sixth-grade mathematics found that the teacher guides were well integrated with pupil textbooks, providing teachers with necessary knowledge of the lessons before embarking on teaching them. Each chapter of the teacher guides, which was in line with that of the textbooks, informed teachers of the following seven components: (a) chapter objectives, (b) important concepts and theories, (c) key terms, (d) teaching materials needed, (e) time needed, (f) instruction for teaching, which also included answers for problems in the textbook, and (g) suggestions for assessing pupil learning (MoEYS, 2001a). Surely, these are prerequisites for teaching, the ignorance of which would doom a teacher to failure in his or her teaching endeavors. The significant effect of teacher guides as found by this study is an important evidence of this relationship and implies the needs to improve the resource bank through which teachers can learn and develop their teaching skills. In doing that can teachers, who are poorly educated themselves and who rarely receive any technical support in their profession, develop themselves to the need of the new pedagogy. The positive contribution of teacher guides on pupil achievement found by this study also calls for more attention to such important teaching resources in future studies, especially those conducted in developing countries where they are still in short supply.

A final important factor found to constrain academic achievement was instructional time loss. Pupils from schools that reported a higher portion of instructional time loss had lower test scores than those from schools with better time management. This finding is in line with Fuller and Clark's (1994) review, which showed a positive relationship between instructional time and academic achievement in 15 of 17 studies. A study in rural India by Word Bank (1997) also found that pupil achievement was higher in schools with more hours of instructional time per years. During school visits for this study, the researcher noted a greater prevalence of time loss. Schools tended to start late and there were often breaks between classes. Two teachers were absent on the day of survey despite setting an appointment with the researcher. There were two cases where the whole school was closed to allow teachers to attend the wedding. In a more systematic observation, the researcher asked two teachers to record their classroom teaching with an audio recorder by themselves without the presence of the researcher. From a total of 20 recorded classes (ten from each teacher), the researcher found that the classes lasted for an average of 28 minutes, which was much shorter than the officially required 40-minute class period[8]. This shows a 30% loss of classroom time. However, this result, which relies on only two cases, should be treated with caution. The CESSP survey conducted on a representative sample of schools reported that school closures due to public holidays and other reasons and teacher absenteeism accounted for the loss of 9% and 5% of annual instructional time respectively (Benveniste *et al.*, 2008). Based on these evidences, it can be concluded that the actual instructional time which is available for pupil to engage in learning tasks is less than 60% of the official 190 school days per year. Although this is a tremendous loss of schooling time, it is not unique to Cambodia. Studies in other developing countries found a reduction of a roughly 30-50% of instructional time as intended by the official curriculum (Abazi, 2009; Benavot & Gad, 2004). Yet, these results should be

considered as lower bound estimates because the measures used in these studies including the current study often fail to take into account pupils' time-on/off-task. The dramatic instructional time loss and its significant effect on pupil learning shown in this section deserves special attention from policymakers. Although some time loss due to natural hazards such as torrential rain fall and flood is inevitable, a large portion of learning time can be gained through improved school management. A strong monitoring system of instructional time could be introduced, coupled with incentives to encourage schools and teachers to develop practices for maximizing instructional time.

6. Conclusion

Following the education production function (EPF) tradition, this study employed OLS regressions to investigate the effect of school inputs on academic achievement of primary school pupils in Cambodia by controlling for pupil- and family-related factors. The study detected a considerable overall effect of school inputs on academic achievement and identified three important aspects of school resources that were significantly correlated to pupil achievement: teacher experience, teacher guides and instructional time. Pupils performed better in schools with more experienced teachers, higher ability of teacher guides and longer annual instructional time than in schools with less of these resources.

Chapter Three: Student-Centered Approach in Cambodia

In this chapter, policy concerning student-centered approach (SCA) in Cambodian primary school is examined and the impact of this SCA reform on teachers and their classroom practices is explored. The analysis of policy documents since the inception of the reform in 1996 showed that SCA has gained a strong support and commitment from Cambodian government as reflected in the new curriculum and teacher training programs. Student-centered approach has also been warmly welcomed by most Cambodian primary school teachers. However, it has not yet been widely implemented and realized in classrooms.

1. Policy discourses on student-centered approach

In 1996, Cambodian education underwent a dramatic reform. It was a reform that upgraded the school education system from 11 (5+3+3) years to 12 (6+3+3) years of general education and a reform that shifted the philosophy of Cambodian education from socialist to democratic orientation. With this reform came new curriculum, syllabus, new textbooks, new teaching method, and a more decentralized school management, all of which embrace the democratic values, which emphasize peace and freedom. Of relevance to the current discussion, teaching and learning approach has also been a major agenda of the reform. Early in the reform, the Ministry of Education, Youth, and Sports (MoEYS) required teachers of all grades to use student-centered approach (SCA) in place of the traditional teacher-centered teaching (TCA), which had until then been a common practice in Cambodian classrooms.

SCA is defined as “a teaching and learning approach which is based on pupil activities. In SCA, pupils are expected to be active participants in the learning process

while teachers are just facilitators or catalysts. Pupils can learn by themselves individually, in small groups, or whole groups in or outside of classroom" (MoEYS, 2001b, p.18). In direct contrast to the traditional methods, SCA emphasizes active involvement of pupils in classroom activities. Pupils' talk, discussion and activities should be maximized, while teacher talk should be kept to a minimum level. Pupils' needs and interest are at the focal point of student-centered teaching. The orientation toward pupils is also reiterated by the Core Curriculum for Basic Education: teaching and learning activities should place pupils at the center and be relevant to pupils' daily life (MoEYS, 2006a, p.7). As an example, for mathematics, the Core Curriculum instructs that teacher should:

- Teach the concrete first by using real objects (វត្ថុពិត) or representation (វត្ថុតំណាង) before moving on to abstract concepts.
- Ask questions for pupils to think, judge, and make assumption by themselves individually or in small groups.
- Avoid transferring knowledge, but give pupils time to think, discuss, and exchange ideas.
- Develop teaching materials from available resource in the local community.
- Get pupils to do mental calculations (គិតលេខដោយមាត់ទទេ), make conjectures (ធ្វើការប៉ាន់ស្មាន), and solve word problems (ដោះស្រាយចំណោទ). (MoEYS, 2006a, p.24)

In a handbook for teacher training approved by MoEYS, the followings are considered principles for effective learning through SCA: active pupil participation; frequent practice and review; meaningful content, i.e., connected to pupils' existing knowledge and daily life; learning via the use of multiple senses (ការសិក្សាតាមវិញ្ញាណចម្រុះ): touch, smell, taste..; feedback; and praise and rewards (MoEYS, 2008, p.29). Teaching strategies suggested by the handbook include direct instruction, group work, exercises

for practice, word problems, experiment, presentation, role-play, peer teaching, study game, outdoors activities, and project work. MoEYS (2001, 2008) instructed that SCA should be conducted through five steps:

1. Setting up: checking attendance and order
2. Reviewing previous lessons: checking homework, revising past lesson
3. Presenting new concept/lesson
4. Strengthening knowledge: giving practices and checking understanding
5. Homework and farewell

In 2007, when the MoEYS issued the Policy on Child-Friendly School (CFS), SCA was elevated as the teaching and learning methodology to be used in all child-friendly schools in Cambodia. The MoEYS aims to make all of the country's schools at basic education level (grade 1 to 9) become child-friendly. Within CFS framework, student-centered learning was characterized by:

- Participation and cooperation
- Problem solving
- Research, analysis, and critical thinking
- Creative and divergent thinking (MoEYS, 2007a)

Based on this conceptualization, it is clear that learning and teaching emphasizes not only pupil activities but also higher-order thinking skills. Such skills are also recapitulated in a recent guideline for textbook development, which dictates that core textbooks should be written to promote high-order thinking such as understanding, analysis, application, synthesis, and evaluation (MoEYS, 2012b, p.27). The guideline also presents a new conception of teaching and learning which regards learners not as mere absorbers but as active constructers of knowledge:

1. A child is an individual who sees the world in a unique way.
2. A child is not a piece of white cloth. They have some basic knowledge from

birth.

3. A child learns and receives knowledge from different sources in addition to classroom.
4. A child is curious about the nature and wants to understand about the world around them.
5. A child learns that there are many ways to understand information through discussing with peers and other people.
6. Research is harder than recall.
7. A child understands when they can use their knowledge to construct new information. (MoEYS, 2012, p.26-27)

The review of policy discourses on teaching and learning mentioned so far seems to indicate that SCA has gained support and commitment from Cambodian government. However, it should be noted that the conception of teaching and learning adopted by SCA-related policies tend to change over time. At its early inception, SCA in Cambodia merely meant pupil activities and group work as opposed to the rote learning and frontal teaching. Later, especially after the adoption of CFS, SCA also accounted for the development of higher-order thinking corresponding to Bloom`s taxonomy of educational objectives (Bloom *et al*., 1984). In other words, there seem to be a shift in focus from behavioral aspects to cognitive aspects of instruction.

2. Training of teachers on student-centered approach

Student-centered approach to teaching and learning was foreign to Cambodian teachers by the time of reform. Traditionally, teaching and learning took place in pagodas with Buddhist monks transmitting knowledge to the pupils through recitation, memorizing, and repeated writing. Corporal punishment was the norm and the teachers had all the

authority. None of these is encouraged in the modern teaching methodology. To enact the new curriculum, Cambodian teachers have to learn a great deal of the new approach and to unlearn their accustomed pedagogy. Recognizing this challenge, MoEYS with technical and financial assistance from aid agencies have focused their efforts on both pre-service and in-service teacher training in the initial stage of the reform.

MoEYS instructed that pre-service teacher training programs should use new textbooks, teacher guides and teacher orientation materials to train new teachers[9]. However, one study showed that SCA was far from being a dominant method of teaching in teacher training colleges. Teacher trainees were still exposed mainly to traditional lecture-type instruction and their practical activities were mainly reduced to the development of visual teaching aids such as posters and cards (Popov, 1998). This is understandable because when the reform on education was announced in 1996, supporting materials and facilities for enacting on the reform were not in place. For example, it is only in 2001 that a comprehensive textbook for orienting teachers and teacher trainees to the new curriculum, pedagogy, and pupil textbooks were produced and distributed to teacher training colleges. The textbook itself spends a great number of pages on how to use the new curriculum materials and lesson planning and not many on introducing the new teaching methodology. Of 195 pages of the booklet, 12 (6%) pages were devoted to student-centered pedagogy, 17 (9%) pages to the understanding of the new curriculum and the remainder was spent on lesson planning and utilization of the new pupils' textbooks.

Teacher trainees also learned about student-centered pedagogy through the CFS initiative which had been incorporated into the curriculum of teacher training colleges. Specifically, MoEYS developed a textbook to address the CFS with a main forcus on Dimension 2: Effective teaching and learning[10]. This textbook is principally devoted to instructing future teachers on student-centered approach on the following content areas:

- Classroom management,
- Questioning,
- Developing learning games,
- Using resources in the classroom,
- Developing reading skills,
- Developing writing skills,
- Assessment and pupil portfolios
- Reflection (self-assessment).

According to the teacher training syllabus developed by the Teacher Training Departments of MoEYS, it should take 30 hours during the two-year training program to cover the topics listed above (p.12-13).

In-service teachers receive their training through the so-called cascade model. At the beginning of the reform, the Teacher Training Department with the assistance from Save the Children Norway and UNICEF adopted the following process for guiding teachers to the new curriculum: 1) textbook writers and teacher trainers (about 20 people) developed materials for teacher orientation and train provincial staff (90 people, about 4 from each of the 22 provinces); 2) provincial staff train district level educational staff; 3) district team train teachers in schools (Popov, 1998). This teacher orientation program was conducted one grade per year starting from the first grade onward. As the orientation process started in 1996, teachers taking charges of sixth-grade classes would receive their training in 2001. This caused a big challenge for grade 6 teachers as they had to teach a new textbook for the newly-established grade[11] before they could have an opportunity to learn about the new curriculum materials. When the national curriculum underwent another revision in 2006, a similar cascade model of in-service training was conducted by the Cambodia Basic Education Project supported by United States Agency for International Development (USAID). Under this project, about 6000 primary and

secondary school teachers in 8 underserved provinces were trained to implement the revised curriculum and newly established achievement standards for grade 3, 6, and 9 during the academic year 2006-2007. However, because the revised curriculum was not accompanied by new textbooks, the project instead produced support materials to complement the existing textbooks and train teachers how to adopt student-centered approach to teaching those materials. The new curriculum and support materials were reported to be distributed to schools throughout the country. Currently, MoEYS is also using the cascade model of in-service training to orient teachers to the CFS program. The figure below shows this hierarchical process through which in-service teacher training should take place, as laid out in the CFS master plan. At the national level, the Teacher Training Department of MoEYS with other related departments (Department of Curriculum Development, Department of Primary Education) are responsible for developing training materials and select national core trainers among the officials in those departments. The national core trainers train provincial trainers, usually teacher trainers at Provincial Teacher Training Centers (PTTCs). The provincial trainers, in turn, train district staff in seminars or workshops organized at provincial level. Then, the district staff (also known as the District Training and Monitoring Team [DTMT]) train school principals and teachers in workshops organized at a school cluster, which is usually made up of five or six schools. The workshop at cluster level is held on the last Thursday of every month among school staff in the cluster. Generally called 'Technical Meeting' by teachers, this workshop is the most sustained mechanism for continuous professional development. It is through this forum that teachers learn about new policy, curriculum, and teaching methods from their colleagues and, sometimes, higher level educational officers. MoEYS reported that in academic year 2011-2012, it provided training on student-centered approach and effective teaching and learning to DTMTs in Phnom Penh and other four provinces (MoEYS, 2013b, p.21). However, there is no

figure showing how many school teachers and principals have received the training from DTMTs. In-service training seminars on SCA are based on two textbooks developed by the MoEYS. One is entitled Student-Centered Approach (MoEYS, 2008) and the other is Effective Teaching and Learning (MoEYS, 2007b). The latter document has the same contents as the one used in pre-service training mentioned earlier.

The cascade model of in-service teacher training:

National level

- CFS training content
- Provide Training of Trainers (TOT) for District Training and Monitoring Teams (DTMT)

Provincial level

- Arrange TOTs for District Training and Monitoring Teams
- Select provisional members for each of the District Training and Monitoring Teams

District level

- Select members of District Training and Monitoring Teams
- Present intensive training inputs to school staff in clusters (or district education offices)

Cluster level

- Organize cluster workshops and monthly meetings
- Arrange meetings for local facilitators

School level

- Apply CFS ideas in each of the six dimensions of the framework (MoEYS, 2007c)

3. Teachers' perceptions

3.1. Surveying teachers' views

Teachers learn about the new pedagogy, the SCA, through various means: by attending teacher training colleges; through workshops and seminars organized by Ministry of Education, Youth, and Sport and NGOs; and through the curriculum materials such as textbooks and teacher manuals they use for their classroom teaching. After more than 15 years of implementation, how well do teachers understand the core ideas proposed by the reform? What do they think about those reform ideas? And how much has the reform affected their classroom practices? The following sections will provide answers to these questions based on questionnaire survey and interviews with teachers. The questionnaire survey covered about 391 teachers from 72 schools in Angk Snuol district of Kandal province and Preah Netr Preah district of Banteay Meanchey province. This sample covered 74% of all primary school teachers in the two districts. Teachers were presented with a mixture of reform and conventional concepts and statements about teaching and learning to see how they accommodate the new ideas against conventional ones. It has been argued that teacher may embrace reform ideas at the expense of more conventional ones, or they may adopt the reform ideas and, at the same time, maintain a great deal of the conventional principles (Cohen, 2001). van den Akker (1994) observes, "Implementation implies a process of learning new roles (and often unlearning old ones) for teachers" (p. 1492).

The interviews were conducted with 30 teachers randomly selected from the two districts (14 from Angk Snuol, 16 from Preah Netr Preah). The purpose of the interview was to understand what the teachers' daily teaching was like and what teaching methods they thought were best for pupils' learning.

3.2. Teachers' understanding of SCA

Since SCA has been adopted for more than 15 years, it is apparent that teachers are well familiar with this pedagogical approach and to a great extent can identify the teaching principles recommended by this approach. To see if this is the case, teachers were presented with 12 key concepts about teaching and learning which were consistent either with reform or conventional ideas and instructed, "Check concepts which you think are identified with student-centered approach." The concepts were mainly extracted from various documents such as teacher training materials and curriculum materials like curriculum framework, textbooks, and teachers' manuals.

As Table 12 shows, there is a clear indication that teachers were well familiar with SCA reform as most of them could identify the seven concepts associated with SCA correctly. Group work topped the list in terms of teachers' familiarity, followed by pupils' activities with 98 percent and 97 percent of correct responses, respectively. This result is expected since group work and pupils' activities have been emphasized since the outset of reform as countervailing forms of instruction for frontal teaching and lecturing, which were common practices in traditional classrooms. It should be noticed that the percentages of correct responses for high level of sound and higher-order questions, the reform ideas which were least correctly identified by teachers, were as high as 79% and 82% respectively. Another point of attention is the '5-step lesson'. Five-step lesson was included in reform ideas because an examination of teacher training materials showed that teachers were advised to plan and conduct their lessons according to this 5-step framework of lesson planning. It is probably for this same reason that the majority of teachers (95%) in the survey associated the 5-step lesson with SCA. As the matter of fact, the 5-step lesson in Cambodian classroom has been in existence well before SCA reform, at least since the early 1980s during the post-civil war rebuilding period. Some researchers on Cambodian education even called this

5-step lesson ‘classic’. However, it should be argued that the 5-step lesson is more in line with the traditional teacher-centered approach, where everything is predetermined by teachers for the pupils. SCA lessons should be conducted in a more flexible way to cater for pupils’ interest and feelings so it is doubtful that the 5-step lesson will work best in SCA classrooms.

Table 12 Percentage of teachers identifying SCA concepts correctly

	SCA concepts	**N**	**Percent**
1.	Group work	391	98
2.	Pupils’ activities	391	97
3.	5-step lesson	391	95
4.	Research	391	91
5.	Various teaching materials	390	85
6.	Higher-order question	391	82
7.	High level of sound	391	79
Average Percentage			90%

Table 13 Percentage of teachers identifying conventional concepts as SCA concepts

	Conventional concepts	**N**	**Percent**
1.	Orderliness	391	84
2.	Copying text from blackboard/textbook	391	50
3.	Strict discipline	391	46
4.	Memorization	389	42
5.	Teachers talking more than pupils	391	5
Average Percentage			46%

While a large majority of teachers could identify SCA concepts correctly, not a few teachers misidentified conventional ideas with SCA (Table 13). Eighty-four percent of the teachers associated 'orderliness' with SCA. Orderliness is used here to mean good organization of classroom space, learning materials, and seating. Although SCA reform does not disapprove orderliness, it is thought to be more a characteristic of conventional classrooms than that of SCA classrooms, where pupils' activities and mobility are encouraged and are likely to result in a less-organized classroom. It is noteworthy from Table 13 that the percentages of teachers who misidentified the conventional ideas which reformers tried to discourage were considerably high. These misidentified concepts include copying text from textbook/blackboard (50%), strict discipline (46%), and lesson memorization (42%). A few teachers associated 'teachers talking more than pupils' with SCA. In short, the results of questionnaire survey on teachers' knowledge of SCA show that a large majority of teachers were aware of the core ideas proposed by SCA reform; yet a sizable number still associated more conventional ideas with SCA.

Based on the interviews with teachers conducted by the author, teachers tended to denote student-centered approach with the followings: the 5-step lesson, group activities, and teaching materials. When asked what SCA was, teachers often said that SCA was a teaching approach that "requires us to follow the five steps", namely warming up, reviewing previous lessons, presenting new lesson, strengthening knowledge, and homework. Teacher also associated group activities with SCA. As one of the teachers stated, "in SCA, there are a lot of pupil activities, learning games, and pupil studying in groups." Usually the activities which the teachers referred to were questions or exercises in the textbook. So group work consisted mainly of pupils working together to find answers to some questions of a reading text or some computational exercises and present the answers to the class. However, teachers

recognized that there was little discussion going on and only one or two pupils in the group did the task, while the rest just sat or played. A typical response from teachers related to group work was, “in group work, only the smart pupils will do the task and the less able just sit and watch.” Lack of cooperation between group members was often raised by teachers as a reason that discouraged them from using group work. This lack of cooperation among pupils may be linked to the types of the tasks the pupils did. Teachers allowed pupils to do more activities in groups but the nature of the tasks remained essentially the same. Normally, teachers took the questions or exercises straight from the textbook and assigned them to pupil groups, who were supposed to work together to find the answers. However, most of the tasks in the textbooks demanded little or no discussion. Only skills in reading in the case of Khmer language and calculating in the case of mathematics are needed. No personal opinion is needed. So, the smart pupils in the group will do everything and the weak pupils will just sit and get bored. From the interviews, it was clear that teachers tended to equate pupils’ activities with answering questions or solving exercises by themselves. To them, this is an important difference from TCA lesson, where teachers would give all the answers to the pupils without getting them to try first.

Another aspect of instruction which teachers tended to associate with SCA was the use of teaching materials such as pictures or real objects. They claimed that materials helped pupils to understand the lesson more easily and to retain their memory longer: “With pictures, pupils can understand and remember easily. When we ask the same question later, the picture will help them to recall the answer. The ability to recall is better than when we use nothing at all.” However, they acknowledged that they rarely brought in or made teaching materials themselves simply because they did not have time to produce those materials. “Pupils will learn a lot if we follow SCA; but if we don’t have enough to eat, we don’t have time for developing materials,” said one of the

teachers. It was well-known that because of their low pay, Cambodian teachers were often engaged in a second job or other productive work, which badly affected their time for teaching. Being unable to produce materials by themselves, teachers just used pictures or drawings available in the textbooks. Another type of materials which was often used in classes was word cards. The word cards were mainly used in Khmer language lessons, in which difficult words extracted from reading texts and written on a piece of paper were shown to the pupils so that they would read the words out loud. It should also be noted that producing word cards was also a popular agenda for materials development during the monthly meetings.

Teaching materials, if any, were very simple and were used mainly by the teachers to illustrate concepts or to make teachers' explanation easy to understand. Rarely were materials used by teachers to pose problems or by pupils to solve problems. Though the materials were sometimes introduced to the classrooms, pupils were hardly exposed to those materials, except seeing them manipulated by the teachers. In this respect, It seems fair to say that the main purpose for using materials in classes is to help teachers' explanation rather than to improve pupils' participation and thinking.

While teachers made frequent references to the 5-step lesson, materials, and group activities, they talked less about pupils' thinking levels or cognitive demand of the tasks they give to pupils even though the policies on teaching and learning emphasized the development of higher order cognitive skills such as analyzing, problem solving, and critical thinking as shown earlier in this chapter. In the questionnaire survey, where options were given, teachers tended to rate concepts denoting deep thinking like 'research' or 'higher-order questions' lower than concepts representing behavioral aspects of the lesson such as 'group work' or '5-step lesson'. When left to talk on their own as in the interviews, teachers barely mentioned how SCA activities would help improve pupils' thinking. Teachers allowed pupils to do more activities and introduced

more materials into classroom, but hardly did these activities and materials challenge pupils to think harder. This shows that teachers have taken up the forms of SCA but not the substance, that is, they have changed their behaviors in some ways without adopting the underlying principles (Brodie *et al.*, 2002). This is an important gap between the policy message on SCA and teachers' understanding thereof.

3.3. Teachers' beliefs about teaching and learning

This section presents results on teachers' beliefs about teaching and learning. Teachers' beliefs are thought to influence their teaching. Teachers who believe that pupils are passive recipients of knowledge will surely organize classroom activities in different ways from those who think that pupils are active participants in constructing new knowledge. With regard to teachers' beliefs, Brophy (1991) claims, "similar pupils learning about similar content from different teachers may have very different experiences if their teachers have very different beliefs about the nature of the subject matter… or about what learning experiences will be most effective for moving pupils toward the extended outcomes" (p.xii).

The questionnaire survey of the current study inquired teachers about their opinions of teaching and learning on 15 statements which are either consistent with reform ideas (10 statements) or conventional ideas (5 statements). Teacher responded on a four-point scale: 1 (strongly disagree); 2 (disagree); 3 (agree); 4 (strongly agree). For ease of understanding, Table 14 shows the results in only two columns: Disagree, which includes responses for both 'strongly disagree' and 'disagree'; and Agree, which includes responses for both 'agree' and 'strongly agree'. The survey results reveal that virtually all teachers tended to agree with 9 of the 10 reform ideas. Of particular note, statement 2, "Teaching is most effective when conducted in 5 steps," received a very high rate of approval (99%). This result coupled with that found earlier indicates that

the 5-step lesson has gain legitimacy in Cambodian primary school classroom. The only statement of reform ideas which divided teachers into halves was, "Teachers should make pupils figure things out for themselves, rather than tell them how to solve a problem". It is interesting that this statement, which is considered a core principle of SCA, received significantly less approval rating from Cambodian teachers as compared to other reform ideas.

While reform ideas were well received by teachers, it was also evident that teachers still held dear to conventional ideas. Surprisingly, about nine out of ten teachers agreed with statement 1 (Table 15), "Pupils learn best when they memorize a lot," the very idea reformers tried to reduce or eliminate. The majority of teachers also endorsed the instruction based on MoEYS-designated syllabus (76%), lectures (57%), and orderliness (55%). As expected, 20% of teachers agree with statement 5, "When teachers allow pupils to discuss or debate ideas in class, it takes time away from learning." In summary, the survey results on teachers' beliefs strongly suggest that while teachers embrace the principles of teaching and learning proposed by SCA reform, they still do not discard the traditional ideas, even though such ideas might not be endorsed by reformers. This implies that teachers see SCA as an additional strategy rather than a change to their existing approach.

Table 14 Teacher beliefs about SCA teaching and learning

	SCA belief statements (*To what extent do you agree or disagree with the following statements about teaching and learning?*)	**N**	**Disagree (%)**	**Agree (%)**
1.	Pupils learn best in classes with a lot of study games.	385	1	99
2.	Teaching is most effective when conducted in 5-steps.	390	1	99

3.	Pupils learn best when the teacher continuously assess pupils' progress.	389	1	99
4.	Pupils learn best when the contents of the lesson is connected to everyday life.	391	2	98
5.	Pupils have better academic achievement in classrooms where their active participation in learning is encouraged.	390	2	98
6.	Pupils learn best when learning contents are suitable with pupils' ability level.	383	3	97
7.	Pupils learn best when they work in small groups (4-6 people).	385	5	95
8.	Pupils can benefit academically from learning that takes place outside the classroom.	386	6	94
9.	Pupils learn best when teachers ask a lot of higher-order questions.	380	7	93
10.	Teachers should make pupils figure things out for themselves, rather than tell them how to solve a problem.	386	47	53

Note: Scale: *1= strongly disagree; 2=disagree; 3=agree; 4=strongly agree*

Table 15 Teacher beliefs about conventional teaching and learning

	Conventional belief statements (*To what extent do you agree or disagree with the following statements about teaching and learning?*)	**N**	**Disagree (%)**	**Agree (%)**
1.	Pupils learn best when they memorize a lot.	389	14	86

2.	Pupils learn best when the MoEYS-designated syllabus is strictly followed.	384	24	76
3.	Classroom learning is most effective when based primarily on lectures, with pupils listening silently to the teacher.	389	43	57
4.	Pupils learn best in classroom with pupils sitting orderly and no mobility.	383	45	55
5.	When teachers allow pupils to discuss or debate ideas in class, it takes time away from learning.	385	81	19

Note: Scale: *1= strongly disagree; 2=disagree; 3=agree; 4=strongly agree*

This conclusion tends to be corroborated by the evidence from interviews with teachers, which also shows that teachers did not view TCA and SCA as contrasting but as complimenting. Some teachers said that they used SCA in Khmer language but TCA in mathematics. Others said they used SCA with difficult tasks and TCA with easy tasks. Yet some others said that they used SCA if the lesson was about a familiar topic and used TCA if the topic was new to the pupils. Teachers saw either SCA or TCA fit into different aspects of their teaching. Such dual standards in teachers' classroom practices was a consequences of a dilemma where they need to cope with the pressure imposed on them from above and, at the same time, to deal with the adverse realities of their classrooms. Teachers felt obliged to use SCA because it was a prescription imposed on them by the MoEYS. Nevertheless, they could not abandon TCA because it fit better with the real conditions of their classrooms. The first constraint often cited by teachers for being unable to apply SCA was over-crowded classes. There were usually too many pupils per class, which made it hard for the teacher to control pupils' behaviors if they were put to work in groups on their own. One teacher said, "I have more than 40 pupils

so when I use SCA the pupils will be very noisy and out of control." The second constrain that prevented teachers from fully exploiting SCA was the fact that there were too many contents to be covered in the curriculum. They complaint that SCA activities usually took longer time to complete and would put them behind the schedule as one teacher put it, "SCA takes too much time. I won't be able to follow the syllabus. I'll be behind the schedule. So I use group work only with difficult questions or exercises." The third constrain was the shortage of teaching materials. Teaching materials have been considered to be a core component of SCA both by the policy makers and the teachers. However, teachers were provided only with the textbooks and teacher manuals and were supposed to develop extra teaching materials by themselves. As argued earlier, teachers barely have any time for producing materials due to their engagement in a second job.

3.4. Classroom Practices

Above all, what reformers seek to change is what teachers and pupils do in classroom. O'Sullivan (2002) writes "implementation ultimately takes place in classrooms and the teachers are ultimate implementers of reforms." Teachers might know and embrace new ideas and beliefs about instruction; but teachers' knowledge and beliefs does not necessarily change what they put into practice in classrooms. To get some image of classroom practices, the survey asked teachers to report on how often they used 15 classroom activities in their mathematics lessons. Again, the 15 indicators range from activities commonly observed in conventional classrooms to those which are in line with SCA principles. Teachers responded on a six-point frequency scale (1=Never; 2= less than once a month; 3= 1-3 times per month; 4= 1-2 times per week; 5= 3-4 times per week; 6= everyday)

The results on classroom practices show a different picture from the findings

presented on teachers' knowledge and beliefs. Overall, teachers reported that their pupils were engaged in conventional classroom activities more often than SCA activities. According to Table 16 and 17, the mean of the least frequently-reported conventional activity (Memorize formula or rules to solve problems; Mean=4.90) is even higher than the mean of the most commonly used SCA activity (Work in small groups on math problems; Mean=4.65), signaling a disproportionately high prevalence of conventional activities in classrooms.

From the distribution of responses on the frequency scale, it was clear that less than 30% of the teachers adopted one or more SCA activities as their daily practices and only about 20% or less allowed their pupils to solve word problems, to make conjectures and explore possible methods to solve problems, and to work with problems with multiple solutions on a daily basis (Table 16). In contrast, table 17 shows that traditional activities such as copying text from textbook/blackboard, working out computational exercises and reciting multiplication tables were the daily pupil activities in most (60% - 77%) of the teachers' lessons. A considerable number of the teachers (41%) still asked their pupils to memorize rules and formula. This finding suggests that the conventional approach to teaching is still dominantly employed in Cambodian primary school classrooms.

Table 16 Teacher's report of classroom practices associated with SCA

	SCA activities (*In this academic year, how often did the pupils in your mathematics classes do the following?*)	**N**	**Mean**	**1 (%)**	**2 (%)**	**3 (%)**	**4 (%)**	**5 (%)**	**6 (%)**
1.	Work in small groups on math problems.	376	4.65	2	2	12	24	32	27
2.	Solve word problems.	381	4.59	1	1	8	36	34	19

3.	Discuss different ways that they solve particular problem	373	4.57	2	5	13	24	29	28
4.	Use manipulative materials to solve problems.	377	4.53	2	6	13	21	29	29
5.	Explain other pupils about how to solve a problem.	381	4.44	5	6	14	19	27	29
6.	Make conjectures and explore possible methods to solve a mathematical problem.	376	4.32	2	5	18	29	25	21
7.	Do problems that have more than one correct solution.	379	3.88	11	8	21	19	27	15
8.	Create exercises/word problems for other pupils to solve.	384	3.86	10	7	21	22	27	12
9.	Work on research activity that extend several days.	363	2.72	33	17	20	14	11	6
Average Mean			4.17						

Notes: Scale: *1=Never; 2= <once a month; 3= 1-3 times per month; 4= 1-2 times per week; 5= 3-4 times per week; 6= everyday*. Mean *is the average value on the scale ranging from 1 to 6, not the average percentage.*

Table 17 Teacher's report of classroom practices associated with conventional approach

	Conventional activities (*In this academic year, how often did the pupils in your mathematics classes do the following?*)	**N**	**Mean**	**1**	**2**	**3**	**4**	**5**	**6**
1.	Copy extended notes from	379	5.49	3	1	2	8	8	77

	textbook/blackboard.								
2.	Solve computational problems on blackboard	379	5.36	1	1	3	12	27	57
3.	Recite the multiplication table.	379	5.31	2	1	5	9	23	60
4.	Solve computational problems on slate	385	5.06	1	3	4	16	32	44
5.	Work individually on problems from textbook.	370	4.96	3	2	8	11	36	41
6.	Memorize formula or rules to solve problems.	376	4.90	3	3	6	17	30	41
Average Mean			5.18						

Notes: Scale: *1=Never; 2= <once a month; 3= 1-3 times per month; 4= 1-2 times per week; 5= 3-4 times per week; 6= everyday*. Mean *is the average value of the scale ranging from 1 to 6, not the average percentage.*

4. Discussion

While it is difficult to estimate how much impact the new reform has had on classroom teaching, with its far-reaching scope and strong commitment of the MoEYS, it is perceivable that the reform must have affected the conduct of teaching in Cambodian classrooms in some significant ways. This chapter has revealed some evidence of the impact this so-called SCA reform has on teachers' understanding, beliefs and classroom practices with regard to the learning and teaching principles promoted by the reform. The survey results clarified that teachers tended to associate SCA with pupil activities, group work, teaching materials, and 5-step lesson. Teachers also have a strong belief that SCA is most effective in producing pupils' learning. At the same time, they still

hold dear to their long-held belief that memorization plays an important role in learning. With respect to classroom practices, teachers reported that pupils now work in groups or individually with their own textbook as reference as they talk and work together on the problem assigned by the teachers. Pupils worked together to write a summary of reading text and take notes of the important points or solving mathematics problems in groups. In this regard, there appears to be a shift from the teacher doing all the talking towards pupils being engaged in doing activities at their seats in group or individually. However, it was found that such collaborative work was only occasionally practiced by the teachers.

While teachers tended to agree with the philosophy of SCA, they also raised a lot of questions about the applicability of this approach. They tended to believe that SCA is inapplicable in practice due to the following major constrains of their classroom: over-crowded classes, shortage of teaching materials, and over-loaded contents. In a nutshell, the survey results presented in this paper show that Cambodian teachers are knowledgeable about SCA reforms, which has been introduced since 1996. They show strong approval for the reform ideas; but those ideas have not been widely adopted in classroom practices. The next two sections attempt to provide some explanations why SCA fail to take root in Cambodian classrooms.

4.1. Fidelity to the past (stick to memorization and chalk-and-talk)

Traditionally, education in Cambodia took place in Buddhist pagodas, the *wat*, where boys were taught by the head monks the teaching of Buddha, paintings, and carpentry. The main emphasis of this type of education is the mastery of the teaching of Buddha as the boys would be ordained to be monks when they got older. The books of Buddha teaching were written in *Pali*, a holy language which Cambodian people did not speak in their daily life. However, early in their school life, the boys would be required to

memorize some verses of prayers before they could understand what they meant. As their schooling progressed, the boys continued to memorize text and because they could now read by themselves, they had to do more memorization and recitation. Text memorization as opposed to sense making was the means through which learning took place. It would take so long a time and too great an effort before the pagoda boys could understand what those texts meant to them because it was written in a language foreign to them. This kind of learning can be referred to as rote learning.

This traditional way of learning and teaching had survived the modernization of Cambodian education during the 90 years of French colonization from 1863 to 1953 and continued to characterize the teaching in Cambodian schools at least until 1996, when the new reform was introduced. However, there is one important difference in teaching between the traditional *wat* education and the modernized school education: the language in which the pupils memorize their text. While pagoda boys memorized text in Pali, which they could hardly make any sense of, school boys and girls of the recent past memorized text in Khmer, their mother tongue. Still, the two kinds of teaching had a lot in common: teachers as sources of knowledge, corporal punishment, and strict behavioral codes.

It is this kind of teaching tradition which originated in religious practice and which has withstood the test of time that might run crosscurrent to the new reforms. In fact, even though teachers tend to say that they follow the SCA in their teaching, they acknowledge that they do so only to comply with the regulations. Some even confess, “I do SCA only when I am inspected.” That is when they would have plenty of materials and activities for their pupils and strictly follow the 5-step model. Teachers say that while they follow the method as prescribed by the MoEYS, they also reflect on their experience to find an effective way to teach their pupils. They reflect on how they had been taught when they were a pupil and also learn from their own teaching experience.

They learn from their experience as pupils that memorization is a means through which they have become a teacher themselves and as such it would help their pupils as well: “Pupils in the past knew the lesson well because they memorized at home. They couldn’t look at the book when asked at school. Now pupils can look at the book as they want;” “We learn from our experience that reciting and memorizing improve our memory.” They also learn from their teaching experience that SCA does not work well in a large classroom with pupils of varying ability, which are a very common characteristic of Cambodian schools: “I have 40 pupils and it would lead to chaos if I put them in groups.” In such cases, the teacher would resort to using whole-class teaching rather than putting pupils in small groups to minimize disruptive behaviors. Teachers still strongly believe that they need to control the class and pupils have to listen carefully to them. They are hesitant to bend their authority for the sake of pupils’ rights and freedom. It is a long-held propriety in Cambodian society that “children should listen, respect and not question elders”. To some extent, this cultural practice runs counter to the principle of SCA which encourage pupils’ active participation in the teaching and learning process. For teachers to adopt SCA, it would mean that they have to change their cultural belief. However, as Stigler and Hiebert (1999) observe, teaching is a cultural practice and is highly stable over time, and is not easily changed.

4.2. Textbook-based instruction (stick to the book)

For Cambodian teachers, a textbook is a survival tool for their teaching. Even though the SCA policy advises that there should be enough materials for both teacher and pupil activities, teachers rarely use other materials to supplement the textbook, stating “I don’t have time for developing materials.” The ministry requires them to make their teaching more student-centered, but does not provide them with an effective means to implement it. Only a limited number of teachers receive guidance on the new pedagogy through

workshops and seminars sporadically organized by the MoEYS. Schools do not have facilities and equipment to support child-centered learning. Laboratories, computers, printers, and projectors are completely absent from schools. Teachers do not have access to audio-visual players. Teachers are only provided with textbooks and teacher manuals, without any accompanying materials such as manipulatives. It should be noted that textbook is one of the important indicators of SCA as teachers, and perhaps policymakers too, tend to believe that teachers can organize leaner-centered activities with textbooks. The MoEYS has been so successful in its distribution of textbooks that even at the far rural areas, the principals and teachers reported that they had enough textbooks for their pupils.

SCA denotes an easier role of the teacher in the classroom, but the teacher should spend a lot of time in preparation and planning for the class, which is a requirement Cambodian teachers cannot afford. Some have to teach two different groups of pupils at different shifts and many have to do a second job to supplement their meager salary. So it is not unusual to see teachers going into the classroom without even a book in their hands, let alone other materials. However, the textbook is always there and it is perhaps the only thing that both the teachers and pupils will depend on for the rest of the day. For example, in a reading class, after the teacher asked some questions about the picture at the top of the page to draw pupils' attention, pupils would read the text in the book in silence, or in loud relays. They then answer the questions following the text and write the answers on their notebooks and put it on the teacher desk for checking. Sometimes, they answer the questions in groups and present the answer to the class. As homework, they have to copy the lesson from textbook to their notebook. From this example, it can be understood that from the onset of the lesson to giving homework, everything was evolving around the textbook. Teachers tend to narrowly interpret the term 'pupils' activities', a core principle of SCA, as questions or exercises

from textbooks. So, to them, encouraging pupils' activities simply means making pupils work with textbooks.

Teachers perceive the use of textbooks by pupils as an improvement of rote learning. In the past, when textbooks were less available, teachers would write the lesson on the blackboard, and get pupils to repeat, read and copy it down onto their notebooks. Reading, memorizing, and reciting were the common practices. Now, with the textbooks in their hands, pupils are free from taking extensive notes and have more time for practice. With the textbooks, they are easier to read by themselves and work in groups with little control from the teacher. Though occasionally practiced, this is the most representative form of SCA instruction in Cambodian classrooms: pupil working in groups on problems from textbooks. Teaching in Cambodia is textbook-centered. Based on interviews with the teachers, the following are some emergent characteristics of their classroom instruction.

- Textbooks as major or sole teaching materials
- A tendency to finish textbook chapters, rather than improve pupils' understanding of contents
- Little deviation from textbook contents
- Textbook-based assignments and assessments

With textbooks being the most accessible materials, teachers have become so dependent on them that they fail to think of other alternatives to provide knowledge and skills to their pupils. Their teaching has become less of meeting the pupils' needs and interest but more of finishing the book chapters.

Part Two: Teaching and Learning in Action

Chapter Four: Instructional Organization

This chapter deals with instructional process. It describes various aspects of instructional organization which includes arrangement of classroom space, pupils' grouping and instructional materials, and the organization of mathematics contents into classroom tasks. Unlike the last chapter, which addresses the same topic based on teachers' report of their classroom practices either through interviews or questionnaires, this chapter examines classroom instruction in action through the analysis of video recordings of 12 mathematics lessons conducted by four teachers. In total, the 12 recorded lessons were about 10 hours in length. The lessons were video-taped between December 2011 and January 2012. The recording schedule was arranged so that there was an interval of one week between one recording and the next for the same teacher. Before the real recording took place, teachers' and pupils' consent was sought and a trial filming was conducted in each of the classrooms to familiarize the teachers and the pupils with the filming process. (see also Chapter 5 for more details of the videotaping procedure)

1. Arrangement of classroom space

Cambodian classrooms were organized in a very traditional way. About three quarters of the classroom space was occupied by pupil tables arranged in rows facing the blackboard hammered to the front wall of the classroom. The teacher desk was in the front part on one side of the room opposite the single doorway into the room. There was usually a raised floor (a stage) at the front space covering the part below the blackboard and on which the teacher desk stood. The raised floor made it easy for pupils to write on the blackboard and see the teacher well when he/she talked. It also provided the teacher

with a good position to control pupils' behavior by just looking on them.

Pupils sat in twos or fours on wooden tables with benches attached and kept their school bags in the table drawers. In most cases, the tables were arranged in six rows from the door way to the rear wall, all facing the blackboard. In each row, there were four two-person tables or two four-person tables with aisles in between. When the number of pupils exceeded 50, another row of tables was added to the back of the room to the extent that the pupils sitting in this back row could use the rear wall as their backrest. When there were not enough tables, pupils had to share seats. So it was not uncommon to see three pupils sitting on a two-person table or five pupils sitting on a four-person table. It should be noted that pupil tables, since they are made from wood and with the benches also attached, are a bit heavy for pupils to move around. Perhaps, this does not cause much problem for sixth-grade pupils (the subjects of this study), but it is a real problem for the small children in the first grade. First-grade pupils must have hard times moving the table during the morning cleaning. Therefore, the tables remain fixed over the school year. This very nature of the classroom furniture also tends to restrict pupil mobility during classroom activities.

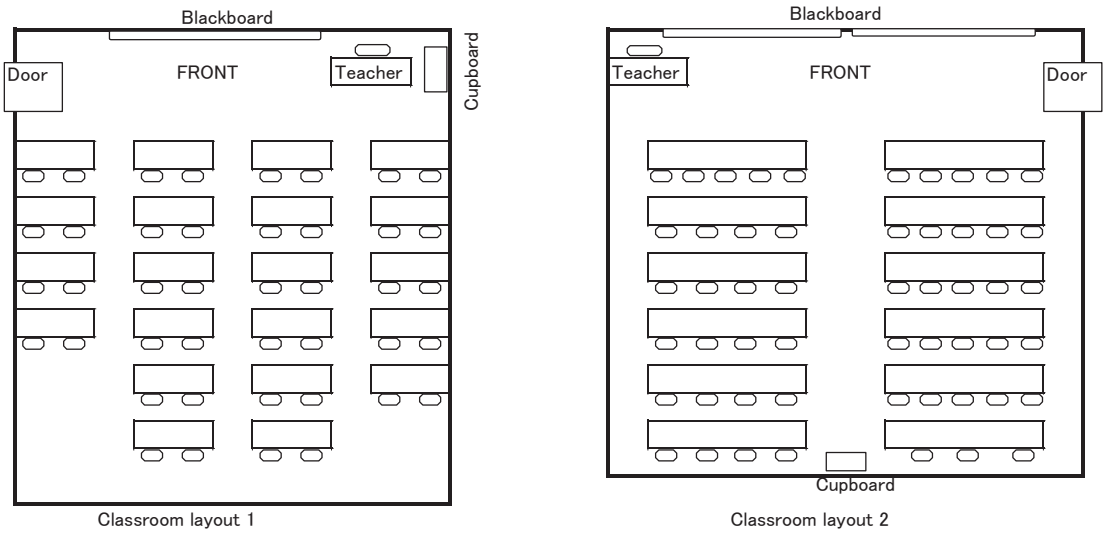


Figure 3 Classroom layouts

Figure 3 provides floor plans of two of the four classrooms under this study. In the first classroom, 42 pupils were seated on two-person tables. In the second, 53 pupils were seated on four-person tables. About half of the tables were shared by five pupils. Cambodian classrooms are normally organized into these two layouts, with the first one (classroom layout 1) being more popular at the present time. More than ten years ago, classrooms with four-person tables (as displayed in classroom layout 2) were more prevalent. Yet, in general, the layouts look very much the same: all tables in rows facing to the blackboard.

There was no clear pattern of how pupils were arranged into their seats. In one of the four classrooms, girls sat on tables on one side of the room and boys occupied tables on the other side. In another, boys and girls shared tables. And yet in another, boys and girls were seated in alternating rows. However, all classrooms seemed to share one common criterion in terms of seating. That is, the rows from the front to the back of the classroom were determined by pupils' heights. Small pupils were likely to be in front rows while taller pupils were placed in the back of the room. This is justifiable because all pupils face the blackboard, which is at the front of the room, so if a tall pupil sits in the front row, he or she will block the view of other pupils. Just as the tables, pupils' seating is fixed over the year. Only one of the teachers reported that he would rearrange pupils' seats every month. Over the period of the study, there was one occasion when the teacher rearranged the seating by getting girls and boys to share the table in place of previous arrangement in which boys and girls sat on different side of the room. In this classroom, the height criterion was also observed to be the norm.

The description so far depicts an arrangement of classroom space which is extremely widespread in Cambodian schools and which looks very traditional: all pupils sitting in rows with their faces to the blackboard or the teacher on a raised floor in the

front of the room. Also, pupils are arranged into their seats so that they can see the blackboard or the teacher well. This arrangement suggests that Cambodian educators give a lot of value to the front of the room. It seems to tell the pupils that there is knowledge in the front; therefore, "Look on and you will get it."

2. Pupil grouping for classroom activities

Pupil grouping has been one of the classroom aspects which reformers wish to change and of which teachers are widely aware. Pupils are expected to participate more in classroom process by doing activities or discussing with peers in small groups rather than passively listen to the teacher in whole-class activities. This section describes pupil grouping within the four classrooms. Table 18 shows the categories and definitions for classifying group arrangement for classroom activities.

Table 18 Classification of pupil grouping based on classroom activities

Grouping	Classroom activities
Whole-class	Teacher in front, pupils as audience, Pupils copying lesson from textbook or blackboard, Pupils reading from textbook.
Small Group	Pupils discussing or solving problems in small groups
Individual	Individual seatwork (on paper, notebook, or slate); work on the blackboard,
Combination	Combination of different groupings happening at the same time.

Group arrangement is coded into four categories: whole-class; small group; individual; and combination of different groupings. 'Combination' is assigned when the

teacher simultaneously put pupils into different types of groupings. For example, the teacher may have one pupil solve exercise on the blackboard and at the same time he or she talks to or asks questions to the rest of the pupils at their seats. 'Whole-class' is coded when the teacher addresses the class as a whole such as when the teacher introduces or illustrates new content on the blackboard while all the pupils listen. Another common feature of whole class grouping is when the teacher asks pupils to copy the contents of the blackboard or textbook into their notebooks. 'Small group' is coded when the teacher assigns classroom work for pupils to discuss or solve in groups. If the work is set for every pupil to do by themselves at their seats, the 'individual' code is assigned. Pupils' working out problems on the blackboard is also classified under this category.

Figure 4 shows the result on grouping arrangement. Overall, pupils spent 64% of their classroom time in whole-class activities and 30% in individual work. Group work occupied only 4% of classroom time. Whole-class and individual instruction was common practice among all the four teachers, and only two of the four teachers were observed to put their pupils in small groups, sometimes.

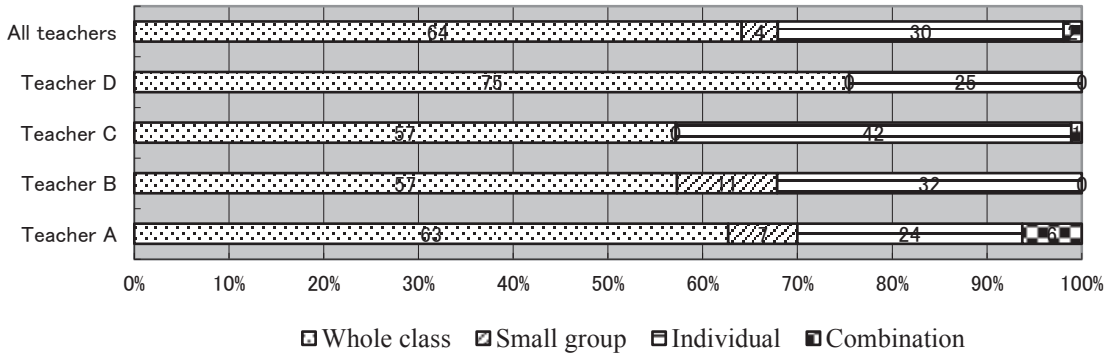


Figure 4 Portions of class time devoted to different types of groupings

Qualitative analysis of the video recordings shows that during whole class

grouping, three activities frequently occurred: teachers' presentation of new contents; teachers' comments on pupils' work (solution); and pupils copying text from the blackboard or textbooks. The teachers tended to give long comments on pupils' solution of problems on the blackboard. While commenting, the teacher went over the solution procedure step by step and explained to the class how it came about. During individual grouping, pupils were mainly engaged in individual seat work assigned by the teacher or were called on to solve exercises on the blackboard. Group work was the least common practice in Cambodian classrooms and its features were also peculiar. Groups of pupils were determined at the beginning of the semester based on the location of their seats. Usually, pupils sitting at two tables close to each other were considered to be in one group. During group work, they did not have to move their tables. (Well, it was hard to move even though they wanted to.) They just turned their heads around and worked together. In one of the classrooms, pupils could not even turn around because the tables were so packed together. Oftentimes, pupils worked with the same old people throughout the semester or the year. In the group activities observed in the video recordings, there was no real group discussion taking place although there usually was a sort of group representation. For instance, in one lesson of classroom B, the teacher put an exercise on the blackboard and told pupils to solve in groups. The first pupil in each group to finish, without talking to other members of the group, went to the blackboard and when one member of each group had come, they started presenting the answers of their groups. Usually, the smart pupils in the groups would go representing their groups except when there was an intervention from the teacher. The tasks given for group work were so simple that pupils did not find any motive to discuss. For example, one of the tasks for group work was "Round 35.194 to the hundredth place." The teacher had told the pupils how to round numbers, so pupils just applied the procedures they were told to solve the exercise and when the smart member, usually the fastest to finish, showed the

answer to the group, the other were likely to agree. No alternatives or arguments were raised. Group work usually lasted for a short time as pupils did not have much to contribute and only the clever members would take over the tasks while the less able may just sit and look at, probably learn from, their smarter peers doing all the tasks. Even worse, when the teacher called for group competition ("Lets' see which group can finish first."), sharing was completely absent from the scene because the smart pupils who were group leaders had to rush to get the answers to the teacher before the other groups did, leaving no time for discussion or sharing.

3. Instructional materials

Teachers are encouraged to use different kinds of materials in their teaching. Cambodian teachers are instructed to present their lesson with three types of materials: concrete, semi-concrete, abstract. At the concrete level, teachers should present concepts by showing pupils the real objects. At the semi-concrete level, teacher could use pictures or illustration to represent the concepts being discussed. If teachers only talk or use text without using any real objects or pictures, they are considered to be teaching at the abstract level. In mathematics, teachers are encouraged to bring in various kinds of materials and to present their lessons from the concrete to the abstract (MoEYS, 2001a).

However, in practice it was observed that teachers rarely used authentic materials in their classes, but the blackboard or textbooks were the tools through which teacher passed on the contents of the lesson. Figure 5 shows the result on classroom materials used in the four classrooms. Blackboard was the most commonly used materials and took up almost 60% of class time, with marked variations between teachers ranging from 28% for classroom B to 74% for classroom A. Textbooks were the second most popular materials and occupied about a fifth of the total class time.

Only a minimal 1% of class time was spent with manipulatives: real objects or pictures. Actually only one teacher (Teacher B) incorporated this kind of concrete or semi-concrete materials into his classes. The other teachers' lessons were mainly conducted with blackboard and textbooks. In a relatively poor country like Cambodia, one would find it understandable that teaching would be carried out with little materials. But as shown in the previous section that textbooks are widely available to pupils and therefore, it should be the case that textbooks are the main materials through which the instruction is conducted. But the fact was that, just as in the past when all lesson content had to be written on the blackboard because the pupils did not have textbooks, the blackboard continued to be the major means through which Cambodian current teachers transferred knowledge to pupils. Teachers and pupils spent more time on the blackboard than on the other types of materials combined.

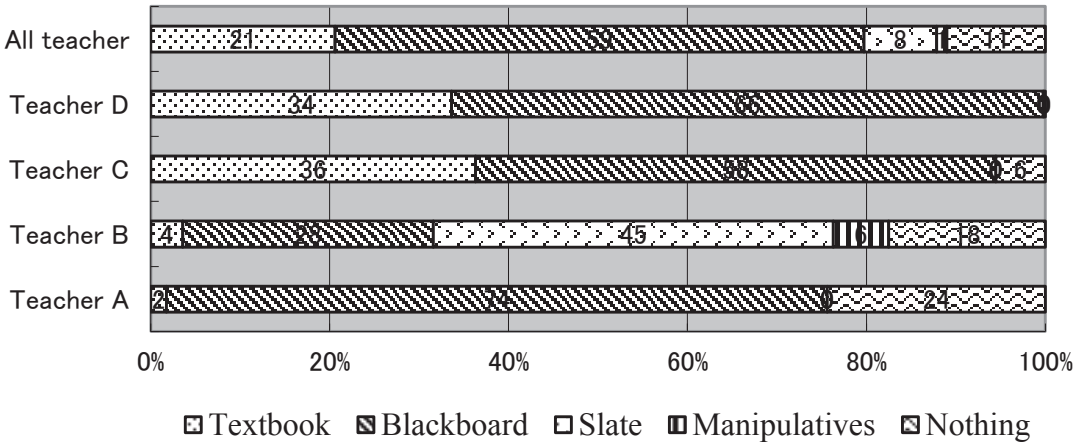


Figure 5 Classroom time devoted to different kinds of materials

One explanation for the prevailing utilization of blackboard was that teachers liked to create exercise or problems for pupils by themselves rather than depended on the textbooks. Even when they used the exercises or problems in the textbook, teachers very often copied them onto the blackboard and therefore drawing pupils' attention

away from the textbooks. Another explanation was that, as described earlier, classroom space was arranged so that blackboard was the center of classroom activities. It is where the knowledge is. It is where the attention should be directed. So it is nothing out of expectation that teachers should do all the activities there as it is arranged to be so.

4. Phases of lesson

Cambodian teachers are supposed to organize and conduct their lesson in five steps. Both pre-service and in-service teacher training programs emphasize these formal five steps of a lesson. The survey results shown in chapter 3 also affirmed that about 95 percent of the teachers thought the 5-step lesson was associated with student-centered approach and most of them believed that it was an effective procedure for teaching. Video data showed that, when all lessons were considered together, the five steps which included warming up, review, new lesson, strengthening, and homework/copying consumed 2%, 12%, 24%, 40%, and 22% of class time respectively (Figure 6).

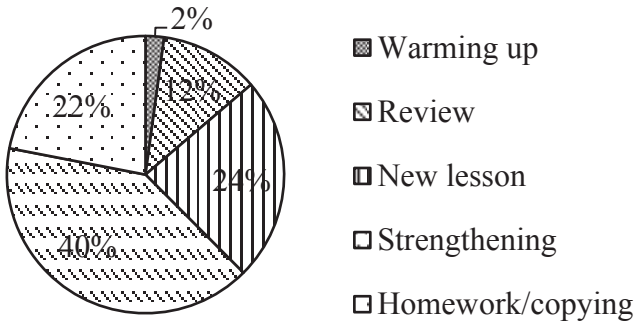


Figure 6 Class time devoted to each of the 5 steps of the lesson

Copying, although not mentioned as part of the formal steps in teacher training materials, was included into the last of the formal steps because it was observed that

teachers often asked their pupils to copy text from textbook or blackboard at the end of the classes. As it was observed, pupils were not only asked to make notes of the important points, but also to copy the whole presentation section of the unit from textbooks. Copying and homework, as shown in Figure 6, took slightly more than a fifth of class time. This seemed to be too much time wasted on text copying since pupils were often asked to write down the materials they would find in the textbooks, which most of them possessed. Strengthening, which consisted mainly of pupils' working on exercises concerning the new content, comprised the largest part of class time, a result to be congratulated. Reformers have been pushing for more pupils' activities in classrooms rather than pupils' listening passively to teachers' presentation. Teachers have translated this policy intention into their classroom practice by having pupils solving exercises on their seats or on the blackboard more by curtailing their own presentation/lecturing time. Specifically, pupils' practice took much more time than teachers' presentation (40% versus 24% of class time respectively).

Though not closely relevant here, it is helpful to highlight how teacher aligned their classroom lessons with the textbook units and to provide some ideas of how the textbooks were used in different phases of classroom lessons. Based on the textbooks for mathematics sixth grade (MoEYS, 2006b), each unit, usually of one or two pages, consisted mainly of two sections, namely the presentation section and problem section. The presentation section usually took half (sometimes longer) of the page(s) provided for the unit and preceded the problem section. In a two-page unit, for instance, the presentation section took up the first page and the problem section used up the second page. In a typical class, the teacher would spend one study period (40 minutes) on each unit. Textbooks were the main resources in phases 3 (new lesson), 4 (strengthening), and 5 (homework/copying). In phase 3, the presentation section of the unit in the textbook became the 'new lesson' of the class; in phase 4, the problem section of the

unit provided practice tasks for ‘strengthening’. There seemed to be too many problems in the textbook for a period of class, so the teacher normally assigned only some of the problems during phase 4, set some more for pupils to do as homework in phase 5 and ignored the rest. As noted a little earlier, pupils were also asked to copy the materials either from the blackboard or textbooks at the end of the class.

To go back to the description of live lessons, the results show great differences in terms of length and phases of lessons among the teachers as well as lessons within the same teachers. None of the 12 lessons were conducted in a complete cycle of 5 steps (Figure 7). Teacher A and B gave their lessons in 4 steps, while teacher C and D conducted their lesson in fewer steps, all without warming up.

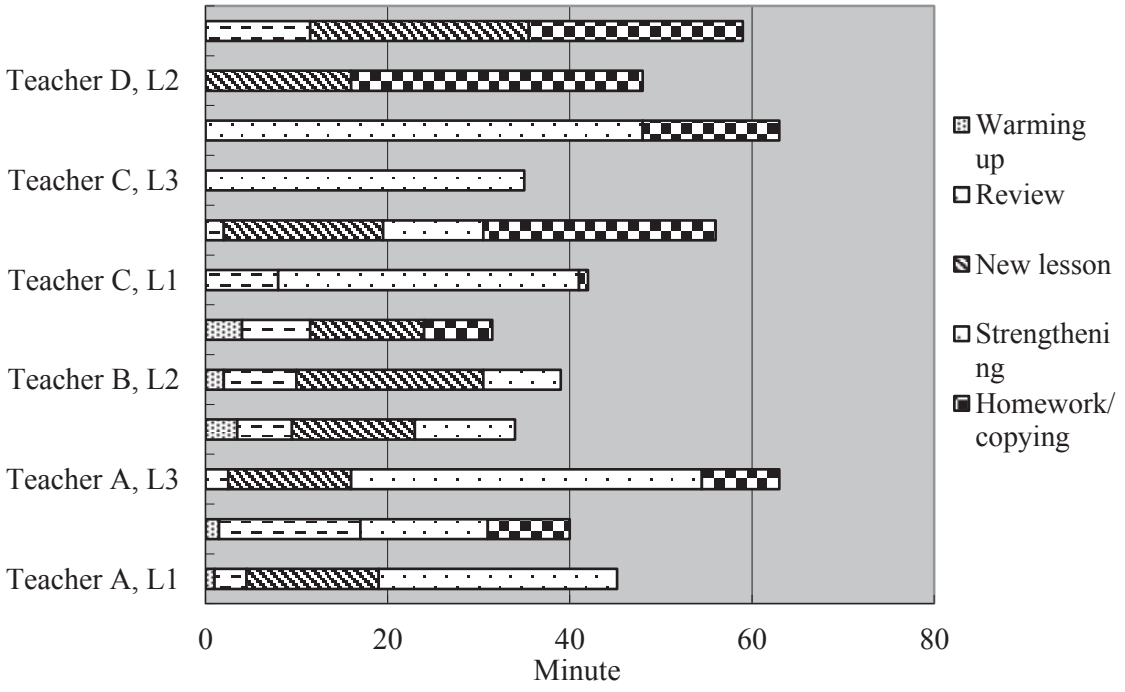


Figure 7 Phases of lesson by teachers

Teacher A started the lessons with a small talk with his pupil as a warm-up and, then, reviewed the lesson studied in the very last mathematics class. He proceeded to

presenting the new content and usually had pupil practice afterwards. In two of the three lessons, he asked pupils to copy the contents of the blackboard onto their notebooks and only once was he observed to give homework.

The first three steps were always present in Teacher B's lessons. He started the lesson by getting pupils to recite the multiplication table. He, then, reviewed the past lessons, and moved on to present the new lesson of the day. At the end of the classes, he got his pupils either to do exercises as strengthening activities or to take notes of the lesson. Only once did he set homework to the class.

Teacher C tended to give his lessons in different ways. His second lesson followed the order of the 5 steps, except that it did not have a warm-up phase. In his first and third lessons, strengthening was done without being preceded by presentation of new contents. In one class (Teacher C, L3), strengthening was the only phase of the lesson. Teacher C usually assigned exercises of the new lesson without first presenting the new materials and tried to draw a summary or rule after three or four exercises had been completed by the pupils. Strengthening (practice) without presentation is understandable if the objective of the lesson is to allow pupils to practice on materials covered in earlier sessions. However, for Teacher C, this happens even with a lesson aiming to present new concepts. Pupils were not at all oriented to the new concepts and were observed to have a lot of difficulty understanding and solving the exercises they were assigned. Teacher C gave homework twice.

The three lessons of Teacher D all started in different ways but ended in the same way: copying. There was no homework observed to be given in any of Teacher D's lessons. The following tables provide two examples of classroom lessons.

Sample lesson 1: Classroom A, lesson 1: Place values (Page 48); 48 pupils

Phases	**Description**

Warming up	The teacher (T) chatted with pupils about yesterday afternoon class, during which the teacher said "You were happy as I allowed you to play so much."
Review	0:01:00 T drew pupils attention to the lesson they learnt yesterday. He said, "yesterday we studied about how to convert fractions to decimals." Then, He put a problem: $\frac{14}{100}$ = on the blackboard, turned to the pupils and asked, "who volunteered to come?" About seven pupils raised their hands and one girl was picked. She went up to the blackboard and wrote the answer 0.14. T looked at the class and asked, "Is she correct?" "Correct," the class said in unison. He beckoned the girl to go back to her seat and drew pupil attention and went over the answer, reminding pupils of the rules behind the conversion. 0:03:05 T put another problem $\frac{4}{1000}$ = and again asked for a volunteer. One boy was picked among several volunteers. The boy wrote the answer 0.004 and went back to his seat. T went over the answer and confirmed that it was correct and thanked the pupil.
New lesson	0:04:35 T announced the start of the new lesson "Place value". T explained briefly about how decimal numbers are different from whole numbers. T drew a table on the blackboard, same as the one in the text book, to show number places. T asked, "what are the places for whole numbers?", "what are the places for decimal numbers?" Pupils suggested the answers and T filled in the table. T put 1.205 into the table. T illustrated the places and place values through the following formula: Number … is in the …… place and has a value of …x…. = …… e.g., 1 is in the unit place and has a value of 1x1=1; 2 is in the tenth place

	and has a value of 2x($\frac{1}{10}$) = 0.2 and ,..etc. while he was explaining, the teacher often called on pupils to fill in the formula orally from their seats. (The table, formula, and illustration are the same as in the textbooks.) T told pupils, "we can verify by adding all the values to see if it is the same as the original number 1.205." and he did the addition as proof. He summarized, "here (pointing to the part he had explained), we have talked about places and place values." T invited pupils to ask questions, but no one asked.
Strengthening	0:19:05 T drew attention to the first group of exercises on page 48 of the textbook and he read the instruction, "Tell the places and place values of the underlined numbers". He told the pupils to look at the items of exercises in the textbook. After about one minute the teacher copied 8 items from the textbook onto the blackboard, saying that, "I will ask you to come and write your answer on the blackboard. But first, do it individually at your seats." The items are: 0.2<u>8</u>; 1.<u>8</u>; 10.2<u>0</u>3; 4.<u>8</u>6; 10.<u>3</u>7; 14.02<u>8</u>; 112.<u>8</u>4; <u>1</u>05.694. 0:27:10 The best (1st-ranked) pupil was called on to do the first exercise. Then, one pupil after another was picked up to come to the blackboard and give answer to each item, sometimes based on hand raises, sometimes not. The fifth pupils, however, could not answer correctly and another pupil was called on to come to the blackboard and answer; but she couldn't either. So a third pupil was called on and, fortunately, she got the answer

Whole number places					Decimal number places		
Thousand	Hundred	Ten	Unit		Tenth	Hundredth	Thousandth
			1	.	2	0	5

	right. The rest of the class section was given in similar manner: pupils were called on one by one to solve the exercises on the blackboard, if the first pupil was wrong, another would be called on until the correct answer was provided. Three pupils who could not solve the exercises had to stand by the blackboard for an extended period before they could answer other problems and returned to their seats. After all items have been answered, the teachers invited pupils to ask questions. Two questions were raised and answered. 00:45:10 The teacher concluded the lesson.
Copying/Homework	*Although the class is officially finished (The bell has rung.), the teacher asked pupils to copy the lesson during the break time.*

Sample lesson 2: Classroom C, lesson 2: Division of mixed numbers (Page 42); 43 pupils

Phases	**Description**
Warming up	No warm-up
Review	After putting the title of the day's lesson on the blackboard, the teacher (T) started the lesson by asking a review question, "How do we divide fraction by fraction?" He told the pupils that the answer could not be found in the textbook but that they had studied it in grade 5 and that it is related to what they were going to study that day. About 1 minute later, a girl raised hand and answered the questions, "multiply the first fraction with the reciprocal of the second." T praised her and repeated the girl's answer.

New lesson	0:01:30 T announced, "Today, we will study about division of mixed number and mixed number." He told pupils to open the book on page 42 and to read the first word problem on the page silently. (A lady had $1\frac{1}{2}$m of garment. From the garment, she made tablecloths, each of which consumed $\frac{3}{4}$m of garment. How many tablecloths did she make?) 0:06:50 About five minutes later, T read the word problem out loud, asking pupils some questions. He also simplified the meaning of the word problem for pupils. He told pupils that "in order to find the number of tablecloths, we must divide the total garment by the garment consumed by one tablecloth." and wrote $1\frac{1}{2} : \frac{3}{4}$ on the board and asked pupils to do the computation. 0:12:30 T asked some pupils who had finished computing to give the answer orally. Then, he invited one pupil to come and solve the problem on the blackboard. 0:15:15 The teacher went over the pupil's solution step by step asking or explaining about the procedure of computation.
Strengthening	0:19:10 T put an exercise on the blackboard ($2\frac{3}{8} : 4\frac{1}{4}$) and told pupils to solve it and said he would pick someone to come to the blackboard later. 0:29:50 T told the pupils that the result of the computation is a proper fraction and "we can't convert it to mixed number." He didn't ask anyone to go to the blackboard or solve the exercise for the pupils. Instead, he directed pupils back to the procedure of the computation for the word problem they did earlier and tried to draw rule of mixed number division. He pointed to the computation and named each computational step loudly.

	Then, T asked the class, "How do we divide mixed number and mixed number?" Nine pupils were picked up one by one to give the answer (rule). Some pupils had difficulty reciting the rule, and two pupils (5^{th} and 8^{th}) could not do it correctly and had to stand up for an extended period before this rule recitation ended. 0:36:25 T summarized the rule for division of mixed number and mixed number, "multiply the first fraction with the reciprocal of the second fraction. Convert the result into mixed number."
Copying/ Homework	0:36:50 T told pupils to copy the lesson onto their notebook. 0:39:00 While pupils were copying the lesson, the teacher suddenly decided to give them some homework, so he asked pupils to open the textbook on page 43. The teacher allowed the pupils to choose the exercises for homework and he leaded a vote-counting to decide on which items and how many items they should take as homework. This process took about 3 minutes before pupils returned to copy their lesson. 01:02:30 The class ended.

5. Classroom tasks

Doyle (1988) argues that the work pupils do, which is defined in large measure by the tasks teachers assign, determines how they think about a curriculum domain and come to understand its meaning. Tasks pupils accomplish in classrooms form the basic unit of enacted curricular contents (Doyle, 1983; Doyle and Carter, 1984) and operate as the proximal causes of their learning from teaching (Shavelson, Webb, & Burstein, 1986). Consistent with these arguments, Stein, Grover, and Henningsen (1996, p.462) observe, "classroom tasks highly influence the kinds of thinking processes in which pupils

engage, which, in turn, influences pupil learning outcomes". Accordingly, it is plausible that the investigation into classroom tasks seems to be a promising approach to understanding how pupils learn from teaching.

Although researchers consistently acknowledge the importance of classroom tasks to pupil learning, they have employed different conceptions of classroom tasks. According to Doyle (1983, p. 161) the concept of task has three important features: "(a) the products pupils are to formulate, such as an original essay or answers to a set of test questions; (b) the operations that are to be used to generate the product, such as memorizing a list of words or classifying examples of a concept; and (c) the "givens" or resources available to pupils while they are generating a product, such as a model of a finished essay supplied by the teacher or a fellow pupil. Academic tasks, in other words, are defined by the answers pupils are required to produce and the routes that can be used to obtain these answers." Mergendoller and associates (1988, p.252) define a task as any written assignment, quiz, or exam that all pupils are expected to complete and that teacher will have an opportunity to grade while Hiebert and Wearne (1993, p.405) equate a task with every single problem that pupils are presented during whole-class sessions and are assigned during seat-work portions of the lessons.

In the present study, a classroom task refers to any single exercise or problem on a particular mathematical topic that requires some kinds of pupils' written responses and, breaking from Hiebert and Wearne's definition, does not include those exercises or problems that the teacher use to present new materials, usually with little pupils' contribution to the solutions of the problems. The tasks may be assigned by the teachers verbally or in written form on the blackboard or in the textbook. Pupils' written responses were located through their answers on slates, blackboard, and notebooks submitted to the teacher.

5.1. Task features

Table 19 provides some features of mathematical tasks observed in the 12 lessons. A total of 57 mathematical tasks were identified, suggesting an average number of about 5 tasks per lesson. On average, time spent on each task is 5.4 minutes. Most of the tasks (39 or 68%) were new tasks, i.e., exercises or problems pertaining to the lesson of the day while others were tasks aimed at reviewing the contents previously taught. The resources that served as the basis for the tasks were the teachers themselves and pupils' textbooks. Half of the tasks were invented by the teachers, while the other half were taken from the textbooks. Almost all of the review tasks (17 of 18) and a third of new tasks (12 of 39) were teacher-made. There was no evidence that teachers consulted other resources for the tasks they gave to pupils. The teachers mainly thought out problems on the scene or took them out of the textbook and put them on the blackboard. It was also observed that only a few of the tasks available in the textbooks were completed.

Table 19 Characteristics of classroom tasks

		Classrooms				Total
		A	B	C	D	
Number of tasks in three lessons		18	22	9	8	57
Average duration (minutes)		4.1	3.1	11.2	8.4	5.4
Types of tasks						
	Review	7	9	1	1	18
	New	11	13	8	7	39
Resources						
	Teacher-made	10	17	2	0	29
	Textbook-based	8	5	7	8	28

Classrooms varied a great deal in terms of the number of tasks given to pupils and amount of time allowed to complete them. Classroom A and B tended to have more tasks with shorter duration, while the pupils in Classroom C and D were provided with about two times fewer tasks, but the duration allowed for each task was two to three times longer. Classroom A and B provided more review tasks and the teachers were the main resource for the tasks, while Classroom C and D provided the pupils with less review and relied more on the textbooks.

5.2. Task pattern

It is helpful to see how tasks were accomplished by the teacher and pupils by segmenting the task into different stages. Classroom tasks tended to follow a regular pattern: task assignment – pupils' response - teacher elaboration/evaluation. The following table provides four examples of classroom tasks (one from each classroom).

Task assignment: As task initiators, the teacher wrote the content of the task on the blackboard and made sure to pupils how they should respond to the tasks. The instructions of the tasks were mainly given orally to save time. The teacher may invent the tasks or choose some from textbooks. Even taken from textbooks, the tasks were usually written on the blackboard. The teachers then decided who should come to respond by calling for volunteers or nominating a pupil.

Pupils' response: Pupils were usually given some time to work on their own individually or in groups ('private response' or 'deliberation') before some pupils were called on to come to the blackboard to do the tasks publicly ('public response' or 'presentation'). Sometimes, pupils were not given time for deliberation. They may be nominated to come to the blackboard immediately after the teacher put the problems on the blackboard. One pupil at a time went to the blackboard, worked out the problem and was allowed to return to his or her seat if the performance was satisfactory. When a

correct answer could not be given, one pupil after another would be called on to the blackboard until someone could find the correct answer and all could return to their seats. In some cases, it was observed that three or four pupils were standing by the blackboard for an extended period because they could not solve the problems.

Teacher elaboration/evaluation: At the end of the task cycle, the teacher may or may not invite the class to evaluate the solutions on the blackboard. No matter what the class said about the solutions, the teachers would elaborate at length over pupils' solutions, explaining or asking about the procedures step by step. Finally, the teachers confirmed whether the solutions were right or wrong. It should be noted that teacher elaboration was like an oral repetition of pupils' written solutions and seemed to fulfill two functions: as verification for pupils' answers and as a slow demonstration of how the solution has come about for less able pupils to learn from. In most of the tasks observed, teachers, except for classroom B, tended to spend a lot of time on elaboration.

Four examples of classroom tasks:

	Task Assignment	Pupils' Response (private, public)	Teacher elaboration / Task Evaluation
Teacher A, Lesson 3, Task 2	0:16:00 The teacher (T) said, "I will get one pupil to come to the blackboard and solve, but those at their seats should do it too and not look at the pupil on the board." Then, T	0:17:30 One pupil went to the board and work out the exercise (public), while other did at their seats individually (private), with the	00:22:15 T asked pupils to compare their answers with the one on the board. Most of the pupils said they had the same answer. 0:23:40 The teacher

	thought of the problem and wrote it on the board: 12.73x6.12 As soon as T finished writing the problem, about half of the pupils raised hands. One pupil was picked up to go to the board and the teacher told the other pupils to start too.	teacher moving around controlling their behaviors.	went over the pupil's solution loudly, explaining the procedures step by step and calling on pupils to participate sometimes. 0:26:55 T finished checking and confirming.
Teacher B, Lesson 1, Task 7	0:23:10 "I'll give you an exercise for discussing in group." As T put 35.194 on the board, he said, "Round the number to the hundredth place." and added, "Do it in group."	0:23:45 Shortly after T put his hand off the blackboard, a girl rose from a table and moved to the blackboard, with a slate. About 1 minute later 6 pupils (one from each group) were lining by the blackboard and started to report the answer one	0:25:45 Tlooked at the slate of the pupil, whose answer was different from others and wrong. He pointed to the number on the board and told the class how to round number and wrote the answer 35.190. 0:26:15 task ended

		person at a time (public).	
Teacher C, Lesson 1, Task 2-5	0:10:35 T told the pupils to open the book on page 38 and do the exercises individually. Then, he copied 4 exercises on different parts across the board ($2\frac{3}{8}x4\frac{1}{4}$; $4\frac{7}{8}x9\frac{1}{3}$; $1\frac{3}{4}x4\frac{1}{6}$; $1\frac{3}{8}x2\frac{1}{2}$). T assigned the exercises so that the pupils sitting in the four columns of tables should work on different exercises. He added, "Do the exercises individually and I will call someone from each column to come to the board." "Take a piece of paper and start."	0:13:40 Pupils pull out a piece of paper out of their notebooks and started to work on the exercises (private). T move around commenting on pupils' work or behaviors. 0:26:30 T called for volunteers. One girl went to the blackboard and solved one of the exercises. When the girl had done, two pupils from other groups went to the board (public).	0:32:40 There was no volunteer from the fourth group, so T decided to correct that exercises first. 0:38:20 T went over one of the solutions given by pupils on the board, illustrating the procedure step by step. 0:42:35 Tasks ended.
Teacher D, Lesson 1,	0:00:00 Silently the teacher copied six	0:03:00 A girl went up and did the first	0:05:10 T asked, "Is she correct?"

Task 1-6	exercises with an instruction from textbook onto the board: $11\frac{3}{4}$x2; $7\frac{5}{6}$x3; $2\frac{1}{3}$x5; $4\frac{2}{5}$x6; $1\frac{7}{8}$x4; $3\frac{4}{9}$x8. As soon as he finished writing, he named one pupil to come to solve the first exercise on the board. 0:08:40 He assigned another pupil for the second exercise. (The other tasks were assigned in similar way, with the teacher pointing pupils to come or basing on hand raise)	exercise. She went back when done. (The second and last pupils spend the longest time on the board because they could not solve the exercises and other pupils had to be called on to solve the exercises)	"Correct," the class said. The teacher went over the pupil's solution loudly, explaining or asking about the procedures. He then copied the solution onto a different part of the blackboard for pupil to note down later. (In similar way, the teacher invited pupils to evaluate the answers on the board, went over them, and copied.) 0:48:10 Tasks ended and T told pupils to write down the solutions into their notebooks.

5.3. Representations of mathematical ideas

Representation is a configuration that can represent something else (Goldin, 2002).

For example, symbolic expressions, written words, drawings, graphical displays, and physical materials are all can be used to represent mathematical concepts. Because mathematical concepts are considered to be abstract (Kaput, 1987), they must be expressed in some material form, and that is the role played by representations. Lesh, Post, and Behr (1987) consider five types of representation as important for mathematics learning: (1) evidence-based scripts; (2) manipulatable models; (3) pictures and diagrams; (4) spoken languages; and (5) written symbols (pp.33-34). Representations should be treated as essential elements in supporting pupils' understanding of mathematical concepts and relationships; in communicating mathematical approaches, arguments, and understandings to one's self and to others; and in applying mathematics to realistic problem situations through modeling (National Council of Teachers of Mathematics, 2000, p.67). Cognitive science research showed that meaningful learning occurs when learners engage in active processing including paying attention to relevant incoming words and pictures, mentally organizing them into coherent verbal and pictorial representations with each other and with prior knowledge (Mayer, 1999; Wittrock, 1989). As different representations affect pupils' sense-making differently, it is desirable that teachers should make uses of different representations in tasks they assign to maximize pupils' learning.

In this section, representations of mathematical ideas through classroom tasks will be considered. All the tasks were coded and analyzed using a scheme modified from Hiebert and Wearne (1993). Table 20 shows different types of representations observed in the 12 lessons. Three types of representations were identified: problems presented using only numerical symbol; problems presented using stories; and problems presented using physical materials. Other representations such as pictures or diagrams were not in use in any of the classes.

Table 20 Coding scheme for mathematical representation

Codes	Example
Numerical symbol only	2*3/8*x4*1/4*=
Stories	A lady had 1*1/2*m of garment. From the garment, she made tablecloths, each of which consumed 3/4m of garment. How many tablecloths did she make?
Materials	The teacher got the pupils to use a scale to compare the weight of padlock and a book. The pupil noted their observation and wrote the answer on the board. (Classroom D, Lesson 2)

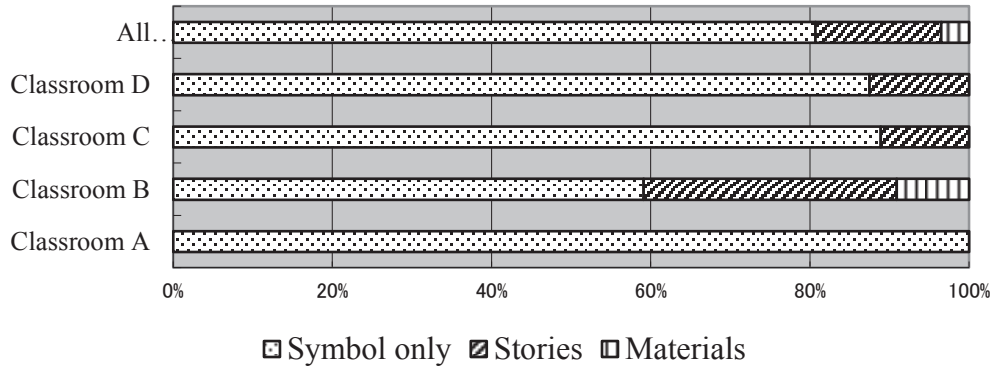


Figure 8 Representations of mathematical tasks

Figure 8 shows that the majority of instructional tasks (81%) were represented in the form of numerical symbol, 16% used stories, and only about 3% used physical materials. Classroom B appeared to be the only classroom that used physical materials to represent instructional tasks. Even with the teacher of classroom B, who was more likely than other teachers to use other forms of representations other than numerical symbols, did so only in his presentation (assignment) of tasks while pupils just worked on numbers in their responses to tasks. This suggests that teachers have started to use

materials in classrooms, but mainly for the purpose of presentation while pupils are still caught up in the abstract world of numbers and symbols.

Cambodian educators have long been classified mathematical tasks into two types: exercises (*lumhatt*) and word problems (*chomnaut*). Exercises are computational problems that consist mainly of numerical and mathematical symbols. For example: 23 + 4 = ?; a + 5 = 7. Word problems are mathematical tasks which are made up of real-life stories. For example, "A boy has 500 Riels. He spends 300 Riels on ice-cream. How much money is left?" In Cambodian classrooms, at least in the past, these were the two ways for representing mathematical problems. Very rarely were pupils asked to solve mathematical problems by using materials or other graphical representations. Thus, the finding that virtually all mathematical tasks are given in the forms of symbols and stories (97% in combination) only confirms this long-standing practice. However, this traditional conception of mathematical problems may deprive pupils of the opportunity to enhance their understanding of mathematics through other ways of representations.

5.4. Cognitive demands of classroom tasks

Another salient feature of classroom tasks which has received particular interest from researchers on instructional process is cognitive levels of tasks. The cognitive level of a task refers to the cognitive processes pupils are required to accomplish it. Tasks that are based on memory, e.g., asking pupil to reproduce or recognize information they have already seen and those that require pupils to use formulas or algorithms to generate answers, are thought to be undemanding or low level; while those that require pupils to make decisions about how to use knowledge and skills in particular circumstances to interpret problems and generate answers are considered to be cognitively demanding or high level (Doyle, 1988).

To get some ideas of the cognitive demand of instructional tasks, a coding

system based on Stein *et al*. (1996) were used. Stein and colleagues classified the cognitive demands of classroom tasks into four categories: memorization; procedures without connection to concepts or meaning; procedures with connection to concepts or meaning; and doing mathematics (p.466). However, only two of the four categories were applicable for Cambodian classrooms. Problems associated with 'memorization' and 'doing mathematics' were not detected in the 12 lessons. Figure 9 reveals that about 80% of instructional tasks were procedural and that only Classroom B tended to provide tasks of different cognitive levels. In other words, most of the tasks demanded skills in manipulating numbers (algorithm) without any connection to the underlying concepts or meaning. Most of the tasks which were coded as "procedure with connection" were word problems related to real life situations. However, it was observed that even with these originally high-level tasks, teachers tended to reduce the difficulty of tasks to mere manipulation of numbers when dealing with word problems. Instead of asking pupils to think of and reason on how they should solve word problems, teachers simply told the pupils what operation should be used and left only the computation for the pupils. The finding is in line with the accumulating literature, which consistently shows that pupils are very likely to be assigned lower-level tasks intended to discrete skills (Doyle, 1983; Henningsen & Stein, 1997; Mergendoller *et al.*, 1988; Stein *et al.*, 1996).

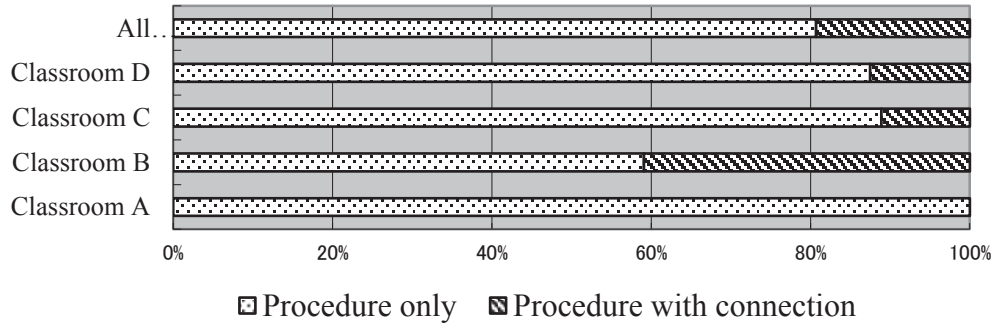


Figure 9 Cognitive demands of classroom tasks

6. Summary

Teaching in Cambodia is conducted in crowded classrooms with stiff furniture. With pupil tables lining in rows from the doorway to the back wall of the classroom and mostly immovable, little space is left for pupils to move around interacting with peers. The classroom space is organized mainly for whole-class instruction with the teacher assuming the prominent role as a knowledge provider. Pupils are rarely asked to work in groups and engaged in using authentic materials other than textbooks and the blackboard. Most of the time, they passively listen to the teacher's explanation, watch a few classmates working out problems on the blackboard, copy materials from blackboard or textbook onto their notebooks, or daydream. The tasks pupils are assigned to do in class consist mainly of computational exercises which demand little thinking beyond an ability to manipulate numbers (algorithm) to generate answers. The description of classroom instruction in this chapter shows that, despite the importance of pupils' participation and thinking as advocated in the policy on student-centered approach, Cambodian pupils are still caught up in traditionally-organized classrooms where they play a passive role as knowledge absorbers. They have to memorize a great deal by listening to teachers, writing plenty of notes, and being involved in memory-level tasks.

Chapter Five: Teacher-Pupil Verbal Interaction

1. Introduction

It is widely accepted that much teaching in classrooms takes place through the medium of spoken language. Teacher talk and teacher-pupil interaction is a primary source of information input necessary for pupils to acquire new knowledge. It is also through talk that pupils demonstrate to teachers much of what they have learned. The importance of talk in developing thinking and learning is also argued for by the constructivist perspective of learning and teaching. Constructivists theorize that knowledge is constructed by the individual learner based on what is already known and new experience in collaboration with, or scaffolded by, others. Talk, being the primary medium of interaction, is central to this view of learning and knowing because it helps learner to make explicit to themselves and others what they know, understand, and can do (Edwards & Westgate, 1994, p.6). Classroom talk is both the medium of teaching and learning, linking experience and values brought to the classroom with new concepts experienced in schools (Edwards & Mercer, 1987). The act of talking can itself help pupils developed improved understanding. Describing, explaining, and justifying one's thinking all helps pupils internalize principles, construct specific inference rules for solving problems, and become aware of misunderstandings and lack of understanding (Chi, 2000). Talking about ideas actually helps people organize and clarify their thinking and develop conceptual frameworks that make further learning possible (Pearson *et al.*, 2008). However, not all kinds of classroom talk and interactions are important to learning. For example, lecturing and recitation drills, which are common practices in traditional classrooms, have been claimed to constrain pupils' opportunities to think and, thereby, their learning (Cohen, 2011). To enhance learning, classroom talk

needs to be responsive and interactive (Goldenberg, 1991). Teachers have to pay attention to pupils' inputs and simultaneously encourage a high level of participation on the part of the pupils.

Although advocated by researchers, responsive and interactive talk is far from a widespread practice in classrooms. Reviewing studies of the patterns of whole class interaction from the 1970s onwards, Burns and Myhill (2004) come up with the following conclusions: a quantitative imbalance of contributions; a lack of reciprocity in exchanges; and an imbalance in control, or power relations. Analyses of classroom verbal interaction further show that about two-thirds of classroom talk consists mainly of teachers' lecturing and asking questions (English *et al.*, 2002; Flanders, 1970; Galton *et al.*, 1980,1999), suggesting a prevalence of non-interactive and transmissive teaching. Studies also show the ubiquity of the recitation model of interaction, wherein the teacher initiates a question, a pupil responds, and this response is evaluated by the teacher, who then initiates the next questioning cycle (Cazden, 1988). This teacher-led recitation pattern has been variously labeled: IRE – initiation, response, and evaluation (Mehan, 1979); IRF – initiation, response, follow-up (Sinclair and Coulthard, 1975) or triadic dialogue (Lemke, 1990). This three-part exchange structure is said to account for a possible 70% of teacher-pupil classroom interactions (Wells, 1999 cited in Culican, 2007, p.12). There is a considerable debate about the functions of this IRF interaction pattern in enhancing or constraining the construction of classroom knowledge. It has, on the one hand, been seen as essential for co-construction of knowledge (Heap, 1985; Wells, 1999) and, on the other, as incompatible with the educational goal of encouraging pupils' intellectual initiative and creativity (Lemke, 1990).

In Cambodian context, since the introduction of the constructivist student-centered approach to teaching and learning, the prescriptions for changes in classroom discourse have also been observed in government-approved documents for

teacher training. Teachers were instructed to talk less and organize the learning environment to encourage pupils to talk as much as possible in group discussion or in oral presentation. For example, it is written in the document developed for orienting teacher to the new pedagogy that "teaching and learning based on student-centered approach represents a shift from the teacher-centered method where teachers talk and explain while pupils just listen and passively acquire new knowledge, to a method where teachers talk less while pupils do more activities" (MoEYS, 2001, p.22). This statement implies that pupils should not be treated as mere receivers of knowledge, but as participants who actively co-construct knowledge by conversing and doing classroom activities with peers as well as the teacher. In the questionnaire survey presented in Chapter 3, it was shown that teachers were acutely aware of this principle of student-centered approach. In a separate document entitled 'Effective Teaching and Learning (ELT)', developed by the Teacher Training Department of MoEYS to train both pre-service and in-service teachers on the important aspects of student-centered approach, one of the eight chapters is devoted to 'questioning'. Teachers are presented with a system to classify questions into six levels according to the demand of thinking they require, from the simplest (or lowest) to the most complicated (highest): memory, understanding, application, analysis, synthesis, and evaluation. This system is based on the Taxonomy of Educational Objectives developed by Bloom *et al.* (1984). The classification system, then, regroups the six levels of questions into two levels. The lower level questions correspond to the memory and understanding in Bloom's taxonomy while the higher level questions parallel application, analysis, synthesis, and evaluation in Bloom's taxonomy. In addition, the chapter puts emphasis on the higher level questions (level 3-6 in Cambodian regrouping) by spending more than half of the training time (2.5 hours out of 4.5 hours) allocated to the chapter for instructing teachers how to effectively ask those higher level questions (MoEYS, 2007b, pp.7-17). The

pieces of evidence shown here strongly suggest that the introduction of student-centered approach was followed by an orientation of teachers towards the reorganization of classroom discourse that was more appropriate for the new teaching style. In reality, how does this policy on classroom discourse or verbal interaction play out in classrooms? Are pupils being provided with more opportunity to interact verbally in class? Are they being engaged in more thinking and constructing knowledge cued by a greater number of higher level questions?

2. **Investigating classroom talk**

Preliminary observation and video-recording

Because the researcher wanted to see the instruction in its authenticity, attempts were made to avoid causing excessive pressure and nervousness on the teachers and pupils and to be as less intrusive as possible to the instructional process of the four classrooms. After having acceptance to the classrooms, the researcher spent one whole morning or afternoon with each of the classrooms conducting a preliminary observation and video-recording of instruction in order to, on the one hand, familiarize teachers and pupils with the shooting process so that they would be less nervous in subsequent filming and, on the other, to familiarize the researcher himself with the routines such as classroom activities and organization, based on which the choice of where to point or position the camera could also be decided. Teachers and pupils were told about the purpose of the study and asked to behave as naturally as they could. Every teacher was instructed “to conduct the lesson as usual and not to make special preparation for the lessons to be videotaped.” The pupils were shown the camera to be used and asked to playfully look at it. They looked at the LCD monitor of the camera at work and even tried filming their friends, mocking on each other happily. When the trial session (a

mathematics lesson) started, the researcher tried shooting the instruction from various angles and positions in the classroom. Then, the teachers and the pupils were shown random parts of the recorded videos on a lap-top computer for about five minutes. While viewing the recorded instruction, they smiled and made funny comments of their friends' and even their teacher' postures and looks in the videos. They also laughed when they spot a friend intentionally turning his or her head to look into the camera. Finally, after having briefly viewing the videos, the researcher asked the teacher and the pupils if they felt alright to have their classes recorded next time. The researcher was concerned that the presence of the researcher (as observer) and the camera in their classroom might cause undesirable pressure or troubles to them, but as it turned out, the teachers and pupils did not feel as such, noting, "No problem. It is just for research purpose."

Through these preliminary sessions, the researcher also learnt that lessons were taught mostly in whole-class instruction with teachers staying mainly in the front, talking to the pupils, who rarely moved from their seats, except when invited to work on the blackboard, and talked only when called on publicly by the teacher.

Video-recording of classroom lessons

The success of any video survey will hinge on the quality, informativeness, and comparability of the videos collected (Stigler *et al.*, 1999). What we see on the videos depends not only on what occurs in the classroom but also on camera habits or how the camera is used. For the purpose of the current study which is to compare certain aspects of classroom instruction, the content of the videos (what is captured) is more important than their aesthetic appeal. It is important that all those targeted aspects be clearly captured in all classrooms in a standardized manner. Considering this purpose and the real conditions of the classrooms as apprehended in the preliminary observation, the

following principles and shooting techniques were adopted to guide the video-recording process in all classrooms:

1. Capturing a general atmosphere of the classrooms: the shot was framed so that most of the things and what happens in the classroom can be captured; so in general the camera operator (the researcher) aimed for the widest shot possible, a shot that professional videographers call the 'master shot'. As the instruction was mostly whole-class and front-oriented, the researcher decided to place the camera on a tripod at one of the corners at the back of the classroom and point the camera to the front part of the classroom so that the blackboard, the teacher's desk, all pupils in the front rows could be included, while at the same time trying to cover the pupils sitting at the back rows as far as possible. This was also decided based on the reason that the teacher stayed in the front most of the time. However, this decision, as a result, left about 20% of the pupils at the far back rows off the frame.
2. Grasping the instructional content: To get an ideas of what the instruction is about the camera was sometimes pointed to and zoomed in to capture the materials written on the blackboard. This occurred when the teacher put on the title of the lesson and tasks as well as when the teacher and pupils wrote answers or solutions on the blackboard. In such close shot the camera was held long enough so that the written materials could be read before returning to the master shot.
3. Focusing on public talk: One of the instructional aspects this study aims to investigate is public talk in classrooms, i.e., verbal interactions that teachers or pupils make publicly to communicate with other people rather than private talk as when a pupil makes toward himself or herself. The public talk here also excludes those disruptive noises that the pupils make when

they are off task. Based on the voice check conducted in the preliminary recording, the sound collected by the built-in microphone of the camera and an IC recorder placed on one of the pupil tables at the front row was good enough for this purpose.

The lessons were recorded in their entirety. The camera was turned on at the beginning of the class, and not turned off until the lesson ended. However, there were cases when additional editing was needed because it was not clear at real time where the lesson began or was over. The beginning and ending of the lesson could not be decided based on the sound of the bell or the determined schedule because some teachers seemed to follow none of these. For instance, the teacher might come to the classroom late or, in the case when the bell failed to sound, the teacher might come in, put the lesson title on the blackboard but the pupils remained outside. In such cases, the camera was turned on before the real lesson started and later the videos had to be edited accordingly. The length of the recorded lessons varied a great deal both within and among the classrooms.

Analyzing classroom talk

Video-recordings of classroom instruction were analyzed using the Flanders' Interaction Analysis Categories (FIAC) as shown in Table 21. This coding system was developed by Flanders (1970) to be used in live observations or audio-visual recorded lessons and consists of 10 categories: (1) teachers accepts feeling; (2) teacher praises and encourages; (3) teacher accepts and uses ideas of pupils; (4) teacher asks questions; (5) teacher lectures; (6) teacher gives directions; (7) teacher criticizes or justifies authority; (8) pupil responses; (9) pupil initiates; and (0) silence and confusions. The italicized description of codes 3 and 4 in Table 21 was added by the current researcher. Classroom talk was exhaustively coded into one of these 10 categories every five seconds. In the

original system, Flanders recommended that these categories be applied at every three seconds to the communication events just completed. However, the present researcher opted for five seconds and applied one of the categories to the utterance that comes right at the point of every five seconds. In rapid exchanges, the every-five-second-point tally might miss out some utterances. But as the whole lesson was exhaustively coded and calculated as percentages, the overall result of classroom talk will not be affected.

Table 21 Flanders' Interaction Analysis Categories (FIAC)

Teacher talk	Response	1. Accepts feeling 2. Praises or encourages 3. Accepts or uses ideas of pupil, *Commenting on pupils' work*
		4. Ask questions, *Dictating problems/exercises*
	Initiation	5. Lecturing 6. Giving directions 7. Criticizing or justifying authority
Pupil Talk	Response	8. Pupil-talk__response
	Initiation	9. Pupil talk__initiation
Silence		0. Silence or confusion

Source: Flanders (1970), p.34.

The FIAC is useful system to determine the power relationship between the teacher and pupils. This can be achieved by measuring the proportion of classroom talk shared by each party as well as the initiative-responsive balance of classroom interaction (Flanders, 1970). This topic of power relationship in classroom is of particular relevance to the context of the current study. Cambodia has opted for a more

learner-centered approach to teaching and learning, which in many ways signifies a change in classroom authority, that is, the change from the view that teachers are information givers and pupils are knowledge receivers to the one that conveys teachers and pupils as co-constructers of classroom knowledge. It is a change that calls for teachers to bend their authority as embedded in their control of classroom discourse and activities to make space for pupils' participation. Classroom discourse is a viable terrain where power relationship between teachers and pupils can be examined. The subsequent sections show the results of the analyses based on FIAC system.

3. Balance of teacher-pupil talk

Using FIAC system, a total of 6896 five-second codes, which correspond to about 10 hours of classroom instruction, were assigned to the 12 lessons. It was found that, overall, a little more than half of the class time was spent in silence (52%), but there seemed to be significant variation between classrooms. As depicted in Figure 10, Classrooms A and B were in silence well below 40% of class time while Classrooms C and, especially, D spent much more time in silence than in talk. This is an appallingly high rate of silence in the classroom, being very unlikely to happen even in the traditional classrooms. This result defies the conclusion of Flanders (1970), which was based on studies across a wide range of classrooms, teachers, and even countries, that silence made up of about one-third of lesson time. Observations of Classroom D, the one with the highest rate of silence, showed that two main activities that contributed to time in silence were the teacher's writing on the blackboard and pupils' copying of texts either from the blackboard or textbook onto their notebooks. The teacher tended to spent excessive amount of time for pupils to take notes at the end of the classes, sometimes, taking up more than half of the lesson time. For the other classrooms, where copying

was not such prevailing, teachers and pupils were more likely to engage in verbal exchanges. The following sections will focus on analyzing verbal exchanges in the classroom and only the part of class time devoted to talk will be considered. In other word, class time spent in silence (represented by 52% = 3593 five-second codes) will be excluded for the consideration that the large differences between classrooms in terms of time in silence might affect the results of the analyses.

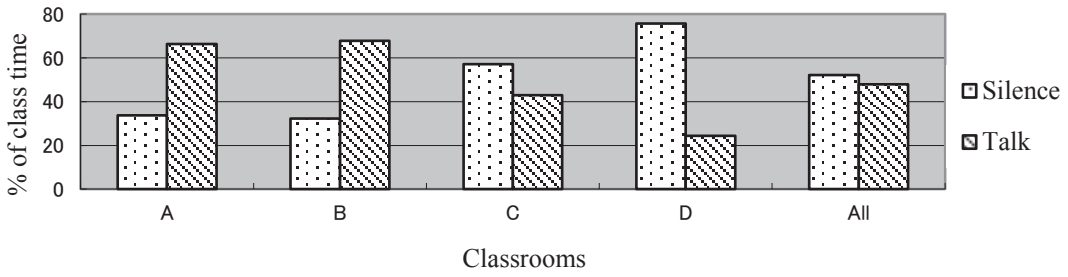


Figure 10 Portions of class time spent in silence and talk

The result of classroom talk analysis is given in Figure 11. The analysis was based on 3303 five-second codes of classroom talk, excluding codes for silence. As expected, teacher talk made up a large portion of classroom verbal interaction at a rate of 83%, while pupil talk contributed only 17% to all verbal exchanges, indicating a clear imbalance of opportunities to talk between teachers and pupils. The most dominant forms of talk was lecturing (Category5), which constituted 40% of all classroom talk, followed by teachers' accepting and commenting on pupils' ideas (Category3) at 17%. Pupils' response was the third common form and shared 15% of all classroom talk. Teachers' questioning (Category4), which was considered to be important for pupils' learning, constituted about 9% of all classroom discourse. Also, pupils' verbal initiation (Category9) was rarely heard (2%), implying a scant opportunity for pupils to ask questions or discuss with the teacher and peers.

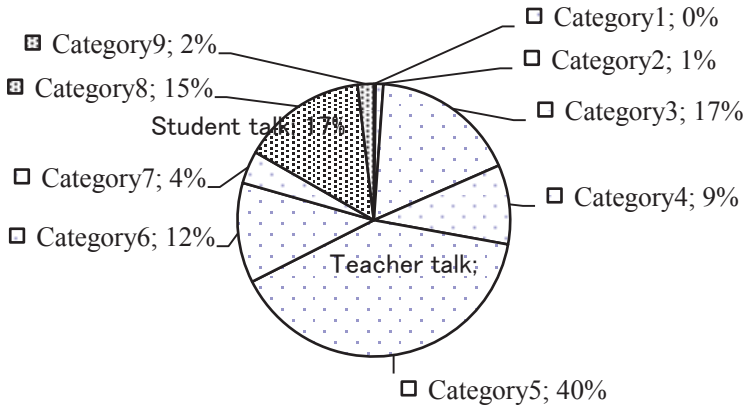


Figure 11 Portion of classroom talk shared by each category

Another interesting aspect which also tells us about the nature of classroom interaction is the rates of teachers' initiation of classroom talk or response to pupils' questions or request. In student-centered teaching, the teacher is considered to be a facilitator of classroom activities and steps in to help when asked for. This instructional approach projects the teacher's role as more a responder than an initiator. However, such a role seemed not to be reflected in classroom talk. A careful look at Figure 11 shows that teachers' initiation of talk (Category 4+5+6+7) was almost four times higher than teachers' response (Category1+2+3) with a rate of 64% and 18% respectively.

Figure 12 shows the comparison of classroom talk across the classrooms. The rates of teacher and pupils talk were similar, except that teacher in classroom B talked at a lower rate of about 70%, while the other three teachers occupied almost 90% of classroom talk. A qualitative analysis of talk in Classroom B showed that pupils in this classroom spent a few minutes reciting multiplication table at the beginning of mathematics lessons and they were often asked by their teacher to elaborate on their problem solutions. These were the two activities which mainly contributed to a higher level of pupil talk in Classroom B. As far as classroom talk is concerned, the foregoing

analyses tend to show that primary school teachers remain the figures of authority in the classrooms. They control more than 80% of classroom talk mainly through lecturing, asking questions and giving direction.

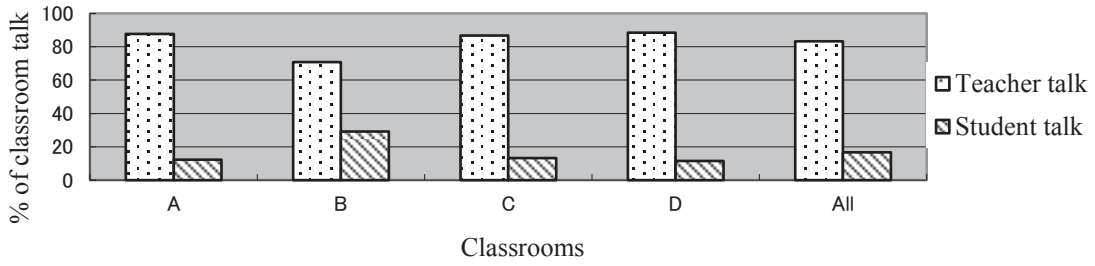


Figure 12 Classroom talk shared by teachers and pupils

4. Patterns of classroom interactions

So far, some important aspects of classroom talk have been presented, but each category was shown in isolation and, therefore, no real interaction was evident. For example, it was shown that pupils' responses was responsible for 15% of all classroom talk, but it was not clear who had requested for the response, how the request was made, and how the response was terminated. To put it another way, what had preceded or followed pupils' responses was not clear. The initiation and termination of pupils' response is critical in classroom communication because, as Flanders (1970) notes, the highest proportion of the class pay attention to the teacher, just before he speaks and when he is about to react to something a pupil said. In this regard, one may assume that the pattern of teacher talk at this moment is most influential to pupils' sense-making of the content under discussion.

To answer the above questions, it is helpful to put classroom talk in sequences. This can be done by, firstly, arranging the codes (categories) representing classroom talk

in chronological order (in order of time lapse of the lesson) and, secondly, connecting two adjacent codes. This process is called code 'pairing' (Flanders, 1970, p.76). As described earlier, all classroom talk was coded into 10 categories each lasting five seconds and represented by numbers 0 to 9. When the 10 codes are paired among themselves, 100 types of combination will result, ranging from 00 to 99; that is, 00, 01; 02;….;98;99. Each of the two numbers comprising the new codes still has the same meaning as the original 0-9 codes. For example, 55 means 'lecturing' followed by 'lecturing' and 48 means 'asking questions' followed by 'pupil response'. The pairs can be decoded this way because they are made up of adjacent codes, rather than random codes. These pairs of adjacent codes retain some sequences of the original talk and Figure 13 shows some patterns of such sequences. The P is added to the new codes to signify that those codes are the results of 'Pairing'. The most dominant pairs are those made up of the same codes such as P55, P33, P88, P66, and P44. These patterns suggests that lecturing, accepting and commenting on pupil ideas, pupil response, giving directions, and asking questions are likely to be preceded or followed by themselves respectively, i.e., each code tends to last more than five seconds. With code P55 being the most dominant pair, it is possible to conclude that teachers are more likely to spend a lot of class time in extended lecturing. Teachers were also likely to use long talk when commenting on pupils' ideas (P33).

The analysis turns now to consider pupils' responses (Category 8) as it was almost exclusively when they made responses that pupils were observed to have an opportunity to talk. As shown earlier and also evident in Figure 13, pupils rarely initiated classroom talk, i.e., rarely did codes preceded by number 9 occur.

To reiterate, P88 shared the third largest portion of classroom talk. This indicates that pupils' response were likely to be preceded or followed by itself, suggesting that pupils tended to make uninterrupted responses which lasted longer than

five seconds. For example, in one activity of Classroom B several pupils were seen to come to line up at the blackboard to present their solutions to a problem in turn for about two minutes. To find relationship between pupils' responses and other talk categories, another question will be put forward: "By what codes, other than itself, is Code 8 likely to be preceded or followed?"

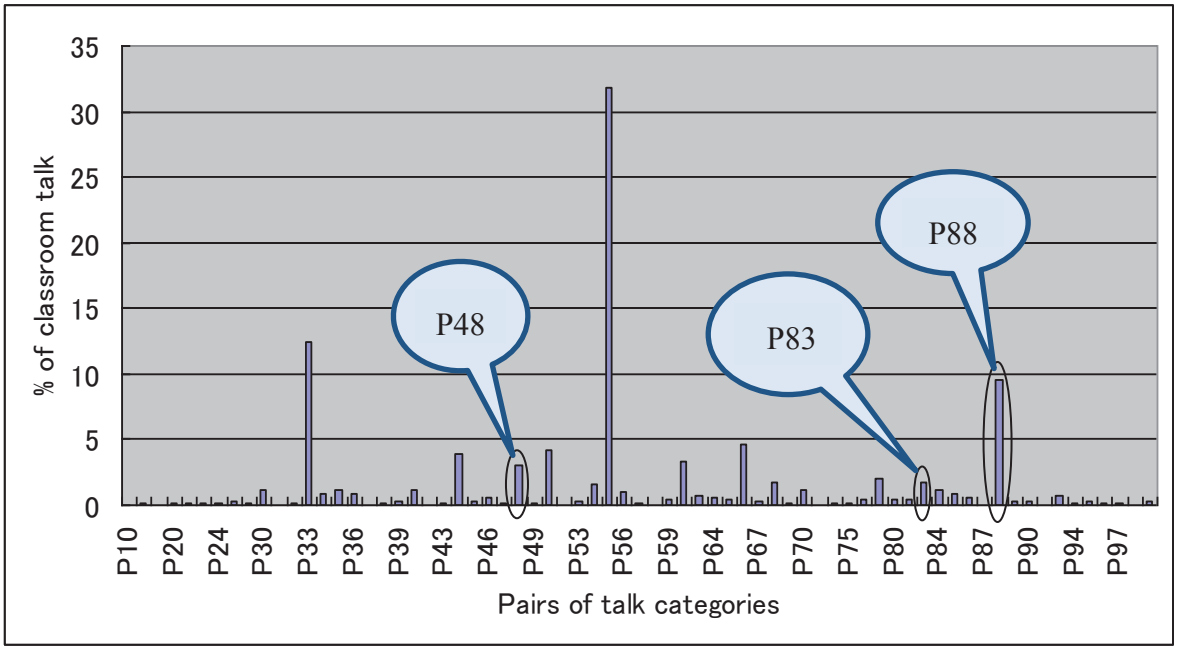


Figure 13 Pairing of adjacent codes of classroom talk

To find the codes that precede Code 8 is to look for the pairs that consist of other codes as the first part and Code 8 as the latter part. Because the original codes range from 0 to 9 (ten codes) and now that 0 has been excluded (reason given earlier), the task is to look for P18, P28, P38, P48, P58, P68, P78 and P98 and see which has the highest count. Figure 13 shows that the pair that happened most frequently was P48. The data from which Figure 13 was produced show that the count for P48 is 102. To put it in familiar terms, pupils' responses were preceded by teachers' questioning 102 times. This means that teachers' questioning was the verbal acts that tended to cause pupils'

responses. Next, what follows pupils' response? Similarly, the answer can be found by looking at the pairs that have Code 8 as the former part and other codes as the latter part. That is to look for P81, P82, P83, P84, P85, P86, P87, and P89 and see, among these pairs, which has the highest chance to occur. Based on Figure 13, it is clear that, among these pairs, P83 has the highest count: 55, implying that pupils' response was frequently followed by teachers' acceptance/comments. In summary, the analysis on pupils' response and its relationship with other verbal categories by means of codes pairing show that the sequence of verbal interaction which involved pupils' responses is mainly categorized by pupils' response – pupils' response (P88), teachers' questioning – pupils' response (P48), and pupils' response – teacher acceptance/comments (P83). This implies that pupils' response is often preceded by teachers' questioning and followed by teachers' acceptance/comment. Pupils in Cambodian classrooms do have real verbal interaction, i.e., the pupils really talk. But they do so only when they respond to teachers' questions. Rarely do they initiate classroom talk. Figure 14 shows the flow of classroom interaction in this sequence.

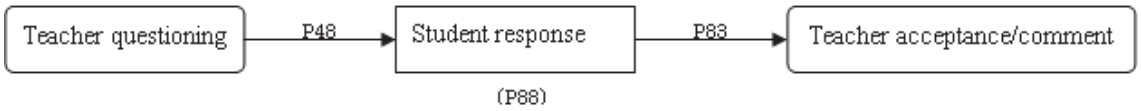


Figure 14 Sequence of classroom verbal interaction involving pupils' responses

Some examples of classroom interaction following this sequence:

Example 1: Classroom A, Lesson 1; 0:11:05 (A lesson on place value)

(*The teacher have explained about the content of the table showing places of numbers and filled the table with 1.205*)

Classroom interaction	Verbal category

T: Chhorvy, what place is number 1? P: Number 1 is in unit place. T: Number 1 is in unit place. (*T started the next cycle of exchanges*)	Teacher questioning Pupil response Teacher acceptance

Note: T: Teacher; P: Pupil

Example 2: Classroom B, Lesson 2; 0:09:35 (a lesson on comparison of decimals)

(*The teacher was reviewing previous lessons. Having dictating some computational tasks for pupils to do on slate, he concluded his review with the following exchange with a pupil.*)

Classroom interaction	Verbal category
T: Linda, how do we add mixed number and mixed number? P: To add mixed number and mixed number, we multiply denominators with whole numbers, add to the numerators, and find a common denominator. T: Or, we say, we change the mixed numbers into improper fractions and find a common denominator. Thanks. Sit down.	Teacher questioning Pupil response Teacher comment *(rephrasing)*

Note: T: Teacher; P: Pupil

Example 3: Classroom C, Lesson 1; 0:03:35 (a lesson on Multiplication of mixed numbers)

(The exchanges happened in the review section)

Classroom interaction	Verbal category

T: Sam Aun, how do we multiply mixed number and fraction?	Teacher questioning
P: (inaudible)	
T: Louder so that people in the front can hear.	
P: In order to multiply mixed number and fraction, improper fraction and…	Pupil response
T: (*Did not wait for the pupil to finish*) That's not correct, is it?	Teacher comment

Note: T: Teacher; P: Pupil

This pattern of classroom verbal interaction (teachers' questions – pupils' response – teachers' acceptance/comments) is parallel with the Initiation – Response – Follow-up (IRF) sequence, which has been shown to be the predominant form of classroom interaction. Edwards and Mercers (1987) argue that such prevalence of IRF exchange pattern reflects attempts by teachers to encourage pupils' participation and activity, while at the same time having to teach a specified curriculum in specified time. As teachers respond to learner-centered policies, they are caught up in a dilemma where they have to "inculcate knowledge while apparently eliciting it" (p.126). Thus, they ask questions to which they know the answers in order to encourage pupils to participate and to monitor their understanding. Commenting on this recitation model of classroom discourse, another name of the IRF exchange pattern, Cohen (2011) further notes, "Teachers may pose scores of questions and mobilize broad pupil participation, but in a stylized discourse in which teachers question and pupils answer. Teachers decide on questions and on timing. Pupils speak, but usually when spoken to. Because teachers focus on right answers, they can carry on rapid-fire, rephrasing or ignoring complicated, partial, or confused answers" (p.150).

5. Cognitive demands of teachers' questions

The cognitive demands of questions refers to the difficulty of questions, in particular whether they require relatively sophisticated thinking skills from pupils (Higher level), or more basic applications of rules or retention of facts (lower level) (Muijs & Reynolds, 2005). Lower-level questions are relatively easy to answer, and are in most cases used to elicit a correct response. As higher-level questions require more thinking from pupils, they are more difficult to answer. Research has shown that effective teachers use more higher-level questions more than less effective teachers, although the majority of questions asked are still lower level. While FIAC is useful in showing the quantity of teacher and pupil talk in classrooms, it sheds no light on the quality of statements made or questions asked. To compensate for this drawback, this study will use a different coding system to investigate into one of the most frequently-researched areas of classroom talk: teachers' questions.

Table 22Number of teachers' questions

Classrooms	A	B	C	D	Total
Number of questions asked in three lesson	81	60	87	95	323

To code for teachers' questions the researcher watched the videos of the 12 classes and transcribed all the questions asked by the teachers. In total 323 teachers' questions were identified (Table 22). On average, teachers asked about 27 questions per lesson. The teacher of Classroom B asked the fewest questions at the rate of 20 questions per lesson and the teacher in classroom D asked the most questions at the rate

of 32 questions per lesson. Table 23 describes codes for classifying cognitive demands of teacher questions. All 323 questions asked by the teachers were coded using this scheme drawn mainly from the classification systems of teacher questions developed by Hiebert and Wearne (1993) and Perry *et al.* (1993).

Table 23 Codes for cognitive demands of teachers' questions

Question type	Description	Example
Factual	Requesting a recall of factual information, rules, or definitions.	'What place is number 2?' 'How do we find the area of a rectangle?'
Computational	Requesting pupils to compute numbers.	'3 times 5?'
Procedural	Requesting pupils to describe a procedure or solution strategies.	'What should we do next?' 'Where does this number from?'
Evaluative	Requesting pupils to evaluate, compare, and reflect.	'Is her answer correct?' 'Where did you make mistake?'
Conceptual	Requesting pupils to think of the principles underlying the concepts.	'How do you justify your answer?' 'Which operation should we use?' 'Why do we use this operation?'

Figure 15 presents the result of cognitive demands of teachers' questions in each classroom. As a whole, the types of questions which were most frequently asked in the four classrooms were computational (40%) and factual (27%) while conceptual questions were asked sparingly.

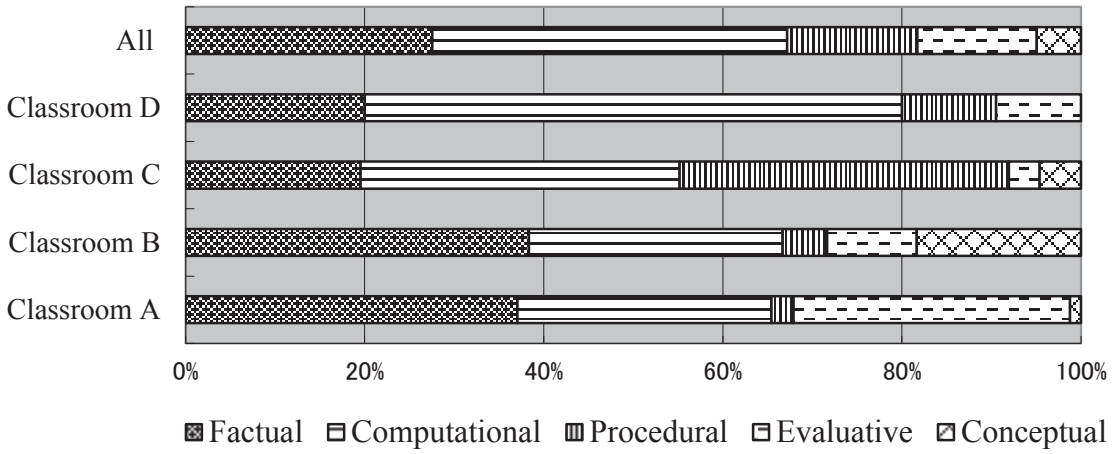


Figure 15 Cognitive demands of teachers' questions

There seemed to be big differences between teachers in terms of the types of questions they asked their pupils. Teachers in classrooms A and B tended to ask more factual questions than teachers in classrooms C and D. Compared to other teachers:

- The teacher of classroom A asked the most evaluative questions (31% of his questions).
- The teacher of classroom B asked the most conceptual questions (18% of his questions).
- The teacher of classroom C asked the most procedural questions (37% of his questions).
- The teacher of classroom D asked the most computational questions (60% of his questions)

To give an example of teachers' questions which are most popular in mathematics classrooms, the following exchange is extracted from one of the lessons in classroom D, whose teacher asked the most computational questions:

(Classroom D, Lesson1; 0:22:05; The teacher went over a pupil's solution of an exercise on the blackboard.)

T: So, here, we multiply 3 by 2. 3 times 2?

C: 6.

T: 6 plus 1.

C: 7.

T: 7. so 7 multiply by 5. 7 times 5?

C: 35.

T: 35. 35 on what?

C: 35 on 3.

T: 35 on 3 equals to how much?

C: 11 and 2/3.

T: 11 and 2/3. 3 times 11, plus 2, equal 35/3. So the answer is correct.

Note: T: Teacher, C: Class

6. Summary

By using systematic observation (Flanders' Interaction Analysis Categories) of classroom teaching, the results show the dominance of teacher talk in classrooms and the prevalence of the three-part exchange pattern. Teachers' questions were also shown to be disproportionately made up of those requiring lower-level (factual, computational, and procedural) of cognitive demand rather than higher-level questions that require pupils to connect and evaluate ideas. These findings suggest that the instruction in Cambodian primary classrooms is largely characterized by teachers' overwhelming domination of classroom discourse and lower-level questions emphasizing facts and rules. Therefore, pupils remain to be exposed to the transmissive teacher-centered form of teaching with few opportunities for them to participate in meaningful construction of knowledge as espoused by the SCA innovation.

Chapter Six: Instructional Process and Pupils' Learning

This chapter attempts to link features of instruction (instructional process variables) described in Chapter 4 and Chapter 5 with pupils' learning. The four video-taped classrooms were re-examined to find out what features of instruction make a difference in pupils' mathematics achievement among these classrooms. The test scores were obtained from an achievement test which was jointly constructed by the teachers, head teachers of mathematics in the target schools, and the researcher. The test was pilot-tested and modified before finally being administered to the pupils under the researcher's strict invigilation.

1. Assessing learning achievement

1.1. Test construction

Cambodian primary school pupils, at least in rural areas, are not accustomed to formats of well-known standardized tests such as the Trends in International Mathematics and Science Study (TIMSS) and Programme for International Student Assessment (PISA) tests. Their teachers give them little or no practice in tests with equivalent design to those of standardized tests. Although teachers evaluate their pupils' achievement on all subjects on a monthly basis, the tests that they give their pupils are just like the usual tasks they do every day. For example, pupils may be asked to answer questions on a reading text from their textbook and submit their answers for marks as part of their reading lesson. Usually, pupils write their responses in their notebook or on a piece of paper rather than choose a correct answer among answer choices as commonly found in standardized tests. Similarly, in mathematics classes, the teacher may put several computational problems on the blackboard and have their pupils solve them and submit

for checking and marking. Rarely does the teacher prepare a printed test paper with elegant design to assess their pupils. Technically speaking, standardized tests are reliable and valid measures of academic achievement, but for the reason shown above, they are not likely to be applicable for the present study. A previous study has shown that test formats that deviate from the familiar practice in classrooms tend to produce low scores (Cambodia Education Sector Support Project [CESSP], 2006). Since the purpose of this study was to deeply understand about pupil learning in just four classrooms, the researcher argued that the achievement test should be developed to fit with the conditions of the classrooms even though it might fall behind international standards.

To develop a test that was well suited the local context, the researcher adopted a participatory approach to test-making. Firstly, the researcher met with the four teachers of the target grade (grade six) in four different schools to survey the mathematical contents they had taught or expected to teach their classes over the period of the study, which was about six weeks starting in early December 2011. By that time, the classes had been in operation for about two months since the start of the school year. However, there appeared to be a big difference in content coverage among the four classrooms even though they were in the same district (Angk Snuol). While two classrooms were still working on chapter 3 (Addition and subtraction of mixed number, p.24) for their mathematics subject, the other two classrooms had already begun chapter 5 (Decimal numbers, p.46). They were about 20 pages different (MoEYS, 2006b). The faster classrooms had covered six mathematical topics (units) ahead of the slower ones. Because the researcher attempted to see the effect of teaching on pupils' learning, the assessment of pupils' learning was arranged so that the learning and teaching experience was still as recent as possible at the time of testing while pupils still had fresh memory about the content. So, it was decided that the test contents should be on the units that

had been recently covered by the classes. Moreover, because the researcher wanted to compare pupils' learning across the four classrooms, it was necessary that pupils in all classrooms be given the same test. These conditions would mean that the faster classrooms had to take the test first and the slower ones would take the test later when they completed the units to be covered by the test. As it turned out, chapter 4 (Multiplication and Division of Mixed numbers) was chosen to be the focus of the test because two classrooms had just finished it and the other two classrooms, based on interviews with the teachers, would complete it too in about four weeks.

Secondly, each of the teachers was requested to write a test paper, the content of which was based on different units belonging to chapter 4 (There were five units in chapter 4). The teachers were asked to write the test in format familiar to the pupils and to vary the difficulty levels of test items (easy, considerably difficult, and difficult). They were told that the test should be long enough for pupils to complete in one class period. Thirdly, the researcher selected and combined some items from each teacher-made test and added some items from pupil textbook and teacher guidebook to make a final test, which was then shown to the teachers and head teachers of mathematics for further comments. By having teachers in the research sites to join the process of test making, it was assured that the contents and formats of the test would be familiar with the pupils and by consulting the textbook and teacher guidebook, it was very likely that the contents of the test were in line with that of the designated curriculum. Finally, the test was piloted with 44 sixth-grade pupils in a classroom of another school in the same district. The purposes of test piloting were to measure the duration and to receive pupils' and the teacher's feedback regarding test instruction and contents difficulty. Based on the feedback received, one item (one of the two word problems) was removed as it was thought to be too difficult for the pupils and would take too much time although overall test results show a satisfactory level of reliability

measure (Cronbach's Apha = 0.83). The omitted word problem read, "A jack fruit weighs $2\frac{3}{4}$kg. Five packs of snack weigh $\frac{1}{3}$ (a third) times less than the jack fruit. How much does a pack of snack weigh?" This problem was so challenging that none of the 44 pupils in the piloted classroom could find a correct solution.

The revised test, which was used as the instrument for measuring pupils' achievement in the target classrooms, had four parts (Appendix G). The first part consisted of five items and focused on multiplication of mixed number and whole number. Pupils were asked to write their computations on the space provided to the right of each item. The second part consisted of five items and focused on multiplication of mixed number and mixed number. Pupils were asked to fill in two or four blank boxes for each item with parts of the answers given. The third part had 10 items with one half of the items focusing on division of mixed numbers and whole numbers and the other half focusing on division of mixed numbers and fractions. The 10 items were put into a table and pupils were asked to provide the answers in the cells corresponding to each item. The last part consisted of a simple word problem aiming to test pupils on division of mixed number and mixed number. The word problem was 'A bucket of palm sugar weighs $13\frac{1}{2}$kg. The palm sugar is packed into small packages each of which can hold $1\frac{1}{2}$kg. Into how many packages can the palm sugar be packed?' Pupils were given some space below the word problem to write down their solution.

1.2. Test administration

As pointed out earlier, the four classrooms were different in terms of content coverage. However, the researcher wanted to test the pupils on the same content with a similar time lapse between instruction and testing. With this condition, the pupils had to be given the test at different time. The pupils of the two faster classrooms were tested on the 9th of December 2011 and the other two were tested on the 4th of January 2012.

These were the dates by which the respective classes had covered the contents included in the test. The test was administered under strict supervision of the researcher and an assistant. Pupils were given a pen and a piece of blank paper for calculating and drafting and asked to put their belongings away.

At the beginning of the test, pupils were told that the purpose of the test was to find out about their knowledge about the lessons they had studied and the results of the test would not affect their monthly evaluation in any way. Pupils, then, were given the test paper and guided through the instruction of each part of the test. When the test started, pupils' behaviors were closely looked on to prevent cheating.

1.3. Test marking and results

The test had a full mark of 32 and was distributed as follow: 5 marks for part one, 12 marks for part two, 10 marks for part three, and 5 marks for part four. Each correct answer for the items in part one, part two and part three received 1 mark. For part four, a complete solution to the word problem received 5 marks. A complete solution was defined as the one that included a correct operation to be used and a final correct answer. An incomplete solution received only 2 or 3 marks. Incorrect answers or failure to respond were given zero mark.

Table 24 and Figure 16 show a summary of test results. The average mark was 14.65 (SD=7.00). The test had a high reliability estimate with a Cronbach's alpha coefficient of .87. Although the scores were not normally distributed, the values of skewness (.198) and Kurtosis (.056) only very slightly deviated from zero, indicating that the score distribution was approximately normal. Therefore, it can be concluded that about 68% of the pupils scored between a range of 8 to 22 marks (within one standard deviation). The majority of the pupils (62%) had a score below the middle score of 16. Only a few pupils could get a score of 30 or higher. Six pupils could not

earn even a single score. These results show that pupils' achievement on mathematical tests was a little lower than average (middle score) even though the test was designed to assess their knowledge of the mathematical contents they had recently studied. If the middle score is considered to be the passing line, it can be concluded that the majority of the pupils fail the test.

Table 24 Descriptive statistics of mathematics test scores

	N	Minimum	Maximum	Mean	Std. Deviation	% of scores <16
Math scores	171	0	32	14.65	7.003	62

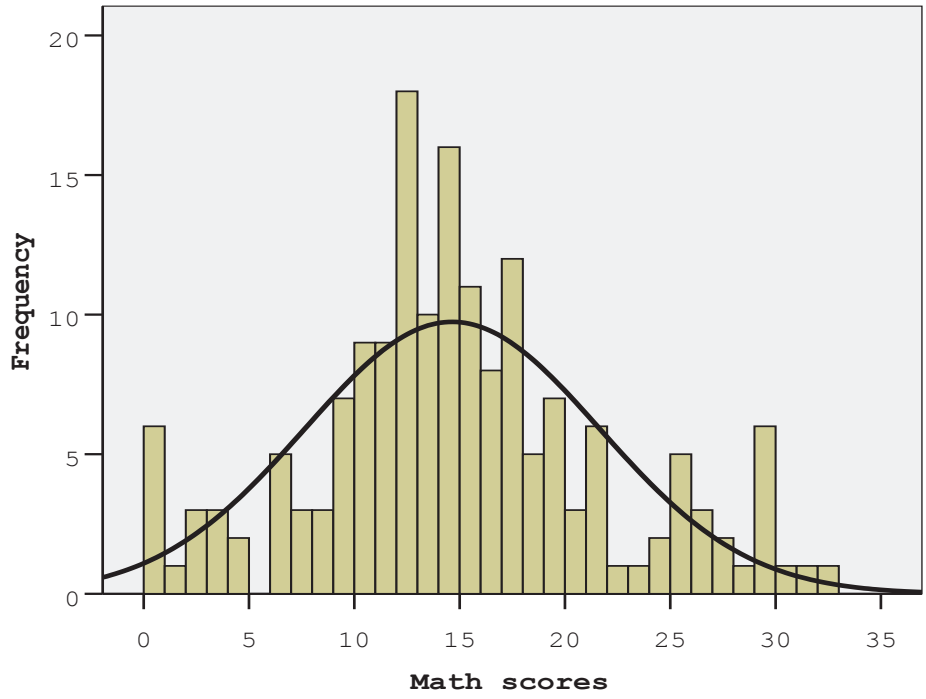


Figure 16 Distribution of mathematics scores

There was a big difference in mathematics scores across the classrooms. Among all the classrooms, Classroom B had the highest pupil performance with an

average score of 17.68 while Classroom D had the lowest pupil performance with an average score of 10.12. Figure 17 shows that, except for Classroom B, the majority of the pupils scored below the middle score, most notably Classroom D with only five pupils scoring higher than 16. Even in the classroom with the highest achievement, about one third of the pupils fell below the passing line.

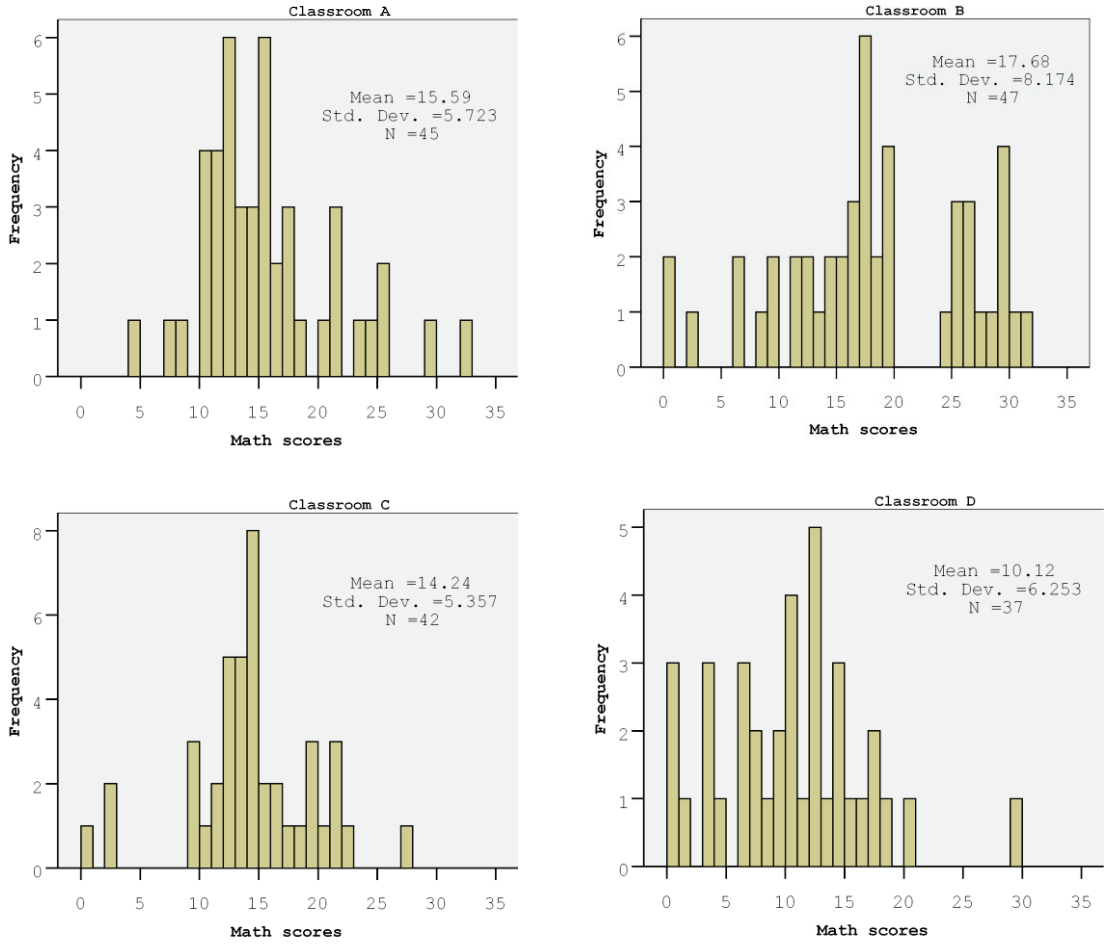


Figure 17 Distribution of mathematics scores by classrooms

Another point worth highlighting of Figure 17 is that even though Classroom B had the highest pupil performance, it also had the biggest standard deviation, indicating greater difference in test scores among pupils in this classroom (Ferreira & Gignoux,

2011). This evidence suggests that in higher achieving classrooms, pupil achievement were more likely to differ more greatly than those with low achieving pupils. In short, the results on achievement test have shown two important concerns: one of quality; the other of inequality. First, pupils' achievement is generally low. Second, there is a larger gap in pupils' learning in high achieving classrooms than in low achieving ones.

2. Instruction and learning

The difference in pupils' academic achievement is a product of countless causes ranging from those intrinsic to the pupils themselves such as intelligence and effort to those external factors pertaining to family, school and society at large. Among all these influencing factors, instruction pupils receive at school is undeniably the one that contributes significantly to pupils' learning, especially if the learning is measured by achievement test scores of school subjects. This study attempted to find some potential relationship between pupils' learning achievement and instructional process by designing an achievement test to match with the instruction the pupils had received. As described earlier, this is achieved by having the classroom teachers join in the process of test construction, by assessing the contents which the pupils had recently been taught, and by designing test formats that were familiar to the pupils. Although the influence of other factors could not be ruled out, the researcher argued that, by customizing the test to classroom context, the effect of instruction on learning would well be reflected by pupils' performance on the test.

The profiles of achievement described above showed differences in mathematics test scores among the four classrooms. The differences were also confirmed by one-way ANOVA (F (3,167)=9.70, p<.001) as presented in Table 26. It can now be concluded with confidence that there were significant differences in

mathematics achievement across the four classrooms. Although ANOVA did not tell which classroom was different from which classroom, it can be implied from Table 25 that Classroom B, which had the highest pupil performance in mathematics, tended to differ from the other classrooms. The difference was most remarkable between Classroom B and D, with 7.56 marks apart. This is a very big difference considering the fact that the full mark for the test is only 32.

Table 25 Mathematics scores by classrooms

	N	Mean	Std. Deviation
Classroom A	45	15.59	5.723
Classroom B	47	17.68	8.174
Classroom C	42	14.24	5.357
Classroom D	37	10.12	6.253

Table 26 Differences in test scores by classrooms

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1237.268	3	412.423	9.702	.000
Within Groups	7099.179	167	42.510		
Total	8336.447	170			

As argued above, the test was made to render the effect of instruction on learning, so the differences in pupils' learning might be a result of the differences in instruction the pupils received. To find out about the differences in instruction and to make some possible connection between instruction and learning, the following sections will revisit the results on instructional process presented in the last two chapters. The

discussion will focus on how classroom B, the best performer, differs from the other classrooms with regard to two aspects of instructional process: instructional organization and teacher-pupil interaction.

2.1. Instructional organization and pupils' learning

Grouping

An important feature that distinguished Classroom B from the rest was group work. In all of the three lessons observed, the teacher assigned some tasks for pupils to do in groups although the group work was short in duration. The teacher also reported changing pupil groups every month allowing pupils to work with different people over the year. Although the observation failed to find any truly cooperative work in this classroom, the fact that the teacher regularly assigned group work might develop in pupils a sense of team work and closeness that might allow these pupils to help and learn from each other more than those in the other classrooms who were not exposed to any group work at all. The changing of group members might also provide more social and academic support for the pupils, especially the slow ones, as they can have more peers to refer to when they have problems with their study.

Materials

The teacher of Classroom B also differed from the other teachers in the way he utilized teaching materials. While blackboard and textbooks were the only materials which were used in Classroom A, C, and D, the two types of materials made up only about 30% of all teaching materials used in Classroom B. Instead, the teacher in classroom B spent more time getting pupils to work on slates and physical materials. To give an example of his utilization of physical materials, in one lesson on comparison of decimal numbers,

the teacher in Classroom B introduced the topic by weighting a padlock and a book using a scale. He let pupils record the weight of each items and find which was heavier. In another class he showed how the area of a parallelogram was equal to that of a rectangle by using a piece of paper. The physical materials the teacher in Classroom B used were simple and available in or around the classroom, but none of the other three teachers in this study were observed to make use of them in any one of their classes. Compared to the other classrooms, Classroom B tended to provide pupils with a greater variety of teaching and learning materials through which he could offer his pupils with a more effective instruction.

The use of slates in mathematics lessons is very beneficial especially for computation practice. Well, there is nothing magic about slates, but they allow the lesson to be conducted more efficiently. The use of slates allowed the teacher in Classroom B to give more practice to a larger number of pupils. The practice was quick and every pupil was doing it. That is why the teacher of Classroom B could work on more tasks than the other teacher even though his lessons were generally shorter in duration. By looking at the responses on slates, teacher could also have a quick feedback on pupils' understanding of the materials taught. However, it is the opposite in the case of blackboard, which was the most frequently used material in Classroom A, C and D. By using blackboard, these teachers could only give a few tasks per period and only a few pupils who were called on to the blackboard could have real practice of mathematical topics of the lesson. Also, these teachers had no way to check if the rest of the pupils understood what was taught. Slates are also beneficial to pupils learning in that they tend to restrict teacher talk. It was observed that the teacher in Classroom B did not elaborate much on pupils' responses on slates, while the other teachers tended to give long elaboration on pupils' solutions on the blackboard.

Copying time

In Chapter 4, classroom lessons were segmented into five phases. Homework and copying comprised the final phase of the lesson and, because homework assignment was basically brief, it was argued that a large majority of time spent in this phase was mainly occupied by pupils' copying from blackboard or textbooks. It is now helpful to consider the time pupil spent on copying because too much time on copying might take away class time for more useful mathematical work. As expected, pupils in Classroom B spent the least time on copying, 8% of class time while pupils in Classroom A, C and D spent a lot more, 12%, 20%, and 42% respectively, on this non-mathematical work (Figure 18). Incidentally, the amount of time spent on copying seemed to have a strong negative relationship with mathematics test scores.

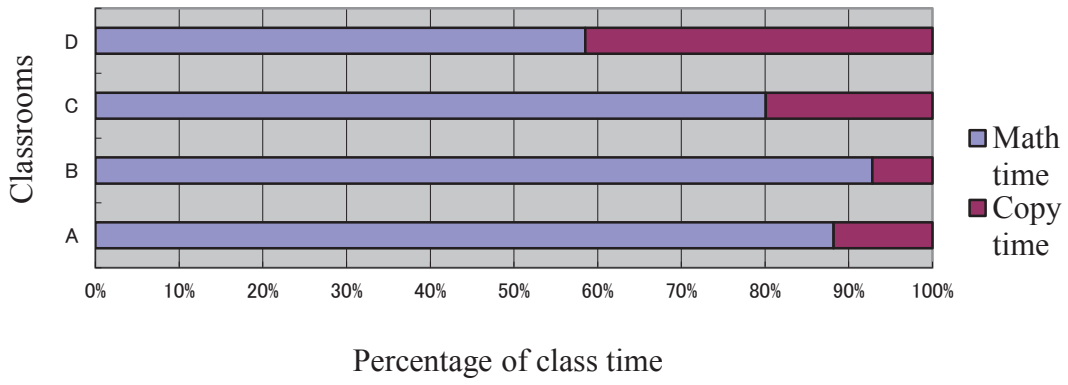


Figure 18 Time pupils spent on copying and mathematics

Instructional tasks

With regard to mathematical tasks, three important features tended to set Classroom B apart from the rest. First, the teacher of Classroom B assigned more tasks per lesson than did the other teachers. There seemed to be a positive relationship between test scores and the number of tasks per lessons. Pupils in classrooms with fewer tasks

received fewer marks than those of classroom which provided more tasks. Second, the teacher of classroom B was observed to spend less time elaborating on pupils' responses to mathematical problems, but allowing his pupils to elaborate on their own answers. For instance, he asked pupils to say out loud their responses they had written on slates and to justify how they got the answers. Third, the teacher of classroom B used various types of task representations including stories and physical materials. While the other teachers gave their pupils mathematical tasks almost solely in the form of numerical symbols such as $7\frac{5}{6}$x3=?, the teacher of Classroom B was observed to represent mathematical tasks in stories and also physical objects to set problems for his pupils. Actually, the teachers in Classroom C and D also gave some problems in the form of stories but mainly because they were there in the textbook and the teachers had to cover them. Unlike these teachers, Teacher B was seen to use stories and real objects even in problems he made up himself for his pupils. By representing mathematical problems with real life stories and real objects, the teacher of Classroom B were able to link mathematical work with daily life and make tasks more meaningful to the pupils. His pupils were more successful than the other classrooms' pupils in making sense of mathematical tasks associated with real life context, as evident in their superior performance in word problem (Table 27). A chi-square test was performed and the difference in pupil performance on the word problem was confirmed to be statistically significant, X^2 (df=6, N= 171)=56.04, p<.000. Specifically, about 48% of the pupils in Classroom B could give a correct answer for the word problem, while only a few percent of the pupils in other classrooms could successfully solve the task. Similarly, while a great majority of the pupils (88-96%) in other classrooms could not respond or gave a wrong answer to the word problem, only the minority of the pupils (45%) in classroom B did so. Of course, as the best performers, pupils in Classroom B may differ from the rest of the pupils in other areas of the test, but it is with word problem that

Classroom B' superiority was found to be most outstanding. Their high achievement in solving word problems may be attributable to the fact that their teacher had given them more opportunities to connect their mathematical lessons with real life situations. This characteristics of Classroom B' instruction was very rarely present in the other classrooms where the teachers mainly engaged pupils in solving computational problems by using mathematical symbols and procedures only.

Table 27 Differences in pupils' responses on word problem

Classrooms (pupils: 171)	incorrect	partially correct	correct	Sig. (Chi-Square)
Classroom A (45)	41 (91.1%)	1 (2.2%)	3 (6.7%)	p<.001
Classroom B (47)	21 (44.7%)	4 (8.5%)	22 (46.8%)	
Classroom C (42)	37 (88.1%)	5 (11.9%)	0 (.0%)	
Classroom D (37)	35 (94.6%)	0 (.0%)	2 (5.4%)	

2.2. Classroom interaction and pupils' learning

Teacher-pupil talk balance

The teacher in Classroom B stood in contrast with the others with regard to time he allocated for pupils to talk in class. Of all classroom verbal interaction, pupils in Classroom B shared 29%, which was over twice more than the talk shared by their counterparts in the other three classrooms (Table 28). The higher rates of pupil talk in Classroom B derived mainly from the fact that the teacher often allowed the pupils to present their answer verbally at the blackboard and that he often asked pupils to elaborate on their answers as noted earlier. These two activities were very rarely present in the other classrooms. When considered as proportion of lesson time, which also

included class time spent in silence, there seemed to appear a clear line of relationship between time allocated for pupil talk and mathematics achievement. The more pupils talked in class, the higher their achievement tended to be. Pupils in Classroom A, B, C, and D talked 8%, 20%, 6%, and 3% of lesson time (Table 28) and received average scores of 15.6, 17.7, 14.2, and 10.1 respectively. This finding also indirectly indicates that time spent in silence might have a negative effect on pupils' learning. This is probably true for the observed classrooms where pupils, as presented earlier, spent most of the time in silence copying materials onto their notebooks rather than engaging in other meaningful learning activities.

Table 28 Pupil talk as percentage of talk time and lesson time

Classrooms	A	B	C	D
Pupil talk as % of talk time (excluding silence time)	12%	29%	13%	12%
Pupil talk as % of lesson time (including silence time)	8%	20%	6%	3%

Teacher questioning

The number of questions asked by the teachers tended to have a negative relationship with test scores. The teacher in Classroom B asked fewer questions, but his pupils performed better than the other three teachers (Table 29). In contrast, the teacher of Classroom D asked more questions but his pupils had the lowest achievement. It is clear from this result that asking more questions does not lead to higher pupil performance. Rather, pupil performance depended more on the types of questions asked. The teacher in Classroom B was most distinct from the other three in the number of conceptual questions he asked his pupils. Among all the questions he asked in three lessons, 18%

could be considered to be 'conceptual', while the rest of the teachers asked no or few questions of this type. This result confirms the finding of previous studies (e.g., Renkl & Helmke, 1992; Staub & Stern, 2002) which showed that the frequency with which teachers presented structure-oriented questions, which they defined as those that foster knowledge of principles and of rational underlying a procedure, correlated significantly with pupils' achievement gain in word problems. Cross-cultural studies also showed that types of questions asked by teachers were a significant variable explaining the superior performance of Japanese and Chinese pupils in mathematical achievement to U.S. pupils. Perry *et al.* (1993) found that Asian pupils (especially the Japanese pupils) were engaged by their teachers in a significantly greater proportion of lessons containing conceptual knowledge questions than were the U. S. pupils.

Table 29 Questions asked by teachers in three lessons

Classrooms	A	B	C	D
Total number of questions asked in 3 lessons	81	60	87	95
Number of conceptual questions asked in 3 lessons (percentage)	1 (1%)	11 (18%)	4 (5%)	0 (0%)

3. Discussion

The analysis so far attempted to connect features of instruction to pupils' academic achievement by using audiovisual data of mathematics instruction from four classrooms. The analysis was mainly conducted by matching the differences in instructional features with the differences in test scores. Although this method sounds simplistic, the fact that the differences in test scores across classrooms tended to happen with the differences in instructional features of those classrooms increased the possibility that the two types of

variables (features of instruction and academic achievement) were related.

Classroom B was zeroed in on due to its superiority in pupils' performance and its distinct features were unearthed. To put the findings together, it is possible to conclude that the instruction in Classroom B is distinguished from the other classrooms in two main aspects. First, instruction in Classroom B is organized so that pupils can accomplish more tasks with different forms of representations per lesson. Second, teacher-pupil communication in Classroom B is conducted in a way that supports pupils' participation and thinking. The teacher in Classroom B can complete more tasks per lesson despite the shorter duration of his lessons. The quickness of task handling in Classroom B is possibly attributable to two features of his instruction: the use of slates and less reliance on text copying. By using slates, the teacher in Classroom B can assign tasks to all the pupils at once without having to write on the blackboard and get pupils to come up to the front one by one as the other teacher do. Also, with the slates he was able to engage his pupils in fast-paced computational practices by calling out the tasks to pupil quickly without having to copy the tasks from textbooks onto the blackboard, which was a common practice of the other teachers. Another feature that helps save class time for meaningful academic activities in Classroom B is the less prevalence of text copying. Pupils in this classroom spend most of their available time actively engaged in solving mathematics problems. The finding that more tasks are associated with better performance is consistent with the findings of expert teacher studies (Leinhardt, 1986) and research on active teaching (Brophy and Good, 1986; Rosenshine, 1983). Leinhardt (1986, p.30) found that expert teachers covered at least 40 problems a day orally in games, as jokes, or as written work, and assigned another 10 or 20 as homework. In experimental studies reviewed by Rosenshine (1983), pupils of teachers who asked more questions and gave more exercises had higher achievement than pupils in the regular, control groups, whose teacher asked fewer questions and had fewer

exercises. Another distinctive feature of the effective classroom is the use of multiple representations in mathematical tasks. Although there has no empirical evidence that one type of representation is better than the other, it has been shown that exposing pupils to multiple representations enhances their understanding of mathematical concepts (Hiebert & Carpenter, 1992; Mayer, Sims, & Tajika, 1995).

As far as classroom communication is concerned, the effective teacher was observed to provide more opportunity for pupils to talk or elaborate on their ideas. This finding has special implication for classroom teaching in Cambodia, where it is observed that teachers very rarely attend to pupils' thinking by asking them to talk about their opinions or explain their solution strategies to the classes. To a great extent, pupils are engaged in recitation or drill model of interaction where teachers asked short and quick questions to lead pupils to a particular answer rather than in conversation where teachers ask questions to explore pupils' explanations and make them explicit, such as asking pupils to share ideas publicly and using those ideas as the basis of discussion. Previous studies have shown that individuals learn new material best when they elaborate on that material in some manner (Brown and Kane, 1988; Pressley *et al.*, 1992). Providing explanations is positively related to achievement outcomes, whereas giving only answers is not or is negatively related to achievement outcomes (Web & Palincsar, 1996). Beyond giving answers pupils must be asked to describe how they solve problems and why they choose a particular strategy or approach (e.g., "How did you solve that problem?" or "How do you justify your answer?"). Closely related to pupils' elaboration is teachers' questioning. The finding of the current study is that although generally effective teachers asked fewer questions per lessons, they used more conceptual (higher-level) questions. This suggests that what matters in classroom communication is not how many (quantity) but what types (quality) of questions asked. This finding supports Redfield and Rousseau (1981)'s conclusion of a review of twenty

experimental studies on teachers' use of 'higher' and 'lower' cognitive questions, that when higher cognitive questions assumes a predominant role during classroom instruction, gain in achievement can be expected. Martin and Pressley (1991) showed that the attempt to answer a 'why' question promoted learning even when the learners fail to formulate an answer.

Conclusion

This study has examined the quality of education in Cambodian primary schools by attempting to link an array of factors to pupils' academic achievement. This section summarizes the findings and concludes the study with a brief policy implication.

Influences on learning

Through both quantitative and qualitative analyses, the study has identified several factors to have significant relationship with pupils' learning achievement. Concerning the effects of school resources (Research Question 1), it has been shown that schools with more experienced teachers, adequate guidebooks for teachers, and longer instructional time tended to produce higher level of pupils' achievement. As an out-of-school academic activity, private tutoring was found to exert a robust influence on academic achievement.

At the teaching and learning (process) level (Research Question 3), two key dimensions of instruction, i.e., classroom tasks (assignments or problems worked out by pupils during classes) and teacher-pupil verbal interaction have been investigated and linked to pupils' achievement. The results clarified that high-achieving pupils were more likely to study with a teacher who gave them more tasks to do per lesson and who presented the tasks in a variety of forms including numerical symbols, concrete objects, and stories. In addition, the effective teacher tended to get his or her pupils involved in elaborating their opinions or solutions of a problem. The effective teachers also asked more high-level questions than the less effective teachers.

Teaching and learning policy and classroom practice

With respect to the relationship between policy and its implementation (Research

Question 2), it has become clear that although teachers exhibit a strong support for student-centered approach, such a high level of support was not followed by classroom practices associated with this reformed pedagogy. Instead, teachers only picked up some superficial aspects of student-centered approach and adopted them into their existing practices. While there was an emphasis on pupils' thinking skills in the policy, teachers' utilization of the new pedagogy was limited to the behavioral changes in their teaching practice. These changes included more pupils' activities and group work. However, these activities consisted mainly of computational problems or questions from textbooks and required little or no thinking. This clearly suggests that SCA innovation has only a limited effect on teachers' classroom practices.

Regional differences

With respect to regional disparity (Research Question 4), the study has detected some differences between the two districts in terms of educational resources, process, as well as pupils' learning outcome as measured by achievement test scores. Regarding resources, it was clear that there were a higher availability of guidebooks for teachers and extra instructional materials other than textbooks in the urban area (Angk Snuol district) than in the rural area (Preah Netr Preah district). The teachers in the urban area were also more experienced (as measured by years of teaching) than their counterparts in the rural area. However, it is interesting to find that teachers in the rural areas, on average, had significantly higher educational level and longer pre-service training than those in the urban area. Although this finding might defy general belief, it reflects the effects of Pol Pot regime on the Cambodian education system. Within the last decade, the government has strived to expand educational access to children in rural and remote areas. New schools have been built and new teachers have been recruited among lower secondary or higher secondary graduates and trained in a full two-year pre-service

program. In contrast, even though new teachers have been employed in urban areas, the bulk of the urban teaching corps is still made up of those who started their teaching in the 1980s shortly after the civil war ended. These teachers were, in general, less educated and trained than those who started their services more recently.

Differences in instructional practices were also observed between the two districts. Classroom practices reported by rural teachers are more associated with student-centered approach. For example, in mathematics lessons, rural teachers were more likely to engage pupils in solving word problems and making conjectures (i.e., reasonable estimates) while urban teachers tended to get their pupils to memorize formulas and rules (Appendix H). However, this should not be taken to mean that instruction in rural areas is student-centered because this study has proved that classroom instruction both in rural and urban areas were predominantly occupied by conventional practices. Nevertheless, the lean toward student-centered instruction of rural teachers must be acknowledged and this might be the result of longer exposure of rural teachers to training on student-centered approach. Generally, as shown above, most of rural teachers have had a full two-year pre-service training and they are often the targets of in-service trainings sponsored by development agencies such as UNICEF and other NGOs, which are more concerned with rural development.

The result of achievement test scores also exhibited a clear regional difference in academic achievement. Pupils in the urban area scored significantly higher than their rural peers. This superior performance of urban pupils can be attributed to the fact that school resources such as instructional time and materials as well as teachers' experience, which have been shown to be significantly associated with pupils' achievement, were more abundant in urban schools. Another explanation for this educational advantage of urban pupils is related to the fact that they had more opportunity to take private tutoring,

also shown to be a significant determinant of achievement, as their families are generally more affluent than those living in rural areas.

Addressing the issue of what matters for educational quality as measured by achievement test scores, this study has identified resource factors to which policy makers should pay particular attention in order to improve pupils' achievement. The evidence found in this study suggested that interventions to boost pupil learning should target on a redeployment system which takes into account teaching experience, an improvement of teachers' resource bank (e.g., ensuring that every teacher has guidebooks), and a better management of instructional time. Not only will these resources improve educational quality, but also they are likely to reduce the regional achievement gap since rural areas are most in need of these resources. Quality of instruction at classroom level also plays a major role in enhancing pupils' learning. Teachers must learn how to get pupils actively involved in classroom tasks and how to effectively interact with them. It is indispensable that teachers learn how to smoothly and efficiently proceed from one instructional task to another and that the tasks pupils are assigned be presented not only in numerical symbols but also in other representations such as real life stories and physical materials. Equally important, it is promising that teachers should strive to challenge pupils to think more by asking them a greater number of higher-level questions and allowing more opportunity for them to express their opinions in class.

Finally, there is a need to rethink the SCA reform process. It is not enough to prescribe policies, publish a new curriculum, guidelines, and textbooks and provide teachers with intermittent training seminars. These top-down policy pronouncements are not likely to affect teachers' classroom practices to a significant extent unless they are accompanied by a sustained commitment to improve teachers' understanding of pupils' learning through SCA and more efforts to remove or improve the classroom constraints

faced by teachers such as crowded classes, and lack of teaching and learning materials. In addition to policy documents and curriculum guidelines, a professional community needs to be developed within and across schools so that teachers can work collaboratively to reflect on and improve their teaching. While further discussion and study must be conducted with regard to its applicability to Cambodian context, 'Lesson study', a technique widely used by Japanese teachers to develop themselves and improve their instruction, might be one of the potential courses of actions to be considered for such initiative. In lesson study, teachers collectively develop and observe the teaching of a model lesson ('research lesson' or '*kenkyuu jugyo*'), and then reflect on the lesson and pupils' responses to it so as to improve on it (Stigler & Hiebert, 1999; Watanabe, 2002). Such a 'grass roots' collaboration is required to ensure a sustained success of the reform on teaching and learning.

Classroom constraints are not easily eliminated, at least in the short run, by a considerably poor country like Cambodia. Even with the currently large classes, the number of teachers is insufficient and many are already working on two shifts. Consider, then, how many more teachers need to be employed and how many more classrooms need to be built if the class size is to be reduced from the current 45 pupils to 25 pupils per class so that teachers are less stressful when organizing learner-centered activities. These will prove too costly for Cambodia. The best chance for improvements lies, then, not in making more policy pronouncements on unrealistic pedagogical ideals but in adopting an adaptive teaching approach that takes into account the adverse realities of teachers' workplace. Given the unconducive conditions of classrooms, the key question to be addressed by teacher training programs should be the following: How can teaching be effective in large classes with limited resources? This study has pointed to some evidence of success in such adverse circumstances as illustrated by the instruction of one of the four teachers examined in this study. Overall, the effective instruction is

characterized by plenty of classroom practice tasks and high level of teacher-pupil verbal interaction with greater availability of teachers' higher-level questions. While such instruction is still far from learner-centered as it is largely directed by the teacher and based mainly on textbooks, it represents an improvement on the "lecturing and drill" of the traditional approach in which pupils are basically passive. The instruction of the effective classroom of the current study seems in many ways to resemble the teaching method commonly known as the direct instruction (also called 'active teaching') approach. In direct instruction, the teachers actively present information to pupils, involve them in interactive discourse, and engage them in learning activities and assignments (Good & Brophy, 2008). This approach is suitable for Cambodian classrooms because it works well with whole-class settings and requires fewer resources than the learner-centered teaching.

Appendices

Appendix A: Student Questionnaire

1. Are you a boy or a girl?
    1. Boy
    2. Girl
2. How old were you on your last birthday?

    I am ……. years old.
3. What grade are you in?

    I am in grade ……..
4. How many brothers and sisters do you have?

    I have …… brothers and sisters.
5. Did you go to kindergarten before starting grade 1 of primary school?
    1. Yes
    2. No
6. Were you taught by anyone before starting grade 1 of primary school?
    1. Yes
    2. No
7. What is the highest education your mother has completed?
    1. None
    2. Primary school not completed
    3. Primary school completed
    4. Junior high school
    5. High school or higher education
8. What is the highest education your father has completed?

1. None
2. Primary school not completed
3. Primary school completed
4. Junior high school
5. High school or higher education

9. About how many books are there in your home? (Do not count your school books.)
   1. None
   2. 1 – 5 books
   3. 6 – 10 books
   4. 11 – 20 books
   5. 21 – 50 books
   6. 50 or more books
10. How often do your parents, brothers, or sisters teach you at home?
   1. Never
   2. A few times a year
   3. Once or twice a month
   4. Once or twice a week
   5. Every day
11. On a normal school day, how much time do you spend before or after school doing each of these things?

   A) I watch televisions or videos

   1. No time 2. less than 1 hour 3. 1 or 2 hours 4. 3 or 4 hours 5. 4 or more hours

   B) I play or talk with friends

   1. No time 2. less than 1 hour 3. 1 or 2 hours 4. 3 or 4 hours 5. 4 or more hours

C) I do jobs or chores at home

1. No time 2. less than 1 hour 3. 1 or 2 hours 4. 3 or 4 hours 5. 4 or more hours

D) I do home work

1. No time 2. less than 1 hour 3. 1 or 2 hours 4. 3 or 4 hours 5. 4 or more hours

E) I attend tutorials

1. No time 2. less than 1 hour 3. 1 or 2 hours 4. 3 or 4 hours 5. 4 or more hours

12. How much money do your parents give you per day?

1. None
2. 100 to 400 riels
3. 500 to 9000 riels
4. 1000 to 1900 riels
5. 2000 to 4900 riels
6. 5000 riels or more

13. How many of these are there at your home?

	None	One	Two	3 or more
A) Televisions	____	____	____	_____
B) Cellular phones	____	____	____	_____
C) Motorbikes	____	____	____	_____
D) Cars	____	____	____	_____

14. How much time do you spend on self-study at home?

15. Do you make your own schedule for self study.

16. For the past 7 days, do you do homework at home?

17. For the past 7 days, do you preview the lesson at home?

18. For the past 7 days, do you review the lesson at home?

Appendix B: Teacher Questionnaire

Section 1: Demographic characteristics

1. Sex: 1. Male 2.Female
2. Age: …….. years old
3. Teaching experience: …….. years ……..months
4. Highest level of general education:

   1.Primary school 2. Junior high school 3. High school 4.University or colleges
5. Teacher certificate: 1. Yes 2. No

Section 2: Teaching materials

6. Do you have mathematics guidebooks? 1. Yes 2. No
7. Do you have Khmer language guidebooks? 1. Yes 2.No
8. Approximately what proportion of your students have math textbook?

   1.None of the students 2. Some of the students 3. Half of the students

   4.Almost all of the students 5. All of the students
9. Approximately what proportion of your students have Khmer language textbook?

   1.None of the students 2. Some of the students 3. Half of the students

   4.Almost all of the students 5. All of the students
10. In this semester, how often do you use the following materials when you teach?

    Please circle one response on the five-point scale to the right of each item.

1	2	3	4	5
Never	Rarely	Sometimes	In almost every lesson	In every lesson

A) Textbooks 1 2 3 4 5

B)	Handouts	1	2	3	4	5
C)	Board drawings	1	2	3	4	5
D)	Real objects	1	2	3	4	5
E)	Picture cards	1	2	3	4	5
F)	Posters	1	2	3	4	5
G)	Maps	1	2	3	4	5
H)	Computer	1	2	3	4	5

Section 3: Preparation and teaching and learning activities

11. Approximately how many hours per week do you spend planning and preparing for class?

…… hours per week.

12. In this semester, how often did you do the followings?

Please circle one response on the five-point scale to the right of each statement.

1	2	3	4	5
Never	Once or twice	Once or twice a month	Once or twice a week	Every day

A)	Give students quizzes.	1	2	3	4	5
B)	Give students tests.	1	2	3	4	5
C)	Give homework.	1	2	3	4	5
D)	Review previous lessons.	1	2	3	4	5
E)	Reteach unlearnt materials.	1	2	3	4	5
F)	Provide supplemental instruction to slow pupils.	1	2	3	4	5

13. In this semester, how often did your students do the following activities?

Please circle one response on the five-point scale to the right of each statement.

1	2	3	4	5
Never	Rarely	Sometimes	In almost every lesson	In every lesson

A)	Listen to or observe teachers presentation.	1	2	3	4	5
B)	Copy materials from the board.	1	2	3	4	5
C)	Use a textbook.	1	2	3	4	5
D)	Respond orally to questions testing recall.	1	2	3	4	5
E)	Respond orally to open-ended questions.	1	2	3	4	5
F)	Recite past lessons.	1	2	3	4	5
G)	Drill on computational skills.	1	2	3	4	5
H)	Work out problems on the blackboard.	1	2	3	4	5
I)	Use hands-on materials or objects.	1	2	3	4	5
J)	Do individual seatwork.	1	2	3	4	5
K)	Ask questions to other students.	1	2	3	4	5
L)	Make problems for other students to solve.	1	2	3	4	5
M)	Engage in discussion primarily with other students.	1	2	3	4	5
N)	Engage in discussion with the teacher.	1	2	3	4	5
O)	Present their assignment to the whole class.	1	2	3	4	5

14. How often do you check homework?

1.None of the homework 2. Some of the homework 3Half of the homework

4.Almost all of homework 5. All of homework

Appendix C: Principal Questionnaire

1. Are you male or female?
    1. Male
    2. Female
2. How old are you?

    ……..years old
3. How long have you been a principal?

    …….. years
4. How many students are enrolled in this school?

    …….students
5. What is the average class size in this school?

    …….students per class
6. Approximately what proportion of the students in this school have textbooks?
    1. None of the students
    2. Some of the students
    3. Half of the students
    4. Almost all of the students
    5. All of the students
7. How many teachers are currently teaching in this school, including temporary teachers?

    ……. teachers
8. How many teachers in this school have grade 12 or higher education?

    …….. teachers
9. How many teachers in this school have teaching certificate?

    …… teachers

10. How many teachers in this school have:

    A) Less than 5 years of teaching experience? ……teachers

    B) 5 – 10 years of teaching experience? ……teachers

    C) More than 10 yeas of teaching experience? ……teachers

11. How often do teachers in this school receive in-service training?

    1. Never
    2. Once every few year
    3. Once per year
    4. Once per semester
    5. Twice per semester

12. Approximately what proportion of the teachers in this school have teacher guidebooks for the main subjects?

    1. None of the teachers
    2. Some of the teachers
    3. Half of the teachers
    4. Almost all of the teachers
    5. All of the teachers

13. How often is a typical teacher absent?

    1. Never
    2. Less than once per month
    3. 1 to 2 times per month
    4. 3 to 5 times per month
    5. 6 to 9 times per month
    6. 10 times more per month

14. Does this school have a library?

    1. Yes

2. No

15. How many hours per day does the library open?

    1. None
    2. 1 to 2 hours
    3. 3 to 4 hours
    4. 5 to 6 hours
    5. 7 to 8 hours
    6. more than 8 hours

16. Approximately what percentage of students visit school library at least once last month?

    1. None
    2. Less than 10%
    3. 10 – 19 %
    4. 20 – 29 %
    5. 30 – 49 %
    6. 50% or more

17. Does this school have toilet facilities for students?

    1. Yes
    2. No

18. Do girls and boys have separate toilet facilities?

    1. Yes
    2. No

19. How often does staff meeting take place?

    1. Twice a month
    2. Once a month
    3. Twice a semester

4. Once a semester
5. Never

20. What are the two most frequent topics discussed at staff meetings?

Please circle two responses.

1. new administrative procedures
2. curriculum content
3. Course planning
4. specific teaching practices
5. student discipline

21. How often do you meet with teachers as a group to discuss ways of improving student achievement?

1. Twice a month
2. Once a month
3. Twice a semester
4. Once a semester
5. Never

22. How often do you check on teacher punctuality?

1. Always
2. Often
3. Sometimes
4. Never

23. How often do you check on teacher absenteeism?

1. Always
2. Often
3. Sometimes
4. Never

24. In this school, approximately what percentage of instructional time in each school year is lost due to any reasons (e.g. teacher absenteeism and tardiness, school unofficial closures).
    1. No time is lost
    2. Less than 10%
    3. 10 – 19 %
    4. 20 – 29 %
    5. 30 – 49 %
    6. 50% or more
25. What is school's expenditure per students?

    …… riels per student per year

Appendix D: Teacher questionnaire on student-centered approach

Teachers' beliefs

To what extent do you agree or disagree with the following statements about learning and teaching?

Mark ✓ one of the four boxes on the right of each statement.

		Strongly disagree	**disagree**	**agree**	**Strongly agree**
1.	Students learn best when the contents of the lesson is connected to everyday life.	1	2	3	4
2.	Students learn best when they memorize a lot.	1	2	3	4
3.	Students learn best when they work in small groups (4-6 people).	1	2	3	4
4.	Teachers should make students figure things out for themselves, rather than tell them how to solve a problem.	1	2	3	4
5.	Classroom learning is most effective when based primarily on lectures, with students listening silently to the teacher.	1	2	3	4
6.	Students can benefit academically from learning that takes place outside the classroom.	1	2	3	4
7.	When teachers allow students to discuss or debate ideas in class, it takes time away from learning.	1	2	3	4
8.	Students have better academic achievement in classrooms where their active participation in	1	2	3	4

	learning is encouraged.				
9.	Students learn best when the teacher continuously assess students' progress.	1	2	3	4
10.	Teaching is most effective when conducted in 5-steps.	1	2	3	4
11.	Students learn best in classroom with students sitting orderly and no mobility.	1	2	3	4
12.	Students learn best when teachers ask a lot of higher-order questions.	1	2	3	4
13.	Students learn best when learning contents are suitable with students' ability level.	1	2	3	4
14.	Students learn best when the MoEYS-designated syllabus is strictly followed.	1	2	3	4
15.	Students learn best in classes with a lot of study games.	1	2	3	4

Classroom practice (Mathematics)

This year, how often did the students in your math class do the following?

Mark ✓one the six boxes on the right of each statement.

		Never	**less than once a month**	**1-3 times per month**	**1-2 times per week**	**3-4 times per week**	**everyday**
1.	Solve word problems.	1	2	3	4	5	6
2.	Discuss different ways that they solve particular problem	1	2	3	4	5	6

3.	Make conjectures and explore possible methods to solve a mathematical problem.	1	2	3	4	5	6
4.	Work in small groups on math problems.	1	2	3	4	5	6
5.	Work individually on problems from textbook.	1	2	3	4	5	6
6.	Work on research activity that extend several days.	1	2	3	4	5	6
7.	Recite the multiplication table.	1	2	3	4	5	6
8.	Use manipulative materials to solve problems.	1	2	3	4	5	6
9.	Solve exercises on blackboard	1	2	3	4	5	6
10.	Copy lesson from textbook/blackboard.	1	2	3	4	5	6
11.	Create exercises/word problems for other students to solve.	1	2	3	4	5	6
12.	Memorize formula or rules to solve problems.	1	2	3	4	5	6
13.	Explain other students about how to solve a	1	2	3	4	5	6

	problem.						
14.	Do problems that have more than one correct solution.	1	2	3	4	5	6
15.	Solve exercises/problems on slate	1	2	3	4	5	6

Teachers' familiarity with reform (SCA) ideas

Among the following concepts, which do you think are identified with Student-Centered Approach?

Mark ✓ in the box on the right of each concept. (You can choose more than one answers)

1. 5-step lesson ☐
2. Strict discipline ☐
3. Copying lesson ☐
4. Law and order ☐
5. Listening to teacher's advice ☐
6. Research ☐
7. Group work ☐
8. Students' activities ☐
9. Higher-order question ☐
10. High level of sound ☐
11. Lesson memorization ☐
12. Teachers talk more than pupils ☐
13. Various teaching materials ☐

Personal Information

1. Grade in charge:…… Primary school name: ……..

2. Gender:…… 3. Age:…….. 4. Educational level:……

5. Years of experience:……

6. Duration of pre-service training:…….

7. In the last 3 years, have you participated in any trainings or workshops?

□□No

□□Yes (Please, specify below)

	Themes of training or workshops	Number of times	Total duration
1			
2			
3			
4			
5			

Appendix E: Main interview questions

1. What do you think are some main factors which influence pupil learning?
2. Comparing to other factors, how much influence do you think classroom teaching has on pupil learning?
3. What is your teaching like? What kinds of teaching methods do you think produce the most learning in pupils?
4. How do you know whether or not a child is learning the materials you teach? How do you check student performance?
5. Thinking of the class you have been teaching this semester, how successful do you think you are? (What percentage of the children have learnt what you taught?)

   Give me an example of your students, who has changed a lot in his/her performance since he/she came to study with you? How did the change happen?
6. In what aspects of your teaching in this semester do you think you have been most successful? And least successful?
7. If you are given enough time and appropriate materials do you think you can teach all the children in your class to a mastery level? How would do that?

Appendix F: Achievement test 1

<u>លំហាត់ គណិតវិទ្យា និង ភាសាខ្មែរ</u>

<u>ផ្នែកទី១ គណិតវិទ្យា</u>

1 តើ 3027035 អានដូចម្តេច? ចូរសរសេរចំនួននេះជាអក្សរ៖

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2 ចូរធ្វើប្រមាណវិធីខាងក្រោម៖

ក/ 21076 x 37 =.....

ខ/ 12 + 5 x 4 ÷ 2 – 7=.....

គ/ 155,705 – 28,15 =.....

3 ពូចាន់មានប្រាក់20000រៀល។ គាត់ចែកអោយកូន5នាក់។ ក្នុងកូនម្នាក់ៗទទួលបាន 3600រៀល។ តើពូចាន់នៅសល់ប្រាក់ប៉ុន្មាន?

ចូរគូស✓ ក្នុងប្រអប់ □ ចំពោះចំលើយដែលត្រឹមត្រូវ

ក. 200 រៀល □ ខ. 2000រៀល □

គ. 4000រៀល □ ឃ. 16400រៀល □

<u>ផ្នែកទី២ ភាសាខ្មែរ</u>

ចូរអានអត្ថបទខាងក្រោម និង ឆ្លើយសំនួរ៖

<u>សំនួរ</u>

ចូរឆ្លើយសំនួរខាងក្រោម។ ចូរសរសេរចំលើយនៅខាងក្រោមសំនួរនីមួយៗ៖

1 តើអត្ថបទនៅទំព័រមុននេះនិយាយអំពីអ្វី?

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2 តើគេធ្វើពិធីបុណ្យចូលឆ្នាំថ្មីប៉ុន្មានថ្ងៃ? នៅថ្ងៃណា? ខែណា?

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3 តើក្នុងពិធីនេះគេរៀបចំអ្វីខ្លះនៅតាមផ្ទះ?

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4 តើពាក្យ **" រមណីយដ្ឋាន "** មានន័យដូចម្តេច?

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5 តើប្រជាជនខ្មែរមានអារម្មណ៍ដូចម្តេចនៅថ្ងៃបុណ្យចូលឆ្នាំ?

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បុណ្យចូលឆ្នាំប្រពៃណីជាតិខ្មែរប្រារព្ធឡើងរយៈពេលបីថ្ងៃ ចាប់ពីថ្ងៃទី១៣ រឺ ១៤ ខែមេសាជារៀងរាល់ឆ្នាំ ។

នៅទីណាក៏ដូចទីណាដែរ ប្រជាជនតែងតែត្រៀមរៀបចំតុបតែងលំនៅស្ថាន និងទីកន្លែងជុំវិញផ្ទះសំបែងអោយបានស្អាតបាតដើម្បីទទួលទេវតាឆ្នាំថ្មី ។ នៅមុខផ្ទះនីមួយៗ មានកន្លែងទទួលទេវតាដោយមានរៀបរណ្តាប់សំខាន់ៗដូចជាផ្កាស្រស់២ថូ ស្លាធម៌ ១គូ បាយសី១គូ រឺច្រើនគូ ទឹកអប់១គូ ទឹកផ្តិលដាក់ផ្កាម្លិះដាក់ទឹកអប់១គូ ម្ជូ ស្លា បារី តែដាក់លើជើងពាន១គូ ចេកនួន រឺចេកណាំវ៉ាពីរស្ទិត ដាក់តំកល់លើជើងពាន រឺ ថាស ។ លើសពីនេះ ប្រជាជនអាចរៀបផ្លែឈើផ្សេងៗទៀត ព្រមទាំងនំនែកយ៉ាងច្រើន រួមនឹងភេសជ្ជៈខ្លះៗ ទៅតាមលទ្ធភាពរៀងៗខ្លួន ។

នៅគ្រប់វត្តអារាមក្នុងព្រះរាជាណាចក្រកម្ពុជា ប្រជាពលរដ្ឋយើងទាំងក្មេងចាស់ប្រុសស្រីនាំគ្នាយកចង្ហាន់ទៅប្រគេនព្រះសង្ឃ និងនិមន្តព្រះសង្ឃបង្សុកូលឧទ្ទិសកុសលជូនបុព្វការីជនទាំងឡាយដែលបានចែកឋានទៅ ។ គេនាំគ្នាពួនភ្នំខ្សាច់ និងស្រង់ព្រះទៀតផង ។

ក្នុងឱកាសបុណ្យចូលឆ្នាំថ្មីប្រពៃណីជាតិ ប្រជាជននាំគ្នាលេងល្បែងប្រជាប្រិយចោលឈូង បោះអង្គញ់ ទាញព្រ័ត្រ រឺរាំរបាំប្រជាប្រិយដូចជា រាំវង់ រាំក្បាច់ សារ៉ាវ៉ាន់ ។ ខ្លះទៀតដើរកំសាន្តនៅតាមរមណីយដ្ឋាននានា ។

ក្នុងរយៈពេលចូលឆ្នាំបីថ្ងៃនេះ ប្រជាជនមានទឹកចិត្តរីករាយ អារម្មណ៍ស្រស់ថ្លា និងតាំងចិត្តតាមពាក្យស្លោកថា" ឆ្នាំថ្មី ភារកិច្ចថ្មី ជោគជ័យថ្មី" ។

Appendix G: Achievement test 2

តេស្តគណិតវិទ្យា

I.ចូរធ្វើប្រមាណវិធីខាងក្រោម

ក. $1\frac{1}{2} \times 5 = \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$

ខ. $1\frac{2}{5} \times 4 = \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$

គ. $7\frac{5}{6} \times 3 = \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$

ឃ. $8\frac{3}{5} \times 6 = \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$

ង. $11\frac{3}{4} \times 2 = \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$

II. បំពេញ $\square$ ខាងក្រោម

ក. $2\frac{1}{4} \times 1\frac{5}{9} = \frac{9}{\square} \times \frac{\square}{9}$

ខ. $5\frac{1}{4} \times 7\frac{2}{9} = \frac{\square}{4} \times \frac{\square}{9}$

គ. $2\frac{3}{8} \times 4\frac{1}{4} = \frac{\square}{8} \times \frac{17}{\square}$

ឃ. $2\frac{4}{5} \times 4\frac{1}{2} = \frac{14}{\square} \times \frac{9}{\square}$

ង. $6\frac{1}{3} \times 3\frac{3}{4} = \frac{\square}{\square} \times \frac{\square}{\square}$

III. បំពេញតារាងខាងក្រោមដោយយកលេខជួរដេកចែកអោយលេខជួរឈរ

÷	$2\frac{3}{4}$	$4\frac{1}{2}$	$12\frac{2}{3}$	$6\frac{4}{5}$	$8\frac{2}{7}$
2					
$\frac{2}{5}$					

IV.ចំណោទ

ស្ករមួយធុងមានទំងន់ ១៣$\frac{១}{២}$ kg។ គេវិលែកដាក់កញ្ចប់តូចៗដែលអាចដាក់បានទំងន់ ១$\frac{១}{២}$kg។ តើគេដាក់បានប៉ុន្មានកញ្ចប់?

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Appendix H: Differences in classroom practices by region

	Angk Snuol		Preah Netr Preah		Mean Difference	*t*	*df*	Sig.
	N	Mean	N	Mean				
SCA activities								
Solve word problems.	132	4.43	248	4.67	-0.24	-2.213	378	0.028
Discuss different ways that they solve particular problem.	125	4.46	247	4.64	-0.19	-1.376	370	0.170
Make conjectures and explore possible methods to solve a mathematical problem.	129	4.12	246	4.43	-0.31	-2.284	373	0.023
Work in small groups on math problems.	126	4.67	249	4.65	0.02	0.188	373	0.851
Work on research activity that extend several days.	125	2.75	238	2.71	0.05	0.263	361	0.792
Use manipulative materials to solve problems.	124	4.63	252	4.48	0.15	1.052	374	0.293
Create exercises/word problems for other students to solve.	131	3.73	252	3.93	-0.20	-1.237	381	0.217
Explain other students about how to solve a problem.	130	4.32	250	4.51	-0.20	-1.267	378	0.206
Do problems that have more than one correct solution.	131	4.01	247	3.82	0.19	1.124	376	0.262
Conventional activities								

Work individually on problems from textbook.	125	4.88	244	5.01	-0.13	-0.965	367	0.335
Recite the multiplication table.	127	5.25	251	5.36	-0.11	-0.918	376	0.359
Solve exercises on blackboard	130	5.30	248	5.39	-0.09	-0.897	376	0.370
Copy lesson from textbook/blackboard.	130	5.52	248	5.47	0.04	0.351	376	0.726
Memorize formula or rules to solve problems.	131	5.07	244	4.81	0.26	1.908	373	0.057
Solve exercises on slate	133	5.19	251	4.99	0.20	1.657	382	0.098

Note: N=teachers; Shaded rows show the activities that are significantly different ($p<0.10$) between the two districts.

Notes

1. Im Sethy, Minister of Edcation, Youth, and Sports; welcome speech at the 30th Anniversary of Historical Opening Ceremony of New Academic Year, 24 September 1979-24 September 2009.

2. Since the end of the Khmer Rouge in 1979 to 1989, Cambodian government was backed by Vietnam and was affiliated with the Soviet-led international socialist bloc. During this period, most of international assistance, except from UNICEF or from socialist countries, was terminated.

3. Cambodia had two prime ministers from 1993 to 1998, each belonging to different parties.

4. National Education Congress Summary Report-Academic Year 2008-09, 2009, p.3.

5. Pocket money was coded 1 for children with an amount of less than 1000Riel, which is the average amount of the sample and 2 for those above the average.

6. A school catchment area refers to a community served by a primary school. The community consists of several villages located within approximately 2 kilometers around the school. Generally, there is very little mobility of students between catchment areas.

7. ICC was computed through the estimation of variance components in test scores by schools using VARCOMP command in SPSS. Restricted Maximum Likelihood was used as method of estimation.

8. The researcher measured class duration between the class start time, signaled by the teacher's announcement of class commencement and the class end time, signaled by the teacher's announcement of break time or class dismissal.

9. Ministry of Education, Youth, and Sport, 1997,Textbook and Teacher Guide Utilization Training Master Plan 1997-2001.

10. Based on the Child-Friendly School Policy issued by MoEYS in 2007, CFS framework consists of six dimensions: 1)Inclusion; 2)Effective teaching and learning; 3)Health and safety; 4)Gender equity; 5)School and Community; and 6)Enabling environments.

11. In 1996, Cambodia upgraded primary education to six years; by that time the 5-3-3 education system was adopted.

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